

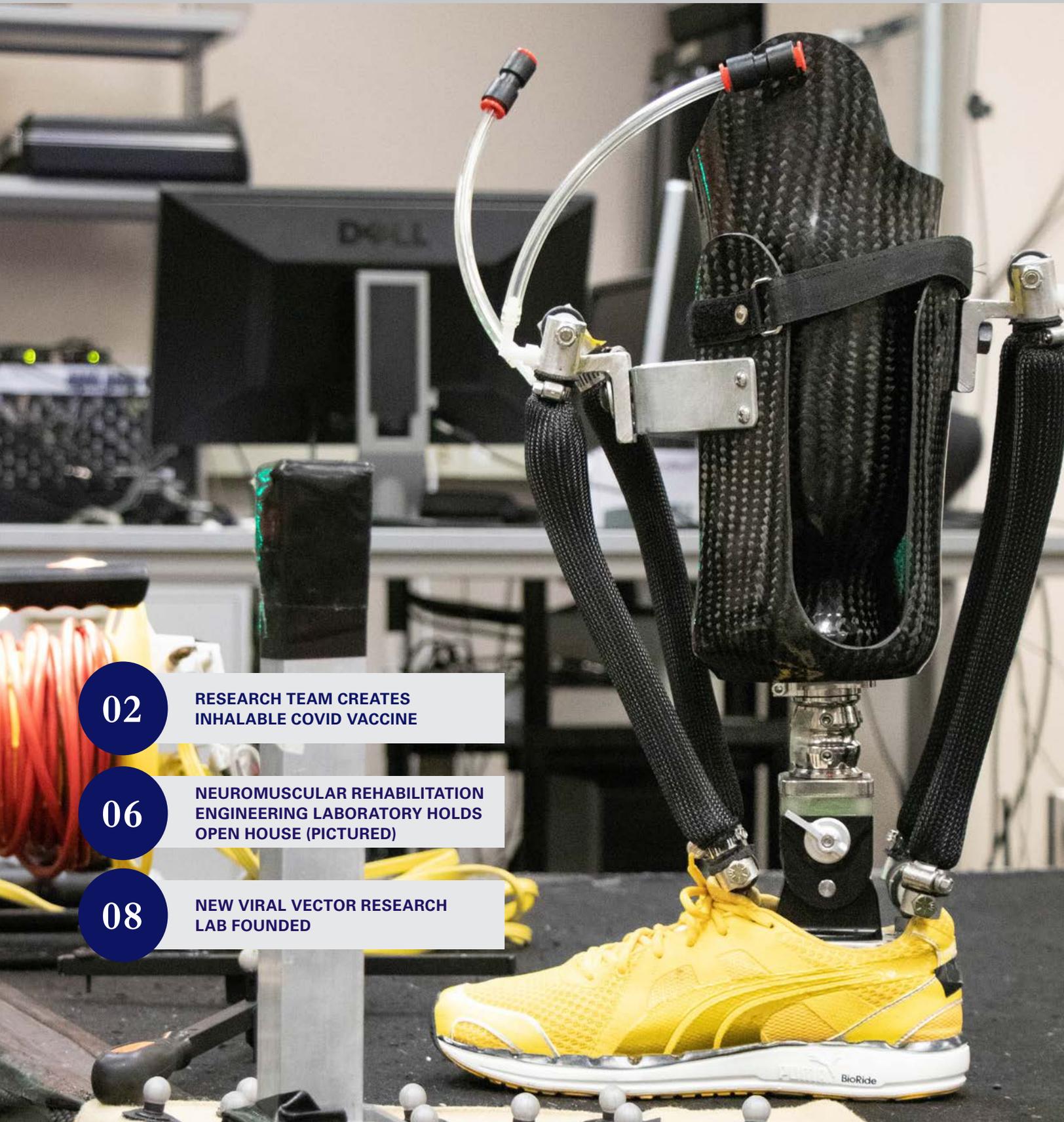
Joint Department of
**BIOMEDICAL
ENGINEERING**



UNC
CHAPEL HILL

NC STATE
UNIVERSITY

FALL 2022 / WINTER 2023



02

RESEARCH TEAM CREATES
INHALABLE COVID VACCINE

06

NEUROMUSCULAR REHABILITATION
ENGINEERING LABORATORY HOLDS
OPEN HOUSE (PICTURED)

08

NEW VIRAL VECTOR RESEARCH
LAB FOUNDED

IN THIS ISSUE

PAGE

02

CHENG, OTHERS
WORK ON
INHALABLE
VACCINE

PAGE

04

FACULTY
MEMBERS RECEIVE
CHANCELLOR'S
INNOVATION FUND
AWARDS

PAGE

08

DEPARTMENT
PLAYS ROLE
IN NEW LAB

PAGE

10

FACULTY
AND STAFF
NEWS

PAGE

15

STUDENT
NEWS

PAGE

17

ALUMNI AND
CORPORATE
NEWS

LETTER FROM THE CHAIR



Paul Dayton

GREETINGS BME ALUMNI AND FRIENDS:

Each fall, I'm amazed at how quickly the energy on our campuses shifts from the slow quiet of summer to become vibrant centers of activity. It hasn't gone unnoticed that the spirit of returning to campus is hitting a little differently this year, especially after two years of our routines being continuously adapted in response to a global pandemic.

Despite these challenges, the pandemic also brought our department together in unexpected ways. We adopted new logistics around teaching and research in the laboratory, we created novel treatment methods for the coronavirus, and our team brought innovative solutions to everything from creating viral vectors, to developing new ideas for at-home HPV testing. And it's no wonder our campuses feel so full of fresh energy this fall: UNC-Chapel Hill received its highest number of first-year student applications and NC State welcomed its largest class in university history.

The change of season also provides an opportunity to look ahead to possibilities on the horizon. Our Strategic Planning Committee has been diligently working with me to establish the next directions for our department. One outcome from our planning is that BME will be launching a major hiring initiative this fall, with our intent to bring in 10 new biomedical engineering faculty over the next three years. Our new faculty will strategically build areas of research expertise, increase our teaching capacity and expand our collaborations with industry and clinical departments.

Additionally, we are growing student opportunities through National Institutes of Health grants that will support the interdisciplinary training of graduate students. Matt Fisher and Ke Cheng are among the project leaders for a training grant received for NC State's Comparative Medicine Institute (CMI), which will bridge molecular-focused researchers across the comparative biomedical sciences, biomedical engineering, and cellular and biomolecular engineering graduate programs. Caterina Gallippi has applied for a training grant that will provide students with first-hand experience collaborating with physician scientists to identify new ultrasound applications. Most recently, Helen Huang has requested a National Science Foundation training grant to build a program for graduate students to develop human-centered computing skills in rehabilitation work to improve the quality of life for individuals with disabilities. This training will assist researchers with exploring new mechanisms and principles underlying motor control by assessing human neural control of movements and adaptation in patients during rehabilitation.

Importantly, we could not look toward our future without the support of our alumni. Joint BME alumni continuously take what they've learned from our program and translate that through tangible impacts to research and industry. Later in this newsletter, you'll read about Craig Nichols, who did just that through his entrepreneurial contributions with the startup company InnAVasc. The company, based nearby in Durham, NC, developed a hemodialysis device that reduces damage to a patient's graft that is often experienced with frequent needle sticks during dialysis.

The joint department is moving through the 2022-23 academic year with a renewed commitment to the principles that drive biomedical engineering: detect and define problems, iterate on possible solutions and create novel technology that supports medical needs. We look forward to the remainder of the academic year and more than ever, we hope to meet you on the horizon.

Sincerely,

A handwritten signature in black ink that reads "Paul Dayton". The signature is written in a cursive, slightly slanted style.

Paul A. Dayton, Ph.D.

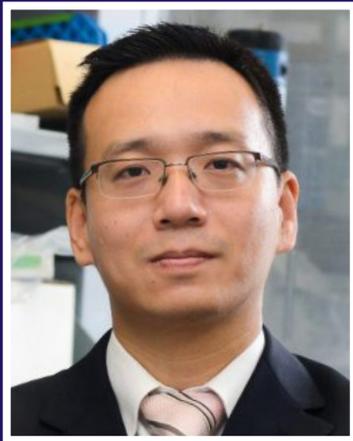
William R. Kenan Jr. Professor and Chair

UNC / NC State Joint Department of Biomedical Engineering

**BME
NEWS**

**CHENG AND
COLLABORATORS
CREATE
INHALABLE
COVID-19
VACCINE**





Ke Cheng

Ke Cheng, the Randall B. Terry Jr. Distinguished Professor in Regenerative Medicine at NC State and in the Joint Department, along with collaborators from the University of North Carolina at Chapel Hill and Duke University, developed an inhalable COVID-19 vaccine,

which is delivered to the lungs through a self-administered inhaler. The development of the vaccine has progressed from prototype to animal studies and was found to be more effective at permeating the mucosal lining within the lungs than other lipid-based nanoparticle delivery methods.

“There are several challenges associated with vaccine delivery we wanted to address,” Cheng stated. “First, taking the vaccine via intramuscular shot is less efficient at getting it into the pulmonary system, and so can limit its efficacy. Inhaled vaccines would increase their benefit against COVID-19.

“Second, mRNA vaccines in their current formulation require cold storage and trained medical personnel to deliver them. A vaccine that is stable at room temperature and that could be self-administered would greatly reduce wait times for patients as well as stress on the medical profession during a pandemic. However, reformulating the delivery mechanism is necessary for it to work through inhalation.”

The new inhalable vaccine rises to meet that challenge, as it can be stored at room temperature for up to three months. Additionally, this vaccine can be used with other protein-based vaccines.

“Vaccines can work through various means,” Cheng said. “For example, mRNA vaccines deliver a script to your cell that instructs it to produce antibodies to the spike protein. This VLP vaccine, on the other hand,

introduces a portion of the spike protein to the body, triggering the immune system to produce antibodies to the spike protein.”

The researchers used exosomes (Exo) secreted from lung spheroid cells (LSCs) combined with the spike protein from SARS-CoV-2 to deliver their vaccine directly to the lungs. Exosomes carry materials between cells and operate as inter-cell communicators throughout the body, so they are a good candidate for drug delivery methods. In rodent animal models, LSC-Exo combined with the spike protein at specific receptor sites (RBD-Exo), promoted the development of antibodies specific to the spike protein and prevented infection with live SARS-CoV-2.

“An inhalable vaccine will confer both mucosal and systemic immunity, it’s more convenient to store and distribute, and could be self-administered on a large scale,” Cheng said. “While there are still challenges associated with scaling up production, we believe that this is a promising vaccine worthy of further research and development.”

The LCSs, which are used to generate the RBD-Exo vaccine, are currently in a Phase I clinical trial by the same researchers for treating patients with degenerative lung diseases. Cheng’s work was supported by the National Institutes of Health and the American Heart Association. NC State has filed a provisional patent on the technologies reported, and the patent right has been exclusively licensed to Xsome Biotech, an NC State startup company co-founded by Cheng. •



NC State Chancellor's Innovation Fund awards go to two Joint Department faculty members

The Chancellor's Innovation Fund (CIF) awards up to \$50,000 to research projects that meet criteria for eventual commercialization. The hope is that these projects will directly impact the community by being brought to market.

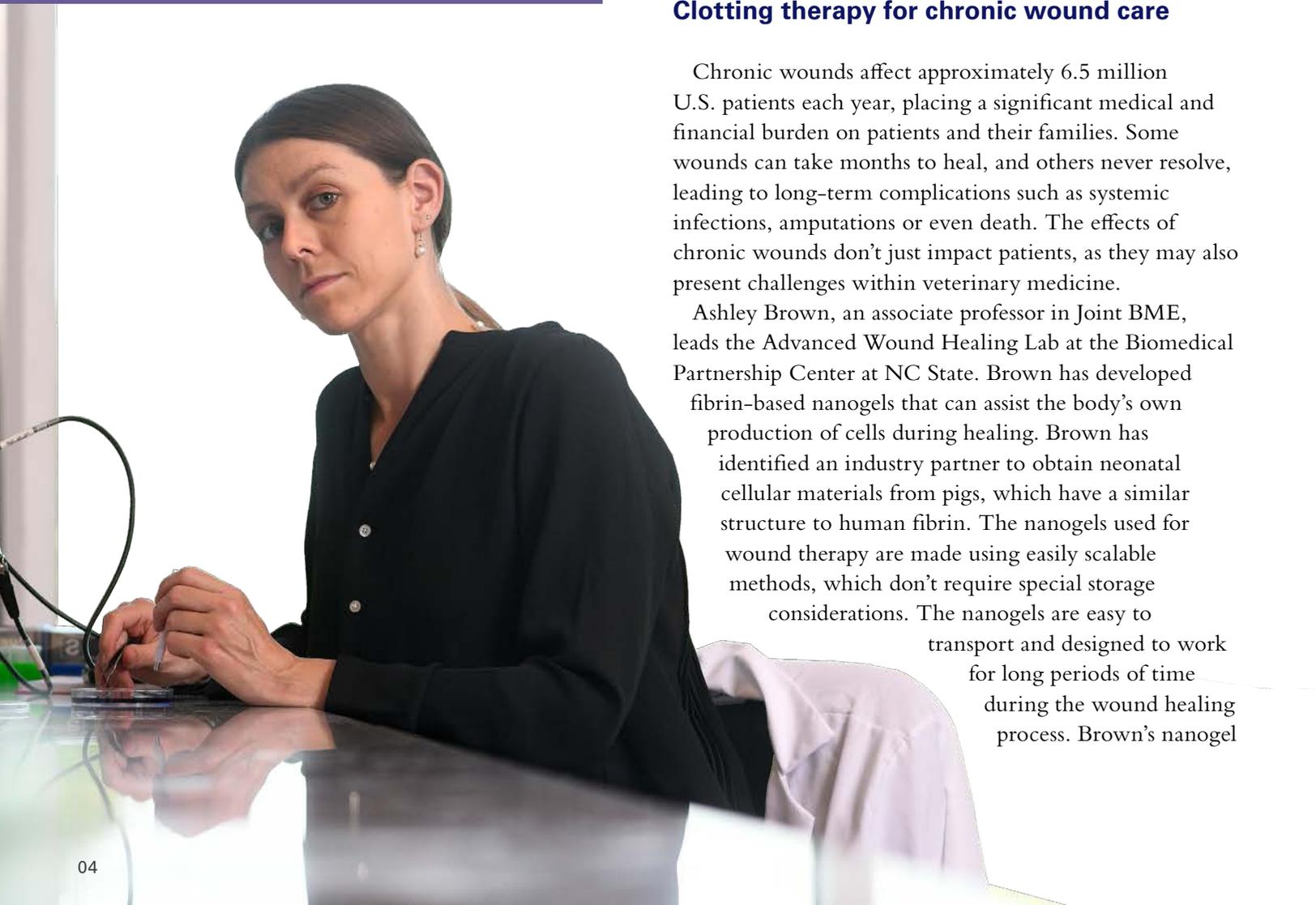
"The Chancellor's Innovation Fund continues to serve as one of the most effective ways we can help our world-class faculty commercialize their cutting-edge research," said Wade Fulghum, assistant vice chancellor of the Office of Research Commercialization at NC State. "The goal is to provide the critical funding needed to translate technologies to a point where a startup can be formed for commercialization or a license can be executed with an existing company."

The Joint Department of Biomedical Engineering is excited to announce that two of its faculty members have received awards from this prestigious fund. This year, six projects were awarded funding and Joint BME members are leading two of the projects that were selected.

Clotting therapy for chronic wound care

Chronic wounds affect approximately 6.5 million U.S. patients each year, placing a significant medical and financial burden on patients and their families. Some wounds can take months to heal, and others never resolve, leading to long-term complications such as systemic infections, amputations or even death. The effects of chronic wounds don't just impact patients, as they may also present challenges within veterinary medicine.

Ashley Brown, an associate professor in Joint BME, leads the Advanced Wound Healing Lab at the Biomedical Partnership Center at NC State. Brown has developed fibrin-based nanogels that can assist the body's own production of cells during healing. Brown has identified an industry partner to obtain neonatal cellular materials from pigs, which have a similar structure to human fibrin. The nanogels used for wound therapy are made using easily scalable methods, which don't require special storage considerations. The nanogels are easy to transport and designed to work for long periods of time during the wound healing process. Brown's nanogel



method can also facilitate delivering drugs directly into wound sites to further the healing process and prevent typical complications, such as infection.

CIF support will be used to conduct pre-clinical trials in rodents, a critical first step in determining its safety and efficacy.

COVID-19 antibody tests

Two major limitations of COVID-19 antibody tests are that they are expensive and they can take a long time to process. Today's tests not only require personnel with specialized skills to process the assays, but they can cost as much as \$1,000 per kit and take over six hours to process.

Michael Daniele, an associate professor in the Joint Department and in the Department of Electrical and Computer Engineering at NC State, together with Stefano Menegatti, an associate professor in the Department of Chemical and Biomolecular Engineering (CBE) at

NC State, have developed a “dual affinity ratiometric quenching” (DARQ) assay. This assay will lower testing turnaround time, as well as lower the cost of antibody testing. The aim of this assay is to reduce processing to as little as two minutes, while keeping the cost at about \$2 per test. Menegatti and Daniele's technology will have wide application reach, from primary care to clinical laboratory testing. The assay is also scalable for future use with other antigens. Labeled as a “simple mix-and-read” assay, other antigen applications can be explored for cancer, autoimmune disorders and degenerative diseases.

CIF support will be used to promote product development with their co-inventors, Katie Kilgour, a CBE graduate student, and Brendan Turner, a Joint BME graduate student. The fund will be used to produce DARQ kits for testing, which will include validating assay quantification of anti-SARS-CoV-2 antibodies in patient samples, scaling for manufacture and evaluating and quantifying the shelf-life of the DARQ kits. •



Neuromuscular Rehabilitation Engineering Laboratory hosts third annual open house

The Neuromuscular Rehabilitation Engineering Laboratory (NREL) held its third annual open house event this fall, where the lab hosted clinicians, research participants and supporters for an interactive demonstration of new research in prostheses and amputee rehabilitation.

NREL researchers are focused on improving the quality of life in persons with physical disabilities, which they accomplish by investigating physical interactions between humans and robotic devices. Through understanding of the neuromuscular system and development of advanced neural-machine interfaces, researchers in the lab can apply assistive technologies to prosthetics, exoskeletons, computers and other assistive machines. The open house event was hosted by Distinguished Professor He (Helen) Huang and Research Assistant Professor Ming Liu, while representatives from the laboratory participated in research presentations, poster presentations and demonstrations of devices.

Open house for NREL functions as a dual-purpose event where clinicians with patients using assistive devices can see new research developments within the field. Additionally, participants who volunteer in research with NREL can see results and insights from the work performed across the laboratory. Open house also provides a recruitment opportunity for the lab, as prospective volunteers can get an in-depth view of the kind of work that is performed and determine research commitments that may be required. Recruiting new participants is essential to the success of research within NREL, as they can provide feedback directly to researchers. Volunteering is also an opportunity for a participant to contribute and invest in prosthetic and amputee rehabilitation research directly, which ultimately advances the depth of knowledge that may one day impact other amputees' lives. •





Kamper and CLEAR core receive \$4.6M grant to assist stroke survivors with research in wearable technology

Despite rehabilitation efforts to promote recovery through therapy, the average stroke patient can experience persistent impairment of sensory and motor functions. Due to these challenges, the effects of having a stroke remain the leading cause of long-term disability in adults in the U.S. A newly funded Rehabilitation Engineering Research Center (RERC) in Assisting Stroke Survivors with Engineering Technology (ASSET) aims to mitigate long-term effects through focused research and development on wearable assistive devices. These devices are different from standard stroke patient therapy in that they are designed to restore the function of movement in an assistive manner, which permits device users to regain control of the movement of their limbs.

Leading this center initiative is Associate Professor Derek Kamper, principal investigator, and director for ASSET RERC. The center was recently funded by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) for a five-year period at \$925,000 per year and is the first NIDILRR-funded research center in North Carolina. The center

involves several members of Joint BME's Closed Loop Engineering for Advanced Rehabilitation (CLEAR) core. Members of the core include investigators from NC State's College of Engineering, the Department of Statistics, the Department of Psychology and the University of North Carolina at Chapel Hill's School of Medicine. The center, together with the CLEAR core, seeks to improve technology and methods for integrating human-machine interactions into the daily lives of patients. Their mission is to use rehabilitation technologies to alleviate operational challenges and enhance physical abilities in individuals with disabilities.

The grant is a CLEAR core milestone, as it is the first center grant obtained by the group. Previously, rehabilitation engineering was identified by NC State College of Engineering as a focused-research area and this newly funded center will help establish the success of rehabilitation research in North Carolina. ASSET RERC will additionally strengthen collaborations between UNC-Chapel Hill and NC State and establish CLEAR and the Research Triangle as a hub for rehabilitation research. •



NC-VVIRAL: A NEW COLLABORATIVE VIRAL VECTOR RESEARCH LABORATORY

This summer, a new research lab that focuses on developing and advancing viral vector technology was opened on NC State's Centennial Campus. The Viral Vector Initiative in Research and Learning (NC-VVIRAL) lab is a collaborative effort between the Joint Department of Biomedical Engineering and NC State's Departments of Electrical and Computer Engineering and Chemical and Biomolecular Engineering. The new lab will provide both researchers and industry with an affordable and accessible space to create viral vectors.

Leading the research within the lab are Michael Daniele, associate professor in Joint BME, and Stefano Menegatti, associate professor in chemical and biomedical engineering. Together, they will guide and train engineering students across multiple engineering disciplines to help advance the mission of their laboratory.

Viral vectors are viruses that have been modified to deliver genetic material into cells for treatment or research. Because viruses already naturally know how to deliver their genomes into cells they want to infect, scientists like Daniele and Menegatti can use non-pathogenic viruses as a vehicle to introduce what they

need directly into a cell. According to Menegatti, the challenge with viral vectors is that "there is no established way of manufacturing vectors because they are so diverse and so complex." However, NC-VVIRAL aims to meet that challenge by providing an accessible space where scientists and commercial partners can access all materials required to create viral vectors specific to their needs. "The gap of knowledge can be collaboratively filled, and I think we have accumulated here the critical mass of instruments and cross-disciplinary expertise to really help the industry accelerate. This is really an intriguing field of research to be in," said Menegatti.

Daniele, who specializes in research relating to wearable and implantable biosensors, organ-on-a-chip models and human-machine interfaces, explained how NC-VVIRAL is uniquely positioned to meet a growing demand in research: "The first immediate need that this fulfills in the industry is the ability to learn and develop technologies to transition new biotherapeutics like viral vectors into a commercially viable product."

In addition to providing an accessible way to develop viral vectors, this laboratory also provides learning

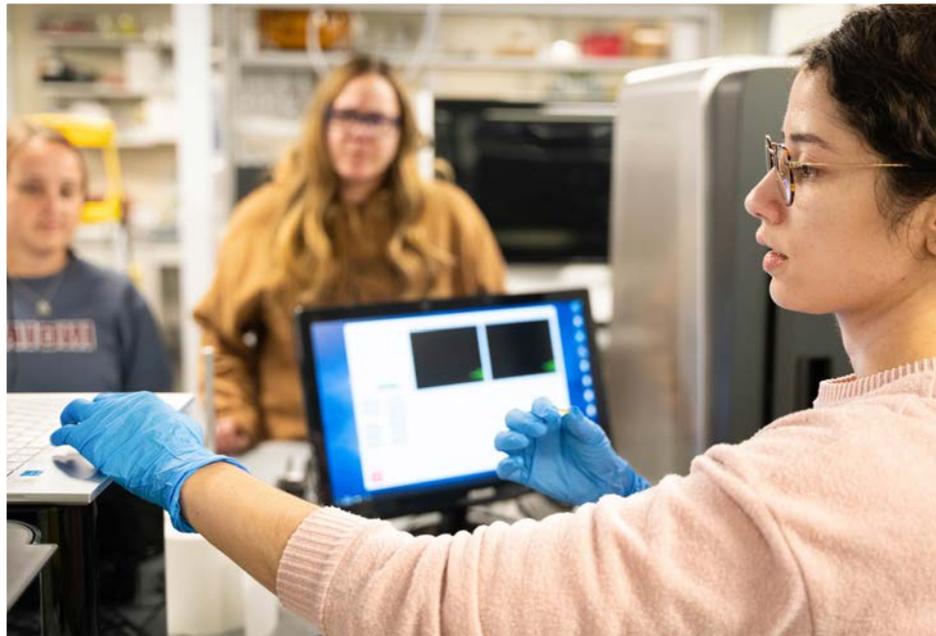
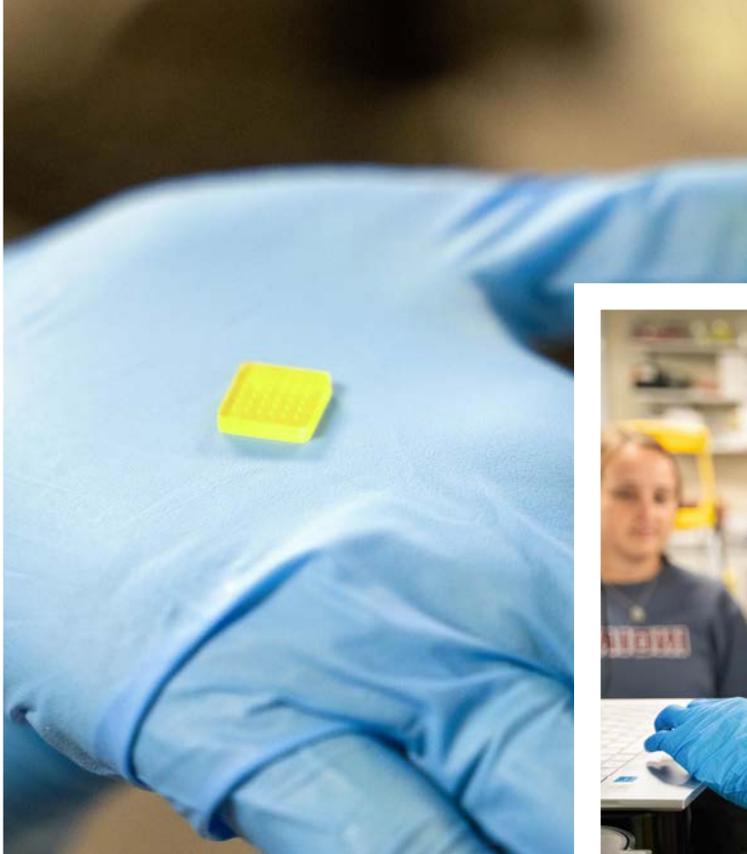


Photo by Charles Hall

and growth opportunities to future scientists in North Carolina. “We have a vision to use this laboratory as a test bed for training. We’re also partnering with other universities and community colleges around the area to train the next generation of scientists to enter the workforce in North Carolina,” Daniele stated.

Daniele emphasized the collaborative focus of NC-VVIRAL as an “opportunity to explore new manufacturing capabilities that we didn’t have previously, but also train our students in the most cutting-edge of manufacturing technologies, bioprocess technologies and even cell and biomolecular analytic tools all in the same place.”

“This truly embodies the multi-disciplinary character of NC-VVIRAL. The students working in NC-VVIRAL research bring in such a wealth of different perspectives, backgrounds and skillsets. We are open to consulting and collaborating with the industries. We are open for business,” said Menegatti. •

“The gap of knowledge can be collaboratively filled, and I think we have accumulated here the critical mass of instruments and cross-disciplinary expertise to really help the industry accelerate. This is really an intriguing field of research to be in ...”

Stefano Menegatti



Roger Narayan

Narayan elected 2022 MRS Fellow

Professor Roger Narayan, M.D., Ph.D., Distinguished Professor of Biomedical Engineering and Materials Science and Engineering at NC State and the University of North Carolina at Chapel Hill, has been

elected a Fellow of the Materials Research Society (MRS). He is recognized for his pioneering contributions in advanced biomaterials and laser additive manufacturing for novel micro- and nano-structured coatings and biomedical structures for tissue engineering scaffolds, drug delivery devices and biosensors. He pioneered the use of laser-based additive manufacturing techniques, including laser direct writing and two-photon polymerization, to process materials with micrometer scale and sub-micrometer scale features for medical applications. This research has been featured on the websites of *Popular Science*, *Laser Focus World* and *National Public Radio*. In addition, Narayan and his colleagues have spearheaded the biosensor applications of microneedles that were created using either two-photon polymerization or digital micromirror device-based stereolithography. Three U.S. patents involving this technology have been licensed by Biolinq, Inc. to produce miniaturized glucose sensors.

MRS Fellows are honored for their distinguished lifetime research accomplishments and their outstanding contributions to the advancement of materials research

worldwide. Narayan was one of the 12 people recognized this year. “I extend my personal congratulations, along with those of the MRS board of directors, for this singular honor,” said Carolyn Duran, president of MRS. “The distinction is highly selective. We are fortunate to have received a large number of excellent nominations each year, which always makes the work of the selection committee extraordinarily demanding, but reflects very positively on the Fellow program, as well as on MRS.”

Narayan has received numerous other awards, including The Minerals, Metals & Materials Society (TMS) Brimacombe Medal; the American Ceramic Society (ACerS) Fulrath Award; TMS Distinguished Scientist Award; Fulbright Fellowships (Brazil, Mexico, New Zealand); and ACerS Coble Award, and Fellow honors from American Association for the Advancement of Science (AAAS), American Society for Metals (ASM)-International, ACerS, American Society of Mechanical Engineers (ASME) and American Institute for Medical and Biological Engineering (AIMBE). He has authored over 265 peer-reviewed papers, a textbook (*Biomedical Materials*, 2nd edition), an encyclopedia (*Encyclopedia of Biomedical Engineering*), a handbook (*ASM Handbook on Materials for Medical Devices*) and 21 book chapters with over 12,500 citations.

Tremblay wins 2022 EHRA Award for Excellence

North Carolina State University Laboratory Manager Douglas Tremblay was the Joint Department of Biomedical Engineering (BME) EHRA recipient of the 2022 Awards for Excellence.



Douglas Tremblay

This award recognizes the outstanding accomplishments and contributions of individual NC State employees who do not hold faculty rank and who go above and beyond an employee’s normal job responsibilities. Awards are given to non-faculty employees who carry

out a wide range of activities in support of NC State’s mission and include categories of Customer Service, Efficiency and Innovation, Human Relations, Outstanding State Government Service, Public Service and Safety and Heroism, and Spirit of North Carolina.

Tremblay was additionally selected as one of two recipients of the College of Engineering’s EHRA Awards for Excellence, as well as NC State University’s Award for Excellence. Tremblay is now eligible as a candidate for the prestigious Award for Excellence amongst all State of North Carolina employees.

Tremblay’s recognition as a BME, College of Engineering, and NC State EHRA Awards for Excellence recipient was based on his continuous efforts to go above and beyond to give students at all levels innovative and interesting laboratory courses, while championing safety culture. Laboratory courses led by Tremblay emphasize the importance of safety while instructing and guiding students on critical scientific processes regularly conducted in laboratories. During the onset of COVID-19, he was instrumental in transitioning laboratory courses to an online format that enabled students to still engage in laboratory activities. When converting to a remote setting, Tremblay helped students meet course learning objectives by recording lab videos displaying major techniques and giving them the opportunity to analyze real data.

Papadopoulou selected for 2022 Carolina Women’s Leadership Award

Research Assistant Professor
Virginie Papadopoulou was recently selected for a



Virginie Papadopoulou

2022 Carolina Women’s Leadership Council Faculty Mentoring Award. Sponsored by the Carolina Women’s Leadership Council (CWLC), the Faculty Mentoring Awards recognize outstanding faculty members who go the extra mile to guide, mentor and teach. Each year, the Council

recognizes three recipients with an award of \$5,000 each in the categories of faculty-to-undergraduate student mentoring, faculty-to-graduate student mentoring and faculty-to-junior faculty mentoring.

The Faculty Mentoring Awards Committee was greatly impressed by Papadopoulou’s outstanding mentoring to undergraduate mentees. Both students and faculty colleagues highly praised her commitment to the highest standards of teaching and mentoring support.

“You have clearly provided your mentees with a rich and supportive environment for higher learning, and you have been an exceptionally positive role model for their careers. We would like to honor your achievements, commitment and passion for your craft with this award,” said Christopher Clemens, provost of the University of North Carolina at Chapel Hill.



Melissa Caughey

Project wins prize in American Heart Association Heart Failure Data Challenge

Melissa Caughey, research assistant professor in Joint BME, and Vishal Rao, M.D., cardiovascular disease research fellow at Duke University School of Medicine, won third

place in the American Heart Association Heart Failure Data Challenge.

The data challenge focused on testing the relationships

between heart failure and health disparities, as well as social and structural determinants of health. The team analyzed associations between socioeconomic status disadvantage and in-hospital heart failure outcomes in patients from diverse neighborhoods. They tested the hypothesis that the social environment, defined by neighborhood socioeconomic deprivation, would be associated with adverse clinical outcomes in patients hospitalized with heart failure.



Nitin Sharma

Sharma selected for 2022 EU-US Frontiers of Engineering Symposium

Associate Professor of Biomedical Engineering Nitin Sharma was selected by the National Academy of Engineering (NAE) for the 2022 EU-US Frontiers of

Engineering Symposium (EU-US FOE). The symposium was held October 19-22, and hosted in Bled, Slovenia, by The Slovenian Academy of Engineering and was in collaboration with the European Council of Applied Sciences, Technologies, and Engineering.

NAE holds the Frontiers of Engineering symposium to bring together select groups of highly accomplished early-career engineers from U.S. universities, companies and government to discuss leading-edge research and technical work across a range of engineering fields while also facilitating international cooperation and understanding. Convening engineers from disparate fields allows them to think about developments and problems in areas different from their own. The symposium encourages collaborative work, transfer of new techniques and approaches across fields, and establishing contacts among the next generation of leaders in engineering.

Giovannucci receives Undergraduate Teaching Award

Assistant Professor Andrea Giovannucci received the Student Undergraduate Teaching Award for his



Andrea Giovannucci

contributions to undergraduate students' education at the University of North Carolina at Chapel Hill. The Student Undergraduate Teaching and Staff Awards were established in 1989 to recognize outstanding undergraduate instruction by both faculty members and teaching assistants. In 2004, the awards were extended to include a staff award to recognize a staff member's specific contributions to the undergraduate experience at Carolina. This award is the only teaching and staff award funded, nominated and selected entirely by undergraduate students. Recipients are evaluated on demonstrated and consistent teaching excellence, success in positively affecting a broad spectrum of students both in and outside of the classroom and creation of a dynamic learning environment.



Yevgeny Brudno

Brudno receives two Teaching Awards

In April, Assistant Professor Yevgeny Brudno received the Outstanding Teacher Award from the NC State University Alumni Association. The recipients of the Outstanding Teacher Award are recognized for

their excellence in teaching at all levels and are inducted as members of the Academy of Outstanding Teachers for as long as they remain members of the NC State faculty. Once awarded, the Alumni Association separately recognizes six to eight of these recipients to be awarded a \$1,000 stipend, which Brudno received earlier this year.



Rocky Rothrock

Rothrock wins Senior Class of 1996 Award for Advising Excellence

In the spring, the University of North Carolina at Chapel Hill’s Academic Advising Program solicited input from students to nominate advisors and campus staff members

serving in an advising capacity for advising awards.

The nomination committee selected Student Services Coordinator Rocky Rothrock as one of the Senior Class of 1996 Campus Advising Award winners for the 2021-22 academic year. Rothrock’s award recognizes the exceptional service he provides to biomedical engineering students.



Andi Scheer

Scheer wins 2022 SHRA Award for Excellence

North Carolina State University Administrative Support Specialist Andi Scheer is the Joint Department’s SHRA winner of the 2022 Award for Excellence. This award recognizes the outstanding

accomplishments and contributions of individual employees who do not hold faculty rank and who go above and beyond an employee’s normal job responsibilities.

Awards are given to SHRA and EHRA non-faculty employees who carry out a wide range of activities in support of the department’s mission. Scheer’s selection

for this year’s award was based on her excellence in performing the varied scope of her roles as receptionist, bookkeeper, human resource administrator, student services coordinator and morale officer.



Kathleen Clardy

The Joint Department establishes new communications position

As part of Department Chair Paul Dayton’s and the Strategic Planning Committee’s new initiatives and hiring strategy, the Joint Department recently

hired Kathleen Clardy as the public communications specialist. Through this position, the department hopes to expand alumni outreach and student engagement and increase visibility of the research that takes place within the department. Over the next year, Clardy plans to reinvigorate the department’s web presence to better meet the needs of students and staff and faculty members across both institutions.

“Having the Joint Department established across two distinct universities presents a challenge in that there are two completely different methods of sharing and disseminating information at both institutions. However, this challenge also provides a unique opportunity to pull strengths and resources from both universities and use those tools to create a communications strategy that’s truly our own,” stated Clardy. Over the next year, the department is expanding its social media footprint and providing more communications and outreach support to faculty members and students. A main goal of this initiative is to highlight diverse department research while translating how that affects the broader medical community.

Clardy previously worked as a lab scientist and did communications work as a collateral responsibility, but recently transitioned to working as a full-time communicator in science. “I think there is a real interest right now in investing in thoughtful science communications, especially in disciplines within the medical field. The public wants to know more about scientific research, but most importantly they want to know how that research will impact their daily lives.”



Jason Franz

Franz receives \$2.7M NIH grant to enhance foot and ankle function in older adults

Jason Franz, associate professor in Joint BME, has received a five-year, \$2.7M R01 grant from the National Institutes of Health. The awarded project is titled

“A framework for feasible translation to enhance foot and ankle function in aging and mobility.” The project is an interdisciplinary effort, including contributions from Kota Takahashi, assistant professor of health and kinesiology at the University of Utah; Howard Kashefsky, associate professor of surgery and director of podiatric services at UNC-Chapel Hill; and Todd Schwartz, professor of biostatistics at UNC-Chapel Hill.

Together, the researchers will investigate age-related reduction in walking performance and economy (i.e., “gas mileage”). Reduction in performance has been mistakenly attributed solely to muscles spanning the ankle, but instead originates with unfavorable changes in active, passive and structural regulation of foot stiffness and power. The purpose of the work is to reduce metabolic energy costs during walking and improve gait performance by testing the efficacy of shoe stiffness modifications to augment foot structure. The project addresses the need for new and modifiable targets to enhance mobility and independence, which will ultimately pave the way for cost-effective assistive devices for millions in our aging population.

Franz receives research instrumentation grant from NSF

Associate Professor Jason Franz and principal investigators in the University of North Carolina at Chapel Hill College of Arts & Sciences, UNC-Chapel Hill School of Medicine (SOM) and NC State College of Engineering have received a \$772,000 National Science Foundation grant to develop scientific and technological

infrastructure for the quantitative measurement of human movement. Additional financial support was awarded from the dean’s offices in the UNC-Chapel Hill College of Arts & Sciences and SOM, along with the Joint Department, Exercise and Sport Science (EXSS) and the Office of the Vice Chancellor for Research.

The grant will enable the acquisition of a high-speed biplane fluoroscopy system, which provides continuous X-ray images at up to 1,000 samples per second. This process allows quantification and orientation of 3D bone positions, as well as visualizing surface mechanics of joints that are otherwise impossible to capture with sophisticated imaging technologies, such as with magnetic resonance imaging (MRI). The grant will also provide technical support staffing, provide an opportunity to launch a Collaborative Fluoroscopy Research Core, create opportunities for instructional innovation in the classroom and develop new community outreach programs. These new resources will allow researchers and students to measure bone motion to help understand how musculoskeletal mechanics and function are achieved and maintained over a mammal’s lifespan. This award will also help establish links in movement biomechanics, identify technological opportunities for surgical innovation and introduce the next generation of rehabilitation robotics.

“This was a plan that started in concept nearly three years ago and was a true team effort, especially the Principal Investigative team: Brian Pietrosimone (UNC EXSS), Troy Blackburn (UNC EXSS), Kate Saul (NC State Mechanical and Aerospace Engineering) and Helen Huang (Joint BME),” said Franz. The proposal also received enthusiastic support from a broader network of scientists and engineers spanning University of North Carolina at Greensboro, High Point University, North Carolina Agricultural and Technical State University and Elon University. “This acquisition is the first such instrument available to any of the students, faculty and fellows across 17 public University of North Carolina System campuses. The availability of the fluoroscopy system has the potential to catalyze lasting new collaborative and interdisciplinary research, providing significant educational impact across our region.” •

2022 Lucas Scholars selected

The Lucas Scholar Fellowship (LSF) was named to honor Carol Lucas, a former chair of the Joint Department, to recognize her contributions to the field. The LSF is an intensive independent research program for outstanding students in biomedical engineering.

The department is proud to announce the 2022 Lucas Scholars and their mentors: Allison Thorson (Mentor: Rahima Benhabbour); Grace Krohn (Mentor: William Polacheck); and Helen Tran (Mentor: Brian Diekman).

“The Lucas Scholarship Program has given me the invaluable opportunity to learn more about cutting-edge research in my field while still contributing to the biomedical sciences. As an undergraduate student researcher, I had the chance to work with other students on novel research that had real-world medical applications. I worked with a diverse group of students on new ultrasound image processing techniques. Completing the summer research gave me the chance to explore applications of biomedical engineering, contribute to an ongoing medical study and exposed me to new fields in medicine.” – Ryen Ormesher ‘18, former Lucas Scholar

Student winners at 2022 NC State’s eGames

North Carolina State University’s eGames is the university’s largest entrepreneurship competition with over \$100k in cash prizes. Student teams compete in two categories — “Think” and “Do.” The “Think” category is for teams in the early (or “idea”) stages of their venture. The “Do” category is for

students with an established startup that is looking to grow or scale, and may have existing customers, products or investment.

In the “Think” category, graduate student Travis McKay won first place and a \$9,000 cash prize for Spir Medical, a startup creating a bag valve mask resuscitation device. “Think” second-place winner with \$7,000 was Rampart Crop Defense, led by four students including MedTech master’s students Taylor Vickers and Austin Ladner, who are combating crop death by mildew prevention.

In the “Do” category, four master’s students — Alan Rosenbaum, James White, Kelsey Ling and Robin Brocato — together with Danielle Zenner from the Poole College of Management, won first place and \$10,000 for their startup Wolfpack Medical, which is working on an emergency trauma tourniquet.

Three undergraduates receive awards for Summer International Research Experiences

Three Joint BME undergraduate students received awards to participate in summer 2022 research experiences at prestigious international laboratories. Those students are Chloe Hinchler, Manasi Krishnakumar and Robert Kobrin. The summer research internships were funded by Joint BME emeritus faculty members Frances and George Ligler, and the NC State College of Engineering. Hinchler’s summer 2022 internship is with Professor Jiri Homola at the Institute of Photonics and Electronics in The Czech Academy of Sciences, Prague, Czech Republic. Krishnakumar’s and Kobrin’s summer 2022 internships are both with ICREAN Professor Arben Merkoci at the Catalan Institute of Nanoscience and Nanotechnology (ICN2), Barcelona, Spain.

Trainees in Brown research group receive honors

Three graduate students and one post-doctoral associate in Associate Professor Ashley Brown's research group recently were recognized by their field's premier professional group, the Society for Biomaterials.

Grant Scull was elected as president-elect for the 2022-23 session of the National Student Section of the Society for Biomaterials. The purpose of the National Student Section of the Society for Biomaterials is to encourage the development, dissemination, integration and utilization of knowledge in biomaterials among students, and encourage multi-disciplinary interactions among all members of the Society for Biomaterials.

Ana Sheridan was a Society for Biomaterials STAR award winner in the Society for Biomaterials Cardiovascular Special Interest Group. The Student Travel Achievement Recognitions (STARs) recognize research excellence and develop future leaders within the society. This award is given to the highest scoring abstract in a Special Interest Group (SIG) at the Society for Biomaterials Conference. Sheridan's award was Cardiovascular Biomaterials. Her abstract/oral presentation was titled: "Targeted delivery of fibrinolytics and anticoagulants to treat thrombotic complications."

Additionally, Nina Moiseiwitsch received an award for her poster in the Cardiovascular Special Interest Group Poster category and Kimberly Nellenbach received third place in the Postdoctoral Recognition Award Contest.

Students receive NIH National Research Service Award Fellowships

Graduate student recipients of 2021-22 National Institutes of Health National Research Service Award (NRSA) Predoctoral (F31) Fellowships are: Michaela Copp, mentored by Brian Diekman; Danielle Howe, mentored by Matthew Fisher; Miranda Ludovice, mentored by Derek Kamper; Sandra Stangeland-Molo, mentored by Jacqueline Cole; and Elizabeth (Snyder-Mounts) Doherty, mentored by William Polacheck.

The purpose of the Kirschstein-NRSA predoctoral fellowship (F31) award is to enable promising predoctoral students to obtain individualized, mentored research

training from outstanding faculty sponsors while conducting dissertation research in scientific health-related fields relevant to the missions of the participating NIH Institutes and Centers.

Juniors win 2nd place in the 2022 PDMA Carolinas Student Competition

An undergraduate student team of juniors won second place in the PDMA Carolinas Student Innovation competition with a design concept for a healthcare need that they identified through the department's design classes. The team, consisting of Hannah Myatt (team leader), Julia Richard, Lillian Chilton, Clara Alonso-Stepanova and Matthew Tian, identified the need for improved at-home testing for HPV uptake among women with previous sexual trauma or those with limited access to healthcare.

The judges found their concept innovative, answering the unmet need related to cervical cancer screening. They were also impressed by the team's understanding of the problem and their market analysis. The team, mentored by Associate Professor Kenny Donnelly, hopes to continue to work on this idea for their senior design project. They also hope to take their idea to the PDMA Global Student Challenge in November.

2021-22 cohort of Abrams Scholars named

The Joint Department is pleased to announce the 2021-22 cohort of Abrams Scholars. This year, 45 excellent undergraduates were selected from a very strong applicant pool to receive a mentored research fellowship funded by the NC State College of Engineering Research Experience for Undergraduates program.

The department's Abrams Scholars Program provides outstanding undergraduate students at both the University of North Carolina at Chapel Hill and North Carolina State University with the opportunity to conduct hands-on, mentored research projects throughout the academic year. The scholars are highly motivated students who are productive in the lab, often presenting their work at local, regional and even national conferences (such as BMES and IEEE meetings) and co-authoring journal articles.

Visit unc.live/3TBbx8n for a complete list of scholars. •



Craig Nichols

NICHOLS '11 LEADS ACQUISITION

BME alumnus Craig Nichols recently served in the successful acquisition of InnAVasc Medical, an RTP startup and global material

science company, by W.L. Gore & Associates. He has worked as a bridge for the acquisition and shared his expertise and knowledge gained while working toward his degree in biomedical engineering within BME.

At one time Nichols was in Kenan Flagler working toward an undergraduate business degree, but he missed the technical aspect of what he was learning in science. “It’s a lot harder to go back and get a strong technical foundation once you’re in business, so I switched my major to biomedical engineering,” he stated.

The mechanical, electrical and digital electronic classes provided relevant and complementary engineering skills to Nichols’ other medical-oriented coursework. “Everything was challenging in that students had to figure things out on their own, but my classes gave me the time and space to solve problems while also providing comfort in speaking with a variety of experts who knew their areas really well,” he said. In the summer before graduation at UNC-Chapel Hill, Nichols joined Department Chair Paul Dayton’s lab through a scholarship, which allowed him to gain experience with the machine shop, microbubbles, radiology and tracking head motion.

After graduation, he first conducted health care research at ORC International as

an intern and later joined the FDA as a medical device reviewer in cardiac electrophysiology. “My biomedical engineering background was foundational to that experience because it gave me the language I needed to communicate with all different professionals.”

Nichols returned to the Triangle in 2016 after completing a Biodesign Fellowship at Stanford, where he began to leverage his regulatory background to shift toward more entrepreneurship as a biomedical engineer. Using Raleigh’s technical and STEM-oriented resources and connections, Nichols joined InnAVasc Medical as the senior development engineer. During dialysis for kidney disease, patients can have artificial grafts that are stuck with needles multiple times per week. Typical graft material can degrade during use, so the company developed a device intended to prevent needle-related injuries and make it easier to cannulate. Nichols said of their design “at the end of the day, this is not curing kidney disease in a radical way, but we are trying to improve the quality of life for those suffering with kidney dysfunction.”

Nichols is assisting with the acquisition of InnAVasc Medical by Gore, but soon will be starting a new role as director of technical operations at SonoVascular, Inc. SonoVascular is a startup based in Chapel Hill that uses licensed ultrasound technology developed at NC State through collaboration with the Joint Department and the Department of Mechanical and Aerospace Engineering. When asked what advice he would give for students studying to be biomedical engineers, Nichols advised “if they want to pursue an entrepreneurial journey, embrace failure as part of the learning process. If you look at failure as an opportunity to learn and embrace it as a chance to be a better biomedical engineer tomorrow, you’ll continue to grow.” •

Joint Department of
**BIOMEDICAL
ENGINEERING**



UNC
CHAPEL HILL

NC STATE
UNIVERSITY

University of North Carolina at Chapel Hill
Campus Box 7575
10010 Mary Ellen Jones Building
Chapel Hill, NC 27599-7575

www.bme.unc.edu

North Carolina State University
Campus Box 7115
4130 Engineering Building III
Raleigh, NC 27695-7115

www.bme.ncsu.edu



@JOINTBME



@JOINTBME



@linkedin.com/company/jointbme

This year, the Joint Department of Biomedical Engineering welcomed its sophomores at orientation at the Museum of Life and Science in Durham, North Carolina. The department was excited to welcome this class in person for a successful day of highlighting the remaining three years of a Joint BME student's journey to becoming an engineer.

Students started the event by touring the museum's butterfly house, as well as the Bayer Insectarium, which houses rare insects and other invertebrates from around the world. After the tour, students received information on department resources, learned the benefits of being dual enrolled at two university campuses, and participated in a diversity and equity activity.

Joint BME is excited to welcome our newest class of biomedical engineers and we wish them the upmost success in the upcoming academic year.

