

# CLEMSON<sup>®</sup>

## BIOENGINEERING

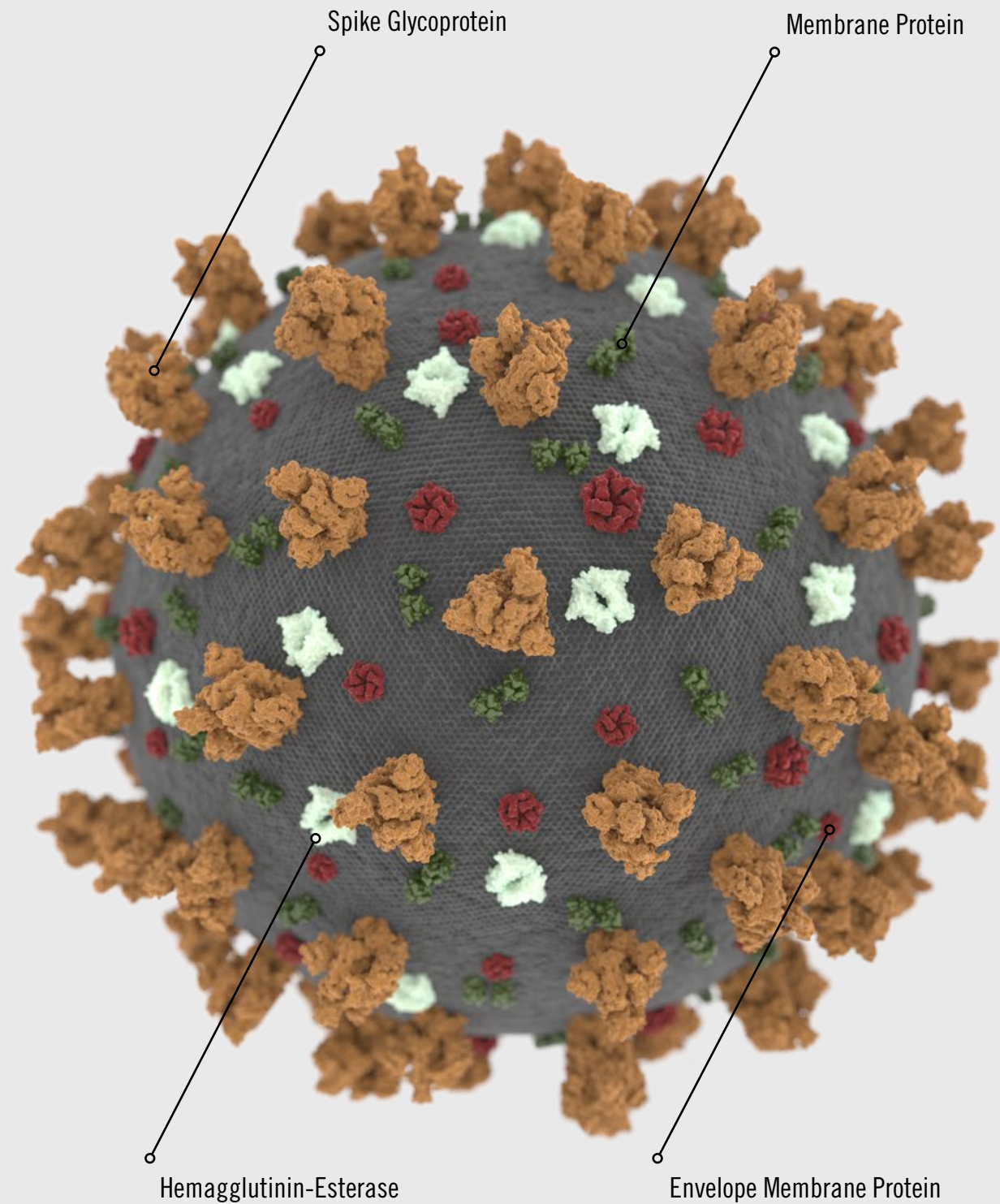
*Educating Thinkers, Leaders and Entrepreneurs*

**THIS NEWSLETTER IS DEDICATED TO HEALTHCARE WORKERS  
WORLDWIDE, WHO RISK ALL FOR THE SAKE OF ALL**

**BIOE** NEWS

Spring 2020





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Cover illustration — COVID-19 structure illustration (by Olga Reukova) highlighting Bioengineering faculty COVID-19 related stories (page 3 and page 5)

Martine LaBerge, Chair,  
Department of Bioengineering

Jenny Bourne, Editor

Olga Reukova, Cover illustration  
and magazine design



# FINDING A SOLUTION TO N95 MASK SHORTAGE

Paul Alongi



M

elinda Harman of Clemson University is volunteering her time to explore how hospitals could wash and sanitize medical masks without having to ship them elsewhere or buy an expensive piece of equipment.

shape while being washed so that they continue to fit securely around the mouth and nose, said Harman, an associate professor of bioengineering and director of Clemson University's Medical Device Recycling and Reprocessing program, or GreenMD. The masks help prevent healthcare workers from inhaling the novel coronavirus that causes COVID-19 and have been in short supply since the pandemic began.

A device that Harman designed to hold multiple N95 masks is central to her idea. It would help ensure the masks maintain their

As part of her work, Harman said she has engaged three leading healthcare companies that offer expertise in detergents and

decontamination. She is testing different kinds of detergents to find the best solution for cleaning mucus and proteins from the masks. The detergents are commercially available and already used by hospitals to clean other types of medical equipment.

Harman said that her goal is "to validate a cleaning process that is compatible with existing capabilities and equipment commonly available at hospitals in South Carolina and worldwide." The challenge is "to avoid interfering with mask performance, while effectively cleaning the masks without degrading their filtering capacity," she said. Harman added, "Working with innovative industry partners is a considerable advantage, with everyone on the team willing to contribute a potential solution. They are providing reliable products that are already proven to meet routine reprocessing challenges in healthcare delivery."

Harman said one of the advantages to her approach is that many hospitals already have the ability to clean medical equipment, even if they aren't yet applying it to the masks. That means hospitals wouldn't need to buy any capital equipment, she said. Further, the masks would stay at the hospital, reducing travel time, the risk of spreading contamination outside of the hospital and the additional burden on an already-stressed logistics system, Harman said.

"The technology I'm working on is meant to be used broadly, compatible with existing reprocessing practices that are already in hospitals," Harman said. "It's intended for rapid deployment in health care settings, and it's meant to be compatible with any sterilization system." Harman added, "Cleaning masks before sterilization enables more masks to be reused. Right now, guidelines for sterilization require N95 masks to be inspected and discarded if they are 'soiled.' My idea is to reliably clean masks to remove both the visible and 'invisible' soils, making the entire reuse process safer."

Martine LaBerge, chair of the Department of Bioengineering, said that Harman is well qualified to lead the work. Harman has conducted extensive research into reuse and reprocessing of medical equipment. As director of GreenMD, she engages students

in industry-driven research targeting healthcare needs in South Carolina and broader global health challenges. GreenMD is the nation's only engineering-focused program for medical device design targeted for reprocessing and reuse,

"Dr. Harman has built a career on developing innovative ways to reprocess and reuse medical equipment that is normally disposable, which uniquely positions her to have a global impact," LaBerge said. "I thank her for her service to South Carolina, the nation and the globe as we join together in the face of the unprecedented challenges posed by COVID-19."

Harman said that if her idea works, used masks would be sent to central sterilization facilities within hospitals. The device she designed would hold the masks while they are cleaned. After cleaning, the masks would go through a separate sterilization process to get rid of any lingering microorganisms, including coronavirus.

The mask-holder that Harman designed could be 3D-printed, she said. However, she is focusing on more rapid manufacturing approaches using common acrylic materials. The technology could be readily adapted in hospitals from South Carolina to India, Harman said. She recently disclosed the technology to the Clemson University Research Foundation, setting it on the path to commercialization and raising the potential for widespread use.

Harman said what's been most interesting to her is that her previous work with resource-poor countries has come home to the United States, with disrupted supply chains and inadequate supplies at the point of need.

"That's exactly the situation we've been working on with other countries," Harman said. "For me that's just been a startling change. It's been amazing to see how many people have become interested in the topic of safe and sustainable reuse and how many unique solutions they come up with. I hope that creative energy continues, because it can solve a lot of global health problems."





# SC UNIVERSITIES, HOSPITALS JOIN FORCES TO DEVELOP CORONAVIRUS ANTIBODY TEST

Liv Osby; reprinted from *The Greenville News*

Delphine Dean, Sarah Harcum and Terri Bruce, BIOE faculty members, are volunteering their services to develop the antibody test. Ed.

South Carolina's largest universities and hospital systems have joined forces to develop a test that can tell people whether they may be immune to the coronavirus. The test, expected to be rolled out this week, looks for antibodies indicating immunity which form after someone's had the virus, said Delphine Dean, a professor of bioengineering at Clemson University, which is partnering with the University of South Carolina, the Medical University of South Carolina and Prisma Health on its development.



Delphine Dean



Terri Bruce

The group hopes to have 200,000 tests by summer and use them to test the state's health care workers, said Dean, who is overseeing the Clemson portion of the work for the Serological Testing and Diagnostic Working Group. They can determine those who are most likely immune and therefore have a lower risk.

The virus has sickened more than 9,200 health care workers across the country, and killed at least 27, according to the U.S. Centers for Disease Control and Prevention. Many people have the virus with mild or no symptoms. Those who test positive could be cleared to return to work.

"We've had so many people who've probably had COVID, but don't know," Dean said. "And for front line health care workers, it's a big concern. You know if you have antibodies, you probably have some immunity as opposed to someone who doesn't."

The group came together about a month ago as leaders of the institutions began talking about the virus and making testing for it a priority, Dean said. First, she said, they inventoried their facilities, supplies and equipment that could be repurposed to do PCR testing for the virus in an effort to help manage the diagnostic load. Soon, however, they decided antibody testing was the way to go.

Around that same time, the first antibody tests began to appear, but some had accuracy problems. "While tests were commercially available," she said, "they hadn't been validated and folks were concerned they were cross-reactive with other coronaviruses." Other coronaviruses are in circulation, including one that causes the common cold, and they wanted to make sure the test could differentiate them, she said.

So Mark Blenner, associate professor of chemical and biomolecular engineering at Clemson, contacted researchers at Mt. Sinai Hospital in New York who shared the substances they had developed that use whole protein to capture antibodies instead of pieces of the protein as some other tests were doing, thereby increasing the accuracy. "Our group is going to make a stable cell line that we can scale up," said Blenner, who is making spike proteins inside human or hamster cells that will serve as the reagent in the antibody tests.

Also working on the project is bioengineering professor Sarah Harcum.



Sarah Harcum growing cells to make proteins out of the bioreactors in her lab.



Mark Blenner

Another issue is that most tests can tell if antibodies are present, but not how much of them, Dean said. But because immunologists have an idea of the level of antibodies needed to confer immunity, the group wanted to get at that as well, she said. "It's not just if, but how much you have of the antibodies," she said. "That will help to answer how much antibodies people need to be immune. And whether they stay at the same levels or drop off." Once a vaccine is developed, that information helps determine if someone needs a booster, she said.

Meanwhile, the tests on the market were being scooped up to the point that they were back-ordered for months, she said. So there was a concern that South Carolina wouldn't be able to get the number of tests needed to test all the health care workers. The state has about 150,000 health care workers — about 30,000-50,000 are on the front lines caring for coronavirus patients, Dean said. Between 500 and 1,000 tests could be ready this week. Results are available in about 48 hours, she said. A commercial partner is needed to scale up production so that tests can be rolled out to the general population, she said.

MUSC and Prisma will send blood samples from their health care workers who've already tested positive to be compared with people who did not get the virus once it emerged in South Carolina and against blood samples already in hand from before September that are assumed to be negative controls, she said.



Dean said that Germany is testing its entire population to be able to slowly reopen their economy. Preliminary results on 500 people show that about 14% have antibodies to the virus, while just 2% had positive coronavirus tests, she said.

Though the Mt. Sinai substance has been approved by the FDA through its emergency use authorization, Dean said that the new test will need to be approved by the agency, though she doesn't expect that will take long.

Accuracy is part of what the researchers are trying to answer, but Dean estimates the test could be at least 98% accurate. The researchers are volunteering their efforts to work on developing the tests for health care providers and the schools and hospitals have provided the funding, she said. "Everybody is pulling together to make this happen," she said. "We're not doing it for profit."

Meanwhile, Clemson researchers also are working on a color change test that could find antibodies in saliva, urine or blood that could provide results in 15 minutes, like a home pregnancy test, Dean said. That test could be six to 12 months away, she said, though it

would go faster with an industry partner. "The first part is validating that you can find antibody in saliva," she said. "If we can show that it's possible ... finding a commercial partner to launch it shouldn't be difficult."

In addition to Blenner, Dean and Harcum, researchers involved in that project are Terri Bruce, research assistant professor of bioengineering and director of the Clemson Light Imaging Facility, and chemistry professor R. Kenneth Marcus.

Funding is needed to push that work forward, Dean said.

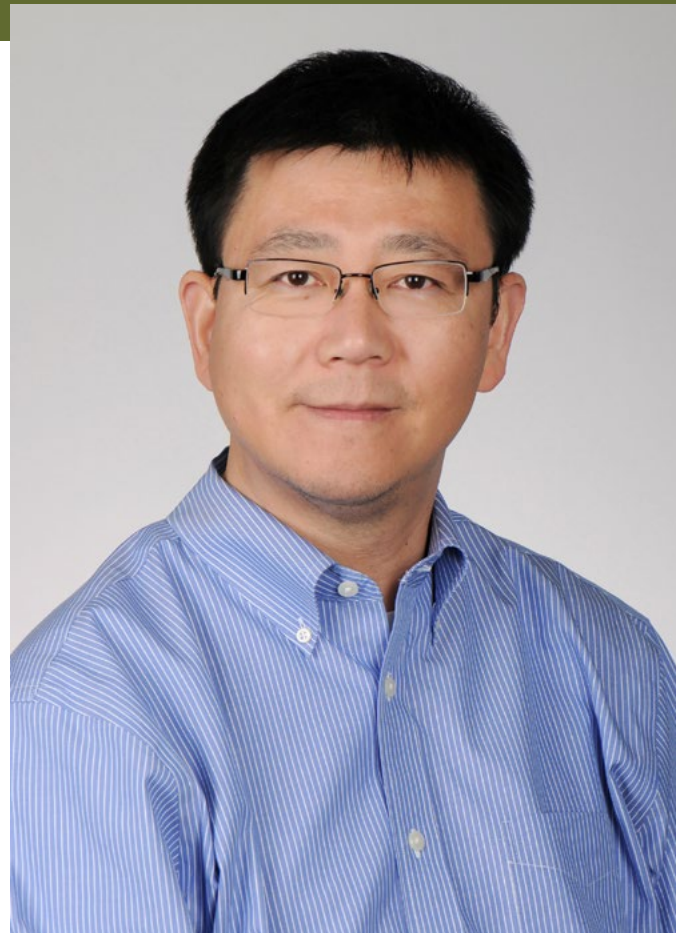
"Typically, when we launch big projects, we apply for federal funding, a process that normally takes months, if not a year or more," she said. "But time is of the essence, and we are finding ways to quickly ramp up work. What we need most now is the funds to help keep the work going."

The FDA on Tuesday authorized the first diagnostic test with a home collection option for COVID-19. It's produced by LabCorp.

## HAI YAO AWARDED MTF BIOLOGICS GRANT

Tommy Gallien, SC TRIMH Program Manager

Hai Yao, Professor and Ernest R. Norville Endowed Chair, and Director of the [South Carolina Translational Research Improving Musculoskeletal Health](#), received an MTF Biologics 2019 Established Investigator Extramural Research Grant, Integrating Ice-Free Vitrification and Nanowarming for Banking Meniscus Allograft. Yao will team up with the coprincipal investigator, assistant professor Yongren Wu. [MTF Biologics](#) is a leading provider of allografts (bone, cartilage, tendons, or other tissues used in transplantation). As cartilage and other tissues often have a very limited shelf life from the time of harvest to the time of implantation, there is a great need to improve tissue banking technologies. The goal of this work is to develop an ice-free cryopreservation technique to optimize meniscus allograft preservation by integrating vitrification and a novel approach of volumetric heating by nanoparticles in an alternating electromagnetic field. This is one of several studies in the Yao lab that focus on improving methodologies and outcomes for long-term tissue banking of allografts.



## 2020 SOCIETY FOR BIOMATERIALS AWARD FOR SERVICE TO JEREMY GILBERT, HANSJÖRG WYSS ENDOWED CHAIR

Martine LaBerge

Dr. Gilbert currently holds the position of Hansjörg Wyss SmartState Endowed Chair and Professor of Bioengineering at Clemson University and Director of the Clemson-MUSC Bioengineering Program. This award is bestowed on him to honor his significant service to the Society For Biomaterials in establishing, developing, maintaining and promoting its objectives and goals.

During his academic and administrative career, which began in the late-1980s, SFB member Jeremy Gilbert has been an ultimate ambassador for the Society For Biomaterials in his roles as scientist, educator, or administrator. Jeremy has clearly shown exemplary dedication to the Society and served as a role model of engagement and leadership for all SFB members. Since the 1990s, Jeremy has been involved in different roles on Council as a committee member, committee chair, President-Elect, and President. Jeremy has served SFB and carried the biomaterials torch as executive editor of JBMR-B for more than 9 years. His hard work and service have significantly improved the value of the journal, leading to a superior recognition of the SFB as the leader for biomaterials science and engineering in the world. Additionally, through his work on the Industry Committee, SIG, and FDA and as industry consultant, he has helped bring industry closer to SFB, resulting in a unique, industry-professional society relationship envied by many.

From a scholarly perspective, Jeremy's work has greatly contributed to enhancing the understanding of biomaterials and their interactions from all aspects including tribology, surface, and corrosion among others. He is a skilled biomaterials scientist, author and mentor. His scientific contributions have led to numerous patents and



peer-reviewed scientific publications. Jeremy has also exemplified the field of biomaterials science and engineering as an educator and assured that his graduate students would become members of the Society. Service to the Society clearly means service to members for Jeremy. His dedication and motivation to serve others are contagious and energizing. He has been an inspiration for all.



# POSITIVE IMPACT OF NIH T32 PROGRAM ON GRADUATE EDUCATION

Tommy Gallien, SC TRIMH Program Manager

**H**ai Yao, Professor and Ernest R. Norville Endowed Chair, became the new Director of the MUSC National Institutes of Health Dental T32 Training Program “T-COHR: Training in Craniofacial and Oral Health Research,” T32 DE017551-12 in January 2020. Only 16 dental schools in the nation have the T32 training program. In addition to his Clemson appointment, Yao holds a dual appointment in the James B. Edwards College of Dental Medicine, Department of Oral Health Research, at the Medical University of South Carolina. Michael Kern, Professor of Regenerative Medicine and Cell Biology, MUSC, serves as Co-Director for this program, which provides outstanding opportunities for both Clemson and MUSC trainees. The T-COHR offers mentored, interdisciplinary research training fellowships in oral health, craniofacial biology and bioengineering for predoctoral, postdoctoral and Dental Scientist Training Program (DMD/PhD) trainees. The program provides a strong

curriculum and thematic research experiences in an integrative framework that emphasizes mentoring, scientific advancement, academic career development, grantsmanship and productivity. Research training includes oral infection and inflammation, oral cancer, bioengineering/biomechanics and oral/craniofacial complex growth and regeneration.

Yao, who also serves as the Director of the South Carolina Translational Research Enhancing Musculoskeletal Health an NIH Center of Biological Research Excellence (COBRE) at Clemson, stated, “The T-COHR has been an important instrument in attracting high-level talented trainees to the MUSC dental research program. Our goal is that by mentoring for success at multiple levels across a multidisciplinary platform, we will successfully develop the next generation of clinician-scientists and scientists engaged in dental, oral and craniofacial research.”



# WILLIAM RICHARDSON NAMED DEAN'S ASSISTANT PROFESSOR OF BIOENGINEERING

Martine LaBerge



Dr. Will Richardson was named Dean's Assistant Professor of Bioengineering in recognition of his research and education accomplishments to the field of bioengineering in the past three years. Will also serves as the co-director of the Multiscale Computational Modeling Core of the NIH Center of Biomedical Research Excellence TRIMH (Translational Research Improving Musculoskeletal Health). With a background in matrix biology and computational modeling and biomechanics, Will has built a skill set that is unique, allowing him to address research hypotheses at the forefront of the field. He has assembled an impressive team of researchers and clinicians to join him in his journey to address “How do mechanical and biochemical signals regulate cell and tissue behaviors related to extracellular matrix remodeling?” and “How can we predict and control this complex regulatory system to diagnose, treat, and prevent fibrotic diseases?”

Despite being an investigator in his early career, Will has secured funding from AHA and NIH with awards from NIBIB (R01) and NIGMS (Junior Investigator for COBRE SC TRIMH and INBRE-COBRE Collaborative Award with a focus on desmosome biology). His research is clearly on an upward trajectory. Not only he is a valued instructor, he has inspired many bioengineers in training to endorse research as career. Will is currently advising seven PhD students and a postdoctoral fellow, all of whom he mentors to become the best researchers. Will serves the professional community through his leadership involvement in ASME BED, champions diversity and inclusion at Clemson University and BMES, and is involved in the Coulter College for innovation and technology development.



## NAREN VYAVAHARE COFOUNDS TGEN TECH

Naren Vyavahare, CTO of TGen Tech, cofounded the start-up with CEO Ajay Houde. Focused on pediatric applications of technologies to improve soft tissue healing, the company's mission is to enable healthier lives for children and adults worldwide, Vyavahare said. The applications are regenerative, thrombo-resistant, calcification-resistant, biological, convenient and pliable. According to the cofounders, all current replacement materials have significant limitations, which result in the need for re-interventions, ranging

from interventional catheterizations with stent implantation to multiple reoperations for conduit replacement. The limitations of these materials involve to varying degrees their thrombogenicity, durability, susceptibility to infection and lack of growth potential. TGen Tech's TxGuard grows with children, reducing the risk of repetitive surgeries and thereby making life easier and healthier for patients and their families.



# Delphine Dean: First recipient of the Ron and Jane Lindsay Family Innovation Professorship

Paul Alongi



**A** bioengineer who works with students to create medical devices for rural areas of Tanzania and other low-resource settings is the first recipient of a professorship named for the family of Clemson University alumni Ron Lindsay and his wife, Jane.

Delphine Dean said she is happy to be the first holder of the Ron and Jane Lindsay Family Innovation Professorship. It was heartening, she said, to see appreciation for innovation and efforts to help students learn innovation. “I want to thank the Lindsay family for this,” Dean said. “It was unexpected, and I think it really makes a difference,

not just for me but for students. This professorship will enable them to go places and meet people and do really cool projects.”

Dean said she will use funds generated by the professorship’s endowment to help pay for students to travel to Tanzania and India for research and to go to conferences to present their findings. The funds will also help pay for supplies that students will use to create prototypes of medical devices.

Dean has established close ties to collaborators in Tanzania and has led several student trips to the East African nation. Students travel to rural villages, where they help repair medical equipment. They

also learn what medical devices residents need and some of the unique challenges they face in delivering medical care. Students then return to Clemson to develop the devices as part of research projects. Prototypes are created by undergraduates, and the devices with highest promise are further developed by graduate students.

Clemson teams have worked with basket weavers to create hand-woven neck braces. They have also developed an infant warmer, a breast pump with an HIV filter and a diagnostic device with a hand crank for electricity. One project spun off into Accessible Diagnostics, a company that markets a low-cost way of using saliva to monitor blood glucose levels in diabetic pets.

Dean is also expanding her research and education efforts to India. She is leading Clemson’s efforts to coordinate with the Indian Institute of Technology Delhi on the Center for Innovative Medical Devices and Sensors.

A \$1 million gift from the Lindsay family funded the professorship, several scholarships and other initiatives in the College of Engineering, Computing and Applied Sciences. Ron Lindsay said he was happy that his family could support the professorship. “We are thrilled that Delphine was chosen,” he said. “We have been very impressed by her technically and interpersonally, and we are equally impressed by the passion she shows for her work and her students. Having her as the recipient makes us that much more pleased with

our ability to support the college and University.”

Ron and Jane Lindsay graduated from Clemson with bachelor’s degrees in 1980. Ron’s degree was in chemical engineering, and Jane’s was in economic biology. After graduation, Ron took a job with Eastman in Kingsport, Tennessee and stayed with the chemical company for 36 years, retiring in 2016 as chief operating officer. He has stayed in touch with his alma mater and now helps guide the college as a member of its advisory board.

Martine LaBerge, chair of the Department of Bioengineering, thanked the Lindsays and said that Dean was a highly qualified choice as the professorship’s first recipient. “The Lindsay family’s generosity is truly inspiring and deeply appreciated,” she said. “Their support will help Dr. Dean position students for success after graduation, nurture their sense of service to others and expand research into medical devices for low-resource settings.”

Dean said that of all her accomplishments, she is most proud of her students’ success. “One of my former Ph.D. students is a professor, and some are working as leaders in industry,” she said. “Some of the undergraduates I’ve worked with have gotten M.D.s and Ph.D.s and done great things. I think that for a faculty member the ultimate accomplishment is seeing the students you’ve worked with do well and surpass what I do. That’s the goal.”

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## ELASTRIN THERAPEUTICS

*Dr. Naren Vyavahare, Cofounder*

Elastrin Therapeutics is a biotech startup with technologies to restore hardened and damaged arteries and tissue by targeting the elastic fiber that makes them work. Founded by Mr. Douglas Mulhall, Dr. Naren Vyavahare, Dr. Charles D. Rice, and Dr. Mirko Stange, the SCRA Client Company has demonstrated proof-of-concept for a patented therapeutic compound that may provide needed repair

and restorative function to lungs that have been damaged by the COVID-19 virus. According to Vyavahare, “Elastin is present in lung alveoli that are being degraded by enzymes such as neutrophil elastases and MMPs released by inflammatory cells in COVID-19 infection of lungs. Our elastin targeting nanoparticle can also target drugs to the lungs and prevent lung injury.”





# AT-HOME MONITORING DEVICE FOR PATIENTS WITH CHRONIC KIDNEY DISEASE

**C**hronic kidney disease is a condition in which a patient's kidneys are not functioning properly to clean the blood, leading to unhealthy buildup of excess fluid and waste products in the body. The Centers for Disease Control and Prevention estimates that one in seven adults in the US (about 30 million people) suffer from this condition, making chronic kidney disease one of the most serious health-related problems in the US today. To address this major health issue, improved methods are required for both monitoring and treating chronic kidney disease.

Robert Latour, McQueen-Quattlebaum Professor in the department of bioengineering, and Sudha Garimella, Clinical Associate Professor of Pediatrics at USC-SOM Greenville and medical director of the Division of Pediatric Nephrology and Hypertension at Prisma Health-Upstate, were recently awarded a CU-Prisma Health Innovation Maturation Grant as PIs for development and clinical evaluation of a test method to enable patients with chronic kidney disease to monitor their kidney function daily.

Latour and Garimella are assisted in this project by co-investigators Jane M. DeLuca, assistant professor in the school of nursing; George Chumanov, professor in the department of chemistry; and Guzeliya Korneva, research associate, and Tyler Harvey, assistant professor, department of bioengineering. Ms. Riley Rapert, department of bioengineering, works on this research as part of her BS/MS degree program.

The overall objective of this translational research is to develop a simple, low-cost method of measuring the ammonia concentration in exhaled breath. While previous research efforts by other groups have documented the association between the ammonia concentration and kidney function, current tests involve relatively complex and expensive methods suitable only for laboratory analysis by trained technicians. They thus are not applicable for at-home use. The research team seeks to develop a prototype breath-test device over the next nine months, to be followed by clinical assessment of its use by patients suffering from chronic kidney disease under the direction of Dr. Garimella.

Successful development of this technology will provide an excellent resource for patients with chronic kidney disease, enabling them to routinely monitor their condition in the comfort of their home between clinical visits. This capability will also provide clinicians additional data to assist them in monitoring progression of a patient's kidney disease over time, assisting them in making more informed treatment decisions for improved patient care.



## AT 20+ YEARS SINCE GRADUATION, MARC LONG IS EXHILARATED ABOUT BIOLOGICS!

*Dr. Marc Long*

*For a dynamic look at our field, from Fortune 100 to nonprofit foundation, we asked Dr. Long, Executive Vice President, R&D, Clinical Affairs, Project Management, IP & Grants at MTF Biologics, to share his experience. Ed.*

I am humbled to share a bit of my experience with you in this newsletter. My graduate school years at Clemson University provided me so much knowledge, experience, and real-world skills to support my industry career. It has slightly more than 3 years since I the move to MTF Biologics. A few things have been different—moving from a Fortune 100 company to a nonprofit foundation, supporting a broader mission including honoring the gift of human tissue and organ donation rather than dealing with biomaterials, being at the executive level to influence strategy and major decisions—but the drive to serve patients and leading great teams to success remain. After 20+ years with two medical device companies (Smith&Nephew, Stryker) while focusing on orthobiologics and biomaterials, it has been exhilarating to be completely immersed in biologics with human allograft tissues and building for the future with regenerative medicine solutions.

[MTF Biologics](#) is a global nonprofit organization on the forefront of saving and healing lives through innovations in tissue and organ donation, transplantation, and research. We collaborate with leading physicians, scientists, and experts in tissue and organ recovery to honor donated gifts, serve patients, and advance science. We create the highest quality and safest tissue grafts and fund clinicians and researchers furthering the science of transplantation. The third pillar of our mission—to advance science—has also been a highly positive element in my continued passion because it provides many channels to innovate and collaborate with top clinical and scientific key opinion leaders. Our dynamic grant program, aligned with our mission, has also been a tradition for MTF Biologics to help junior and experienced researchers in their careers and make an impact in the field of allograft tissue science.



**I would summarize: Never stop learning and Innovate towards finding a solution to an unmet need.**

If I may share a couple of pearls of wisdom, I would summarize them as “never stop learning” and “innovate towards finding a solution to an unmet need.” Clemson is a prime place to develop both of these outlooks as I had the privilege to experience when I arrived in this country 30 years ago. I have had opportunities to give a bit back by serving on boards, and it has been an exciting experience to see how the BIOE Department and teams have continued to grow into a top worldwide institution under terrific leadership. Being in NJ may be a big jump for a South Carolina Tiger, but we are the “Garden State”—you just need to drive a few miles away from the Newark airport. Moreover, just across the river is the place where “if you can make it there, you can make it anywhere”—I could say the same for Clemson BIOE!





# PROMOTING SCIENCE AND ENGINEERING ACROSS SOUTH CAROLINA

*Dr. Jorge Rodriguez*

*With the goal of promoting science and engineering to middle school students across South Carolina, Clemson University's College of Engineering, Computing and Applied Sciences partnered with Duke Energy to create the EXPLORE mobile lab. The program's lead engineer is Dr. Jorge Rodriguez, research assistant professor in the department of bioengineering and the dean's office. With a background in teaching and mentoring at the collegiate level and industry experience, Jorge brings a wealth of knowledge and skills to EXPLORE. Ed.*

Engineering is a crucial field that has shaped the way we live every day. It drives technology, and technology impacts our daily lifestyle. As I tell students, An engineer is someone who really understands science and uses this



better chance to reach your goal. As middle schoolers, you have plenty of time to start seriously training.

I introduce engineering as a broad field through hands-on activities that allow students to experiment with real problems. Students get the chance to build a prosthetic leg and a bridge and experiment to see how the insulation at home works and how a scale works. They get to program a robot to do desirable tasks.

I enjoy the big impact of my job: I touch a lot of lives. I try to be very positive and not just introduce students to engineering, but help them think about how they are contributing to society.

**You need to train your brain, increasing its memory to increase the level of deep thinking that it can do.**



knowledge to create innumerable things for the benefit of society.

For students, I characterize the difficulty of learning engineering this way: Engineering can be compared to running a marathon. If you asked me to run a marathon tomorrow, most likely I wouldn't be able to do it. If I want to do it, I need to train every day, pay attention to my nutrition and sleep, take care of injuries, and avoid addictions. I have to build the number of miles that I run per week. Then I can certainly run a marathon in a few months or in a year.

Training for any highly intellectual career, such as engineering, is the same. You need to train your brain, increasing its memory to increase the level of deep thinking that it can do. You have to train it every day. That way, when you enroll in college, you will have a

# BIOENGINEERING RECOGNIZES ITS STUDENT BODY SERVICE BY ESTABLISHING THE EUGENE M. LANGAN III SERVICE AWARD

*Martine LaBerge*

The Eugene M. Langan III Service Award was established in 2020 in recognition of Dr. Langan's outstanding dedication and service to the Department of Bioengineering. Dr Langan is a world renowned vascular surgeon and scientist who exemplifies service, promoting and supporting the field of biomedical engineering, the Department of Bioengineering, its students and faculty.

Eugene M. "Gene" Langan, III, MD, Adjunct Professor of Bioengineering at Clemson University, is a vascular surgeon whose entire clinical and academic career have been in Upstate South Carolina. Originating from Scranton, Pennsylvania, Dr. Langan graduated from the University of Scranton and Georgetown University School of Medicine and completed his vascular surgical training at Geisinger Medical Center. When relocating to Greenville, South Carolina in 1994, Dr. Langan began his clinical career at the Greenville Health System (GHS) and immediately started a collaborative research program in vascular engineering at Clemson University. At GHS, Dr. Langan pioneered the first two-year accredited vascular surgery residency in the nation and first vascular surgical residency in South Carolina. He later became the Chairman of the Departments of Surgery and Orthopedics at GHS and developed the Divisional structure of both Departments. Dr. Langan has a long career of service to his patients and clinical and academic partners. A point of pride is Dr. Langan's long service to mentor the future careers of students and young adults, including high school, undergraduate, graduate, and medical students as well as residents, fellows and faculty members. It has always been critically important to pass on the need to assist others in making career choices and advancements.

For the past 26+ years, Dr. Langan has consistently provided support to bioengineering students with countless hours as research co-



advisor or committee member, internship mentor, capstone design mentor, guide for transition to the healthcare profession, and lecturer in many courses. Dr. Langan has co-authored many manuscripts and conference proceedings with bioengineering faculty and students. Throughout his career, Dr. Langan has exemplified leadership through service. The recipients of the inaugural Eugene M. Langan III Service Award are Riley Rapert, Bioengineering graduating senior, and Timmy Samec, PhD Candidate. Congratulations to both and thank you to Dr. Langan for his humble acceptance that this award be named in his honor.



# SIMULATOR COULD HELP VASCULAR SURGEONS IMPROVE THEIR SKILLS

Paul Alongi

An important part of medical school could soon be upgraded for the digital age, as a group of Clemson University researchers develop the first simulator of its kind to help teach future vascular surgeons how to suture blood vessels.

The SutureCoach would come equipped with cameras and sensors to capture a range of data, including how the surgical tool and needle move and the forces the user exerts. Other simulators have been created, but the SutureCoach would be the first to combine these types of data to objectively measure vascular suturing skill. It's crucial that surgeons are proficient in suturing because blood vessels carry blood throughout the body.

Joseph Singapogu, an assistant professor of bioengineering at Clemson, is leading the development of the simulator. The work is funded with \$1.1 million from the National Institutes of Health. "Our ultimate goal is improved patient outcomes," Singapogu said. "This research is based on the belief that the skill of a surgeon is one of the most critical factors that contribute to successful patient outcomes. We're asking as a community, 'How can we enable better, faster training?'"



Singapogu is collaborating with colleagues at Clemson, Prisma Health-Upstate, the University of Virginia and several vascular surgery educators across the country. Over the next three years, the team will gather large data sets from residents, fellows and attending surgeons to get a better understanding of how a spectrum of skill can be reflected in metrics. Then it could be possible to set benchmarks that would be more formally incorporated into medical education. "For now, we're asking, 'How can we best quantify vascular suturing skill?'" Singapogu said. "If we train people on these metrics, can we see if they get better faster?"

Martine LaBerge, chair of the department of bioengineering at Clemson, said Singapogu is well-positioned to help students improve their surgery skills. "Dr. Singapogu has deep experience in simulation-based skills training to improve patient outcomes," she said. "Further, the rich, interdisciplinary environment that Clemson has created with its partners, including Prisma Health-Upstate, serves as fertile ground for impactful innovation."

The work on the simulator began in 2013 as a collaboration with John Eidt, who presented the

need for the device and is a vascular surgeon at Baylor Scott & White Heart and Vascular Hospital in Dallas. "The engineering team at Clemson is working to create a device that markedly improves our ability to teach surgeons how to optimize their surgical skills," Eidt said.

The SutureCoach reunites Singapogu with David Cull, a vascular surgeon and the vice president of academic development for Prisma Health's Health Sciences Center. Singapogu and Cull previously worked together to create a simulator to teach students to find arteriovenous fistulas, which are veins and arteries that have been surgically connected for dialysis.

Cull said he's excited about the work on the SutureCoach. This research is aimed at helping future vascular surgeons develop a

core set of skills to improve patient outcomes," Cull said. "These new tools have the potential to accelerate training and provide performance-based metrics." Collaborators also include Richard Groff, an associate professor in Clemson's Holcombe Department of Electrical and Computer Engineering, and Sara Riggs, an assistant professor of engineering systems and environment at the University of Virginia.

Anand Gramopadhye, dean of Clemson's College of Engineering, Computing and Applied Sciences, said the research will help advance health innovation. "The amount of the award is a testament to Dr. Singapogu's hard work and the success he and his team have had in creating medical simulators," Gramopadhye said. "They are well-positioned to help create a healthier society. I offer them my wholehearted congratulations on the grant."

## BIOE students distinguish themselves in three-day HERO pitch event

Clemson's Hayek Center for the Business of Prosperity held a three-day event to help Clemson students incorporate business principles into their community outreach and international aid projects. The program included lectures by renowned philanthropists, business leaders and scholars and small-group mentoring by graduate students. Student organizations that best incorporated business principles into their charitable projects were eligible for HERO Prizes ranging from \$2,000 - \$5,000.

BIOE's Umbilical Cord Care Kit team (Amanda LeMatty and Robert Falconer) was runner up, and the Bloodless Malaria Detection Test (Habib Rafka, Izabella Kamieniecki, and Jacob Steiniger) team won first prize. The teams are mentored by Delphine Dean, John DesJardins and Melinda Harman. According to Dr. Dean, "A number of other BIOE students participated in the pitches, and they all did really well."





# SPOTLIGHT ON WOMEN OF ORTHOPEDIC RESEARCH SOCIETY: JENNIFER WOODELL-MAY

*As part of a series on women in orthopaedic research, the ORS Women's Leadership Forum asked Jennifer to provide insights on her career and experiences. Reprinted from ORS CONNECT. Ed*

Jennifer Woodell-May received her PhD in Bioengineering from Clemson University in 2001, her MS in Bioengineering from Clemson in 1996, and a BS in Physics from Furman University in 1995. She is the Associate Director of Research in Biologics for Zimmer Biomet.

## **Where do you fit into your organization?**

Since 2001, I have been in R&D in the Orthobiologics division for Biomet, Inc. and then exclusively for Biomet Biologics beginning in 2007 and then Biologics for Zimmer Biomet 2015.

## **Could you describe your main job responsibilities?**

I manage research activities for currently marketed therapies as well as pre-clinical, clinical, development, marketing, and regulatory efforts for new technologies.

## **What do you like most about your current position?**

I find it very exciting to get the opportunity to actually translate ideas from bench top to clinical trial in humans to commercial product. It is so rewarding to actually speak with patients that feel that your product has helped their quality of life.

## **Can you describe your career path?**

I completed my PhD in 2001 and then joined Biomet as a Project Manager. I have progressed through being a Principal Scientist and then Associate Director of Research.

## **Can you describe challenges/obstacles you faced in your career?**

I know my challenges are shared by millions of women trying to earn respect and being considered equal to our male peers. I cheer my advocates and have become more confident to highlight disparities when I can.

## **What are some ways in which mentoring (either as a mentee or mentor) has shaped your career in orthopaedics?**

I have grown from both my mentor and mentee relationships. I was originally hired by a female scientist. Her guidance both as a professional and as a scientist was invaluable to me. I have since had the honor of having young female scientists report to me and

have learned just as much from them as I hope I have been able to guide them.

## **What is one piece of advice you can offer to people interested in pursuing orthopedic research in industry?**

Find a company whose corporate culture best fits your own personality. You will have so much more job satisfaction in a place that matches you. It is OK to ask during an interview what the culture is like. Companies work hard on their culture and they should be able to describe it to you.

## **Is there any other information or comments you would like to offer?**

We are always our worst critics. I personally battle with imposter syndrome throughout my entire career. Find allies that will give you the confidence you need to grow.



*Find allies that will give you the confidence you need to grow.*

# CLEMSON BIOENGINEERING SOCIETY — ORGANIZATION UPDATES

*Timmy Samec, President, Clemson Bioengineering Society*

# H

appy spring, Tigers! It has been quite an academic year thus far for the Clemson Bioengineering Society with many successful events: Hosting home tailgates, including our Alumni Homecoming Tailgate on October 26, many social events and showing our support for Clemson Athletics through working concession stands at basketball, softball, and baseball games! We have put together a large schedule of events this year that will serve as the model for those who come through the organization in the coming years and are very excited about the future of CBS!

For quite some time, the graduate student organization and undergraduate student organization have been two separate entities that, except for certain occasions, have remained separate. However, it is with great pleasure and excitement that we release the official announcement that the graduate and undergraduate Clemson Bioengineering Societies have successfully merged into one inclusive and cohesive unit for the betterment of all students, faculty, and staff. This new organization will continue to be Clemson University's student chapter of the Biomedical Engineering Society and Society for Biomaterials professional organizations. We have finalized this merger in order to encourage professional, positive relationships between all members of the Clemson Bioengineering department. The general structure and operations of this organization will remain similar to previous CBS standards, with increasing focus on mentorship and professional development through interactions between graduate and undergraduate students in a cooperative effort to further the reputation of Clemson Bioengineering.

Our new organization has already started ramping up involvement with increased fundraising activity and support of Clemson Athletics,



planning several service activities including a bioengineering demo for the Girl Scouts, holding an information table at the Engineering Expo and Walhalla STEM Night, continuing our spring service to Roebuck Elementary's STEM Day, and finalizing details for our First Annual Spring Formal and Awards Banquet. You can definitely expect to see great things out of our department in the coming semesters! Make sure to follow Clemson Bioengineering on Facebook and Instagram to stay up to date with what we have going on and to see how you can get involved!

## NEWLY HIRED Administrative Coordinator

Anna Craft, a recent graduate of Anderson University, has been hired to fill the position of Administrative Coordinator. With a major in Digital Media Communications and a minor in Applied Computing for Business,

Anna will be the departmental webmaster. Additionally, she will

develop and specify promotional material tailored to various audiences including those at national conferences. Traveling to events, she will work with faculty and staff to deliver and evaluate the department's approach. Anna will assist faculty with travel arrangements and with subsequent reimbursement and will manage all aspects of planning for on-campus events.



# Three Bioengineers awarded 2020 National Science Foundation Graduate Research Fellowships

Three awardees in one year — a departmental first! Ed.

## Maggie Elpers

I am honored to have been chosen to receive the NSF Graduate Research Fellowship and represent Clemson Bioengineering in this way. Most importantly, I'm so grateful for the mentorship I have received from Dr. Dean and Dr. Alexander-Bryant, who have supported me in my research interests including developing a device to inactivate HIV in breastmilk and developing a peptide-hydrogel drug delivery system for treating glioblastoma multiforme. They have helped me gain numerous skills to become a confident researcher, and I am excited to continue developing my skills while pursuing my PhD at Cornell University in the fall. Although I do really enjoy research, I also spend plenty of time doing other things! Outside of lab I enjoy hiking, traveling to new places, and finding new coffee shops and breweries.

The most impactful part of this experience and my whole undergraduate experience has been the people I've met and shared this with along the way.



## Britney Hudson

I'm very honored to have been offered an award for the NSF Graduate Research Fellowship Program. This fellowship allows me to have the fortunate opportunity to continue my graduate research and commit more time to its advancement. My current research goals involve exploring the role of chemical and mechanical stimuli in bladder dysfunction.

I'm also happy and grateful to have a strong support system, not only from my family, but also from my lab, my mentor Dr. Nagatomi, and the whole BIOE department. While the lab is my home and where I spend a lot of my time, during my downtime, I express myself creatively through painting and drawing.

## Megan Pitz

I am honored to have been chosen to receive the NSF Graduate Research Fellowship. I would like to thank my friends, family, mentors, and labmates for supporting me in my endeavors and helping me reach this achievement. I feel very fortunate to work in the Nanobiotechnology Lab with Dr. Alexander-Bryant as my advisor, where I am working on developing a peptide-based delivery system for chemotherapy and gene therapy for treatment of glioblastoma multiforme. In the future, I hope to pursue a career involving a combination of research, scientific communication, and public policy.

Outside of the lab, I enjoy anything outdoors, especially camping, hiking, and backpacking! My favorite place to be is on top of a mountain. After taking a few years off from theatre and ballet, I also hope to find my way back to the stage during my time in Clemson! When I'm not in the mountains or dancing around the house, you can find me reading or crocheting with my two cats.



## ALUMNUS ANDREW COBB

Andrew Cobb '15, '16 is a Design Quality Engineer II with Abbott's Cardiac Rhythm Management Division. Ed.

At Abbott, I apply design control techniques to link design requirements through risk management to production and process controls. I rely heavily on data to make data-driven decisions to continuously improve product reliability and reduce cost. Daily, I work to ensure the success of new product transfer through design and process verification and validation activities by collaborating with R&D engineers and manufacturing engineers.

At Clemson, I went through the electrical engineering track while earning my bachelor's and master's degrees in Bioengineering. Now, I am a member of the Biomedical Engineering Society's Industry Committee and serve on Clemson Bioengineering's External Advisory Board. Clemson Bioengineering was a cornerstone for me in understanding the importance of patient-focused engineering. Rather than engineering for the sake of engineering, a patient-focused approach through the application of physics and design controls allows for the customer need to be achieved at a lower cost.

Outside the medical device industry and academia, I enjoy traveling the world and learning from diverse cultures. I currently speak Spanish, Italian and Portuguese and look forward to learning more languages to connect with others around the world!



*Clemson Bioengineering was a cornerstone for me in understanding the importance of patient-focused engineering. Rather than engineering for the sake of engineering, a patient-focused approach through the application of physics and design controls allows for the customer need to be achieved at a lower cost.*



# Team Receives Spine Podium Award from Orthopedic Research Society

# Award-Winning Students!



Daniel Bonthius's team received the Spine Podium Award at the Society's annual meeting in Phoenix, AZ. The team's presentation was, "Rib-hook Construct for Pediatric Hyperkyphosis and Kyphoscoliosis." Daniel noted, "We are working on a new type of implant to treat children with very bad spinal deformity." The ORS Spine Section describes itself as a catalyst for development of global innovative spine-specific teams that encompass a wide variety of professions and a culture of sharing ideas, time, resources, and results.

Tammy Rothell, Undergraduate Student Services Coordinator

We are very proud of all our winners for their hard work and accomplishments and are disappointed that we will not be able to honor them at the Spring Formal as originally planned. However, we will be honoring them publicly in another way soon! We hope you all will continue good practices of social distancing and handwashing as we make our way through these unusual circumstances. We wish good health to you and your loved ones!

## The Department of Bioengineering is pleased to announce our 2020 College Award winners:

**Robert W. Moorman Award for Outstanding Junior in Engineering** — Corrina R. Laird

**Blue Key Academic & Leadership Award** — Jared A. Capuano

**Dr. Robert W. Snelsire Diversity Prize** — Azrin M. Jamison

**Jacquelyn Willis Anthony Award** — Illana A. Jamison

## NEW FACULTY

Two new faculty members have joined the department. Heather Dunn, a lecturer in the Department of Animal and Veterinary Sciences, is now a BIOE Research Assistant Professor. Heather's research interests include mammary gland development, cancer biology and epithelial mesenchymal transition.



Jessica Larsen is now Assistant Professor of Chemical and Biomolecular Engineering and Bioengineering. Her research interests include drug delivery, biomaterials and nanotechnology.

## The Department of Bioengineering Awards Committee is pleased to announce our 2020 Departmental Award winners:

### Undergraduate Award Winners

**S. W. Shalaby Outstanding Bioengineering Sophomore Award** — Rick K. Kakanou

**Larry S. Bowman Outstanding Bioengineering Junior Award** — Curtis J. Bakle and Lauren E. Davis

**Poly-Med Outstanding Bioengineering Senior Award** — Margaret A. Elpers

**Barry W. Sauer Outstanding Bioengineering Undergraduate Researcher Award** — Jared A. Capuano

**Jonathan Black Undergraduate Leadership in Bioengineering Award** — Adam M. Abdulrahman

**C. William Hall Undergraduate Departmental Honors Award** — Aynsley Q. Hartney

**R. Larry Dooley Entrepreneurship Award** — Amanda S. LeMatty

**Eugene M. Langan III Service Award** — Riley E. Rapert

### Graduate Award Winners

**Austin T. Moore Leadership Award** — Nardine M. Ghobrial

**Outstanding Graduate Bioengineering Teaching Assistant Award** — Mikhail A. Bredikhin

**Page Morton Hunter Bioengineering Graduate Researcher Award** — Robert C. Coyle

**R. Larry Dooley Entrepreneurship Award** — Zachary R. Ballard

**Eugene M. Langan III Service Award** — Timothy M. Samec





Clemson University  
Department of Bioengineering  
301 Rhodes Research Center  
Clemson, SC 29634

You are **BIOE STRONG**, Striving To Reach Opportunities, Networks, Goals!  
*Congratulations, BIOE Class of 2020!*

