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BIOE NEWS

Spring 2021



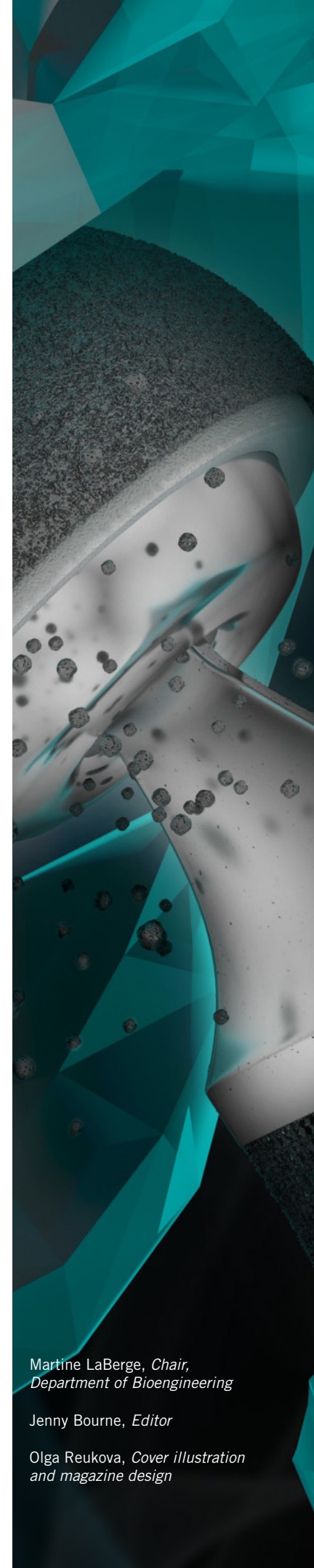
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Orthopaedic Medical Device Product Specialist certificate

ARE YOU INTERESTED IN EXPLORING A CAREER IN MEDICAL DEVICE OR HEALTHCARE SALES? INTRODUCING A UNIQUE CROSS-COLLEGE EDUCATIONAL OPPORTUNITY IN PARTNERSHIP WITH ARTHREX, INC.

For more information, please contact Jennifer Hogan (Program Director) at jrhogan@clermson.edu

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Clemson Tigers help drive Life Sciences in South Carolina

Zach Hargett, SCBIO Technology & Innovation Manager

In South Carolina, life sciences are booming, driven by an expanding base of diverse companies, outstanding research universities like Clemson, excellent healthcare systems, a rapidly emerging innovation ecosystem and the leadership of SCBIO. A recent study documents that life sciences in South Carolina involves over 850 firms in 42 of 46 counties and generates a \$12 billion annual

economic impact: Life sciences, the fastest-growing segment of the state's knowledge economy, is thriving globally.

CEO Sam Konduros, a Clemson graduate, said recently that SCBIO is "passionate about our mission to build, advance, innovate and grow the life sciences industry and ecosystem in South Carolina. We

◀ Women in Life Sci

undertake this bold journey shoulder to shoulder with extraordinary partners, collaborators and stakeholders to move our state forward and to drive innovation, investment, job creation, economic diversification and quality of life for our citizens."

Earlier this year, SCBIO welcomed over 660 industry stakeholders, university faculty and students from around the state and nation to SCBIO's Virtual Annual Conference, themed The Power of Us. Over two days, state and national presenters shared how the industry is advancing innovation, developing talent and creating partnerships to fuel a brighter tomorrow. According to Morgan Nichols, SCBIO's Corporate Affairs & Investor Relations Manager and a Clemson alumna, "The SCBIO 2021 Virtual Conference produced a crescendo of positive momentum, connectivity and energy within the state. Life sciences have been on the front lines battling COVID-19 since last spring, and the conference was a perfect tribute to all those who stepped up for others this past year."

SCBIO has benefited from partnering with universities, including Clemson. Erin Ford, SCBIO EVP and COO, noted, "I'm thankful for Dr. Martine LaBerge's leadership at Clemson over the years. Her guidance and insight continue to be an important resource and inspiration for SCBIO and me personally as we develop programs to grow the industry and engage students." Recent SCBIO programs include a platform to support young innovators and entrepreneurs, strategies to better prepare students to enter South Carolina's life science industry, and advocacy work to promote women in STEM.

Often, these SCBIO initiatives are led by Clemson students and graduates. Zach Hargett, SCBIO Technology & Innovation Manager and a Clemson BIOE alumnus, leads SCBIO's innovation

As a woman in STEM, I understand the importance of introducing girls to life sciences at a young age and showing them the amazing opportunities for their future.

Amanda LeMatty

SCBIO is excited to continue to partner and collaborate, at Clemson and beyond, to showcase The Power of Us in South Carolina.

Zach Hargett

platform, which assists innovators and entrepreneurs in advancing development efforts by leveraging SCBIO's partnerships, network and internal engineering team. "SCBIO is more than a cheerleader for innovation, it's a resource and partner for young innovators and entrepreneurs," said Hargett. "2021 is going to be an exciting year as our engineering team is tackling several pilot projects while building scalable strategies and partnerships to accelerate innovations through South Carolina's ecosystem."

Amanda LeMatty, SCBIO Senior Intern and Clemson BIOE student, noted that her SCBIO internship has provided "hands-on experience working with industry professionals to bring solutions from concept to creation while allowing me to leverage skills I'm learning about in classes." Ashlea Willis, Clemson microbiology senior and SCBIO intern, has worked closely to plan student-focused events that enable them to connect and engage with industry leaders. "These opportunities are so important for students like me who want a career in life sciences, but aren't sure what options exist," said Willis.

In 2021 and beyond, SCBIO will continue serving as a connector between students seeking to learn about the industry and industry leaders seeking next generation talent. Besides providing students with free SCBIO memberships, another major initiative is SCBIO's Women in STEM. Its 2020 kick-off was a Young Women in Life Science Conference attended by 650 high school girls. Besides learning about life sciences, they connected with 75 industry leaders in a networking session. LeMatty said, "As a woman in STEM, I understand the importance of introducing girls to life sciences at a young age and showing them the amazing opportunities for their future. I'm proud to be part of such a meaningful initiative and excited to help SCBIO build on this momentum."

SCBIO remains committed to its mission to build, advance, innovate, and grow South Carolina's life sciences industry. With many mission-centric initiatives and plenty of work to do, SCBIO is excited to continue to partner and collaborate, at Clemson and beyond, to showcase The Power of Us in South Carolina.



Curbing COVID-19 on campuses nationwide

Clemson News
March 22, 2021

First study documenting public university testing outlines strategy decreasing cases by 154%.

While COVID-19 cases may be on the decline, the virus is still prevalent nationwide, and higher education institutions need to prepare for a successful 2021 academic year. New research from Clemson University in *The Lancet Child & Adolescent Health*, one of the world's premier peer-reviewed general medical journals, indicates how surveillance-based informative testing (SBIT)

mitigates the spread of COVID-19 on campus, paving the way for other institutions, even those without the infrastructure or funding for mass-scale testing.

SBIT was implemented during the first two weeks of the Fall semester at Clemson. According to the study, random surveillance testing to identify outbreaks in residence halls and with targeted follow-up testing was twice as likely to detect a positive case than random testing models. In the absence of SBIT, transmission

models developed by the research team show COVID cases would have increased by 154 percent.

By focusing on residential hotspots, our SBIT strategy identified and contained outbreaks throughout campus. This strategy made efficient use of our resources, detecting positive cases at twice the rate of simple random testing.

Lior Rennert, Assistant Professor, College Of Behavioral, Social And Health Sciences

The study is the first to document the implementation, results and relative effectiveness in detecting and containing COVID-19 outbreaks and mitigating university campuses' spread. For most universities, voluntary testing was implemented, leaving many cases undetected and contributing to an increase of COVID on campuses and in their surrounding communities.

The surveillance-based informative testing was spearheaded by Clemson's public health team. The authors of the manuscript are Lior Rennert, Christopher McMahan, Corey Kalbaugh, Yuan Yang, Brandon Lumsden, Delphine Dean, Lesslie Pekarek and Christopher Colenda, and are the first Clemson team to publish in a *Lancet* family journal.

SBIT led to a 36% decrease in prevalence over a two-week implementation period. Without SBIT, estimated prevalence would have jumped by 60%.

Clemson's commitment to COVID-19 safety

The study's research team played an integral role in the University's ability to bring students back to campus in Fall 2020. Towards the tail end of the semester, there was a precipitous decline in student cases, despite significant increases in the case counts in surrounding communities. The declines were due in large part to the public health strategies implemented. At the pinnacle of these strategies was an aggressive plan to test as many students and employees as often as possible. By identifying active cases, the University was able to mitigate the virus's community spread, thus reducing risk to students, faculty, and the larger community.



What Clemson faced was not unique – and it was not the only campus with a high number of reported cases. The difference? Clemson implemented a robust and repetitive testing strategy for students and faculty regardless of symptoms or exposure. In doing so, positive cases were identified and removed from the population, thus limiting the virus's spread both on-campus and in surrounding communities through isolation and quarantine procedures.

Clemson's public health strategies were derived through data-driven means. Over the summer, the University's public health team designed and built models demonstrating pre-semester testing would reduce the spread and minimize peak cases during the semester. Acting on these findings, the University mandated all students and faculty be tested before returning to face-to-face instruction. As a part of these efforts, nearly 3,000 COVID-19 cases were discovered, preventing the return of nearly 3,000 infected students and faculty, who would have unknowingly spread the virus to others – infectivity is thought to be two to four people per confirmed case.

As in-person instruction began, the University also began randomly testing 5 percent of the student body weekly. These surveillance

efforts allowed for the identification of “hotspots” in both the on- and off-campus student body. Testing was then redirected to these hotspots. This combination of testing drove the COVID prevalence to below 1 percent.

Since the initial testing efforts, Clemson’s positive rate dropped weekly – as did the population using isolation and quarantine accommodations. While most of the credit should rightfully lie with students’ responsible behavior, the University’s public health strategies undoubtedly contributed to the decreasing case count. Beginning October 2020, the public health team implemented a weekly testing regime, keeping disease prevalence down ever since.

Lior Rennert, assistant professor of biostatistics
Department of Public Health Sciences
College of Behavioral, Social and Health Sciences

Christopher McMahan, associate professor
School of Mathematical and Statistical Sciences
College of Science

Corey Kalbaugh, assistant professor
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Yuan Yang, Ph.D. student
School of Mathematical and Statistical Sciences
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Delphine Dean, Ron and Jane Lindsay Family Innovation Professor
Department of Bioengineering
College of Engineering, Computing and Applied Sciences

Lesslie Pekarek, medical director
Student Health Services
Division of Student Affairs

Christopher Colenda, President Emeritus
West Virginia University Health System

IMBA, JD... BIOE?

Bo

Bowman, a medical malpractice attorney with an IMBA, decided to reduce his legal practice and enroll in the master’s program in January. Here, he comments on his latest career move. Ed.

I have always been interested in the practice of medicine, but understood early in my education that clinical practice was not for me. I had the opportunity to intern with a major medical device manufacturer while working towards my IMBA. I was fascinated by the devices and products that the company investigated, produced and evaluated for acquisition. After graduating from law school, I focused my legal practice on complex civil litigation, specifically medical malpractice actions. The aspect of those cases that most interested me invariably revolved around the devices that were being used by the medical professionals. I always looked forward to speaking with physicians and experts about the devices and techniques that they utilized. These professional experiences gave me a strong desire to learn more about the medical device industry.

I developed an interest in Clemson’s master’s degree in bioengineering several years ago while practicing law, but I did not believe that it aligned with my educational and professional background. Out of curiosity, I scheduled a meeting to learn more about the department. Within the first fifteen minutes of my meeting with Martine LaBerge, Ph.D. my assumption that BIOE was not a possibility for me was shattered. I was immediately “all in” on the program. Martine LaBerge’s, Ph.D. passion for the program and her desire to help me achieve my professional goals were inspiring. It made the decision to pursue this degree very easy. The program seemed like a perfect fit.

The most important aspect of my Clemson experience so far has been the attention paid to my career aspirations. Dr. LaBerge and the administrative staff at Clemson went above and beyond to assist me selecting a curriculum that would best position me to reach my goals. Every course that was suggested seemed to be

I really enjoy working with my classmates; I have learned so much from them. I feel very fortunate to be a part of this world-class program.

tailormade for me. Although this is only my first semester, it is easy to see why I have heard so many great things about the BIOE program and its faculty over the years.

I would tell prospective students that it is never too late to pursue their interests. No matter the journey, students can leverage their past educational and professional experiences to help reach their career goals. I would also add that it has been a pleasure working with the administration, faculty and staff in the bioengineering department. They truly have a passion for helping students identify their aspirations and equipping them with the knowledge and experience to succeed. Finally, while the coursework is challenging, it is worthwhile: It provides students with the skills and tools needed to excel after graduation. I would encourage any prospective bioengineering students to reach out to the faculty to see how the bioengineering program can help them reach their goals.



Having been in the workforce, I now take a different approach to my education. As an attorney, I am very analytical. That is one way that I can meaningfully contribute when working as part of a team.

BIOE Graduate Instrumental in Commercialization of Microban

Working with a team of inventors and financial backers, Glenn Cuman Ph.D. gave Microban Products Company its commercial start. Ed.

In the late 1960s, work by W.L. Morrison led to development of the first truly antimicrobial polymeric products for both medical and consumer applications. Morrison's original concepts have undergone significant refinement. His ideas have made the transition from the laboratory to the global marketplace, thanks to an experienced team of professionals with the resources to make dreams a reality.

Microban Products Company was incorporated in 1984 and received funding for commercial activity from Clinitex Corporation, founded by Glenn Cuman, Henry Richbourg and Barnwell Ramsey in 1987. Clinitex produced orthopedic devices and specialty medical products, many of which incorporated Microban technology based on Morrison's original work. Their background in global biomedical product development from their days at the Zimmer Division of Bristol-Myers gave Cuman, Richbourg and Ramsey insight into the possibility of incorporating safe, long-lasting and effective antimicrobial ingredients into products other than medical devices.

Since 1984, Microban Products Company has made the concept of antimicrobial polymers, coatings, textiles and end-use products a practical and affordable enhancement for a variety of industries and markets. Proprietary processes, numerous patents and regulatory registrations protect these technologies. Through deep technical know-how, Microban antimicrobial and odor control protection are incorporated into a wide variety of consumer, industrial, medical and textile products to provide continuous, safe and effective protection against a broad spectrum of bacteria, mold, mildew, fungus and yeast.

Includes excerpts from microban.com.

In October 2020, the EPA found Microban 24-Hour Sanitizing Spray kills SARS-CoV-2 within 60 seconds on hard, nonporous surfaces. The spray provides 24 hours of protection against 99.9% of bacteria.



CLEMSON BIOLOGICAL SCIENCES ANNUAL STUDENT SYMPOSIUM: CBASS 2021

CBASS, a crossdisciplinary event, is open to all undergraduates, graduate students and postdoctoral fellows involved in research with a life sciences component. Ed.

Sophomores Brook Schmid and Andrew Derasmo won the 1st and 2nd awards, respectively, for their CBASS 2021 presentations. According to Martine LaBerge, Ph.D. "Their work is helping us to strengthen our relationship with our academic partners – the Materials Science and Engineering Department and the Biological Sciences Department."

Schmid said that an antenna is a long, tapered, fluid-filled tube with no musculature, and her group has observed that an insect can bend it considerably upon demand. She stated, "My presentation introduced the driving logic and preliminary evidence behind our group's general hypothesis: that the mechanism of antenna manipulation is based on a controlled fluid dynamic pressure system of hemolymph (insect blood), which flows through the antenna."



Derasmo said, "My presentation was about a comparative analysis between the tensile properties of various insect antennae. I performed tensile tests on the antennae of cockroaches, hawkmoths and painted lady butterflies, with the general conclusion being cockroach antennae exhibit a J-shaped stress strain curve, typically a trait of biomaterials and tissues like human skin and collagen. Future experiments could be used to design synthetic fibers with properties like those of the antennae."

Jonathan Black, F.B.S.E. 1939-2020

Martine LaBerge, Ph.D.



Jonathan Black was one of a kind and will be dearly missed. Spirited, opinionated, caring and a mentor to all who would seek his help, Black never left an opportunity to trigger controversy and positivity. He challenged everyone to think, innovate and give the very best. He supported colleagues at many stages of their career, developing wonderful friendships based on science and biomaterials. Who did not fear Jonathan's comments? "It was always with some trepidation that anyone would watch Professor Black approach a microphone at an SFB or ORS meeting after some poor resident or grad student or professor had just given a talk," Jeremy Gilbert, Ph.D. said. "You knew what was coming would not be pretty, but it would make you think, the speaker squirm and the audience cringe."

Black's academic career, a wealth of success stories, impacted three institutions: University of Pennsylvania (1971-1988), Clemson University (1988-1993; 1993-2020 as professor emeritus) and Cornell University (2011-2015). Black joined the faculty at Clemson as the inaugural Hunter Endowed Chair in Bioengineering, the first chair worldwide devoted to biomaterials science and engineering. One could wonder if he ever thought after receiving the

1986 Clemson Award for Contributions to the Literature from the Society For Biomaterials that he would one day be recognized as a cornerstone of the birthplace of biomaterials? In his plenary address at the 1986 SFB Annual Meeting, he compared the study of biomaterials to the story of the three blind men who find an elephant and attempt to describe it, speaking on "Biological Response to Materials: Three Aspects of the Elephant."

Black's colorful reputation as a storyteller and an engaging eccentric helped promote the field of biomaterials and the Society For Biomaterials, which he served as president in 1982-1983. Under Black's presidency, the Founder's Award was instigated, and for the first time, separate poster presentations were displayed as part of the annual meeting program. That annual meeting drew the largest number of participants to date, with 600 people attending and 256 papers contributed. The biomaterials community took a major step forward in its efforts for extensive exchange of research findings among colleges worldwide with its improvements to the International Liaison Committee. By that time, all five constituent international societies had agreed to reciprocity with registration fees for all members.



As an educator, Black merged philosophy and engineering, triggering excitement in the classroom. His classes on biomaterials were highly sought by students and colleagues: He crafted his lectures spontaneously without notes, pacing and reflecting on engineering and physics fundamentals and never neglecting to mention that creative avoidance is the place where innovation is defined.

One of the pioneers in the field of orthopaedic biomaterials, Black's seminal work on corrosion is still cited today. He inspired generations to serve science with perseverance.

"One of my many wonderful memories about Jonathan, which gave me my first real experience of his uniqueness," Robert Latour, Ph.D. said, "was during the banquet of the Society for Biomaterials Conference at the Waldorf-Astoria hotel in New York City in June 1987. I was in my second year of graduate school. Jonathan and his group were sitting together at one of the banquet tables. As I recall, the banquet meal was a nice chicken dish for about 700 or so attendees. When the server got to our table and started to place a plate in front of Jonathan, he looked up at the waiter and said, "I think I will have fish instead." Without skipping a beat, the waiter picked back up Jonathan's plate and returned about 15 minutes later with a nice fish dinner plate. So 699 people had chicken that night and Jonathan had fish. That event told me a lot about this unique individual. He certainly was one of a kind!"

One of the pioneers in the field of orthopaedic biomaterials, Black's seminal work on corrosion is still cited today. He inspired generations to serve science with perseverance. Martine LaBerge

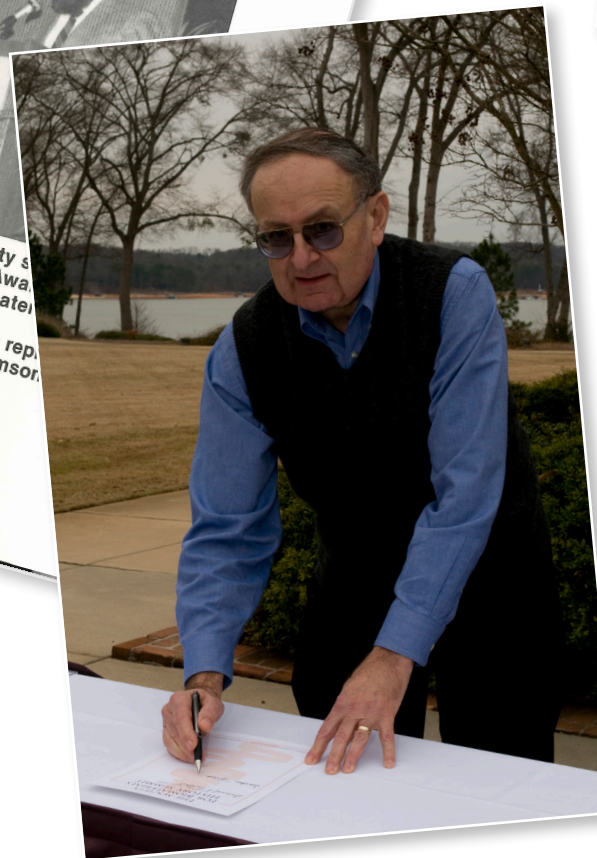


In 2011, Clemson's Bioengineering Department recognized Black's legacy to the world of biomaterials and innovation by establishing the Jonathan Black Undergraduate Leadership Award. It is given annually to an outstanding undergraduate student for leadership and service in addition to scholastic excellence, exemplifying Black's craftsmanship as an educator, leader, author and philosopher.

Jonathan Black has left big shoes to fill; he carried the Torch to the end with inspirational dedication. An exemplary role model like no other!

"A match can light a torch, but will never blaze as long or as brightly."

*-P. Elaine Duncan
The Torch, September 1986*



'Homegrown science' highlights Clemson University's increasing strength in biomedical research

March 26, 2021

Clemson University is showing its growing strength in biomedical research with the publication of a new paper that describes a way of measuring three-dimensional extracellular diffusion. All 10 of the co-authors in the Nature Communications paper are faculty, students or graduates from the Clemson University-Medical University of South Carolina Bioengineering Program.

The overwhelming Clemson presence on the team shows that years of local and federal investment in biomedical research are paying off,

said Hai Yao, who is the senior author, Ernest R. Norville Endowed Chair at Clemson and associate chair for the joint bioengineering program. "This is homegrown science," Yao said. "The University's investment and the funding we have received from the National Institutes of Health have provided the support we need to build capacity to conduct high-impact biomedical research and cement our reputation as a world-class research university."

The name of the article is, "A noninvasive fluorescence imaging-based platform measures 3D anisotropic extracellular diffusion." Read the paper at <https://news.clemson.edu/homegrown-science-highlights-clemson-universitys-increasing-strength-in-biomedical-research/>. The paper describes a research tool that took about five years to create. The team calls the tool LiFT-FRAP, which is short for light-sheet imaging-based Fourier transform fluorescence recovery after photobleaching. The paper will be of most interest to biologists and bioengineers who are interested in noninvasively measuring the 3D anisotropic extracellular diffusion of biorelevant molecules, Yao said.

Extracellular diffusion of biomolecules is critical to the vast majority of biological processes, such as: nutrient supply and waste removal for cell survival; signaling molecule transport for tissue development and organ homeostasis; and drug delivery for disease treatment.

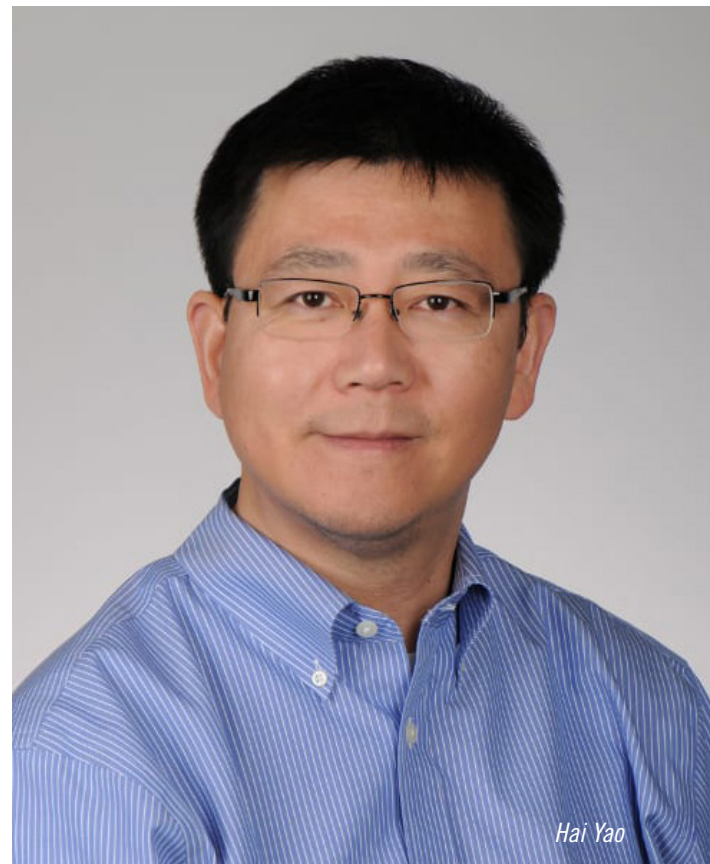
Martine LaBerge, chair of the Department of Bioengineering at Clemson, said the paper is an example of well-done interdisciplinary and collaborative research. "Clemson and its partners continue to conduct impactful research in the area of health innovation," she said. "This high-quality work is made possible by tireless hours in the lab and office, creativity, teamwork and years of investment, especially from the University and the National Institute of General Medical Sciences and the National Institute of Dental and Craniofacial Research. I would like to thank all those who have supported this initiative and the many others within the department."

A key building block supporting the research was an \$11-million

National Institutes of Health grant that funded the creation of the South Carolina Center for Translational Research Improving Musculoskeletal Health, or SC-TRIMH. Yao, who is the principal investigator on SC-TRIMH, said the center enabled the collaboration between him and co-corresponding author Tong Ye, an associate professor of bioengineering and a target junior investigator of SC-TRIMH at Clemson. Their Ph.D. students, Peng Chen and Xun Chen, contributed equally to the research and were a driving force behind the project, Yao said. Peng Chen is studying under Yao, and Xun Chen is studying under Ye.

Co-authors of the paper are: Peng Chen; Xun Chen; R. Glenn Hepfer, a postdoctoral fellow in Yao's lab; Brooke J. Damon, a research assistant professor in the joint bioengineering program; Changcheng Shi, a former Ph.D. student under Yao and now an associate professor at Ningbo Institute of Technology; Jenny J. Yao, a former high school research intern in the joint bioengineering program and now an undergraduate student at Harvard University; the late Matthew C. Coombs, who was a postdoctoral fellow in the joint program prior to his death; Michael J. Kern, a professor of regenerative medicine and cell biology at MUSC and bioengineering at Clemson; Ye; and Yao.

This work was supported by National Institutes of Health (NIH) grants P20GM121342, R03DE018741 and R01DE021134 to HY, and R21GM104683 and P20GM103499 to TY. This work was also supported by NIH T32 post-doctoral fellowship DE017551 to RGH, and F32 postdoctoral fellowship DE027864 to MCC.



Corey Kalbaugh, Joint Professor

Corey Kalbaugh, assistant professor in the Department of Public Health Sciences, is now a joint professor in bioengineering. Kalbaugh's research interests include investigating implicit bias in health-care delivery, measuring smoking with electronic health record data and creating clinical decision support tools to facilitate guideline-indicated care.



BIOE Trend Setters

Adam Abdulrahman: First BIOE M.D.-Ph.D. Student

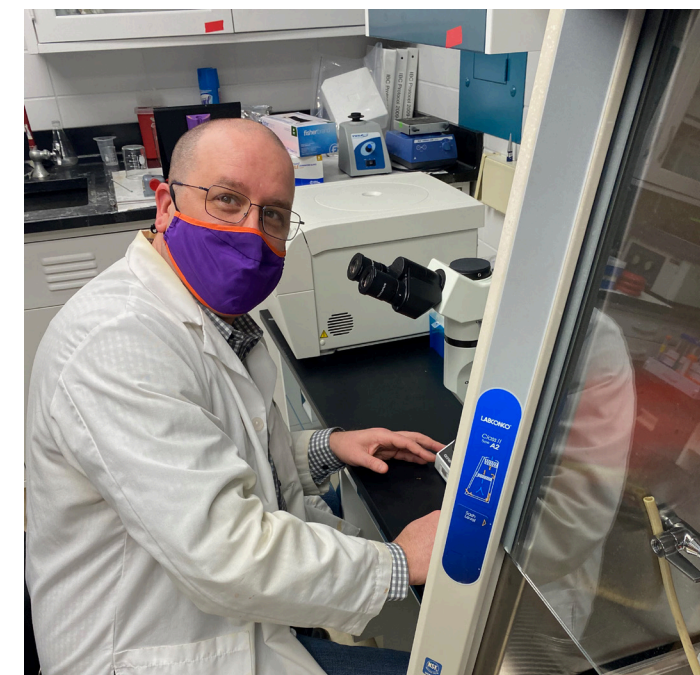
Adam Abdulrahman

I am deeply honored and thrilled to have been accepted to the Vanderbilt School of Medicine Medical Scientist Training Program (MSTP). Made possible through NIH funding, the MSTP aims to develop physician-scientists through an M.D./Ph.D. dual degree program. My goal is to translate biomedical innovation in the lab with medical practice in the clinic as a physician-scientist. I am excited to pursue my Ph.D. studies in biomedical engineering, drawing upon the strong foundation in Clemson's bioengineering program.

At Clemson, I work in professor Delphine Dean's lab to study the effect of glucose and advanced glycation end products on vascular smooth muscle cells and how these interactions may be implicated

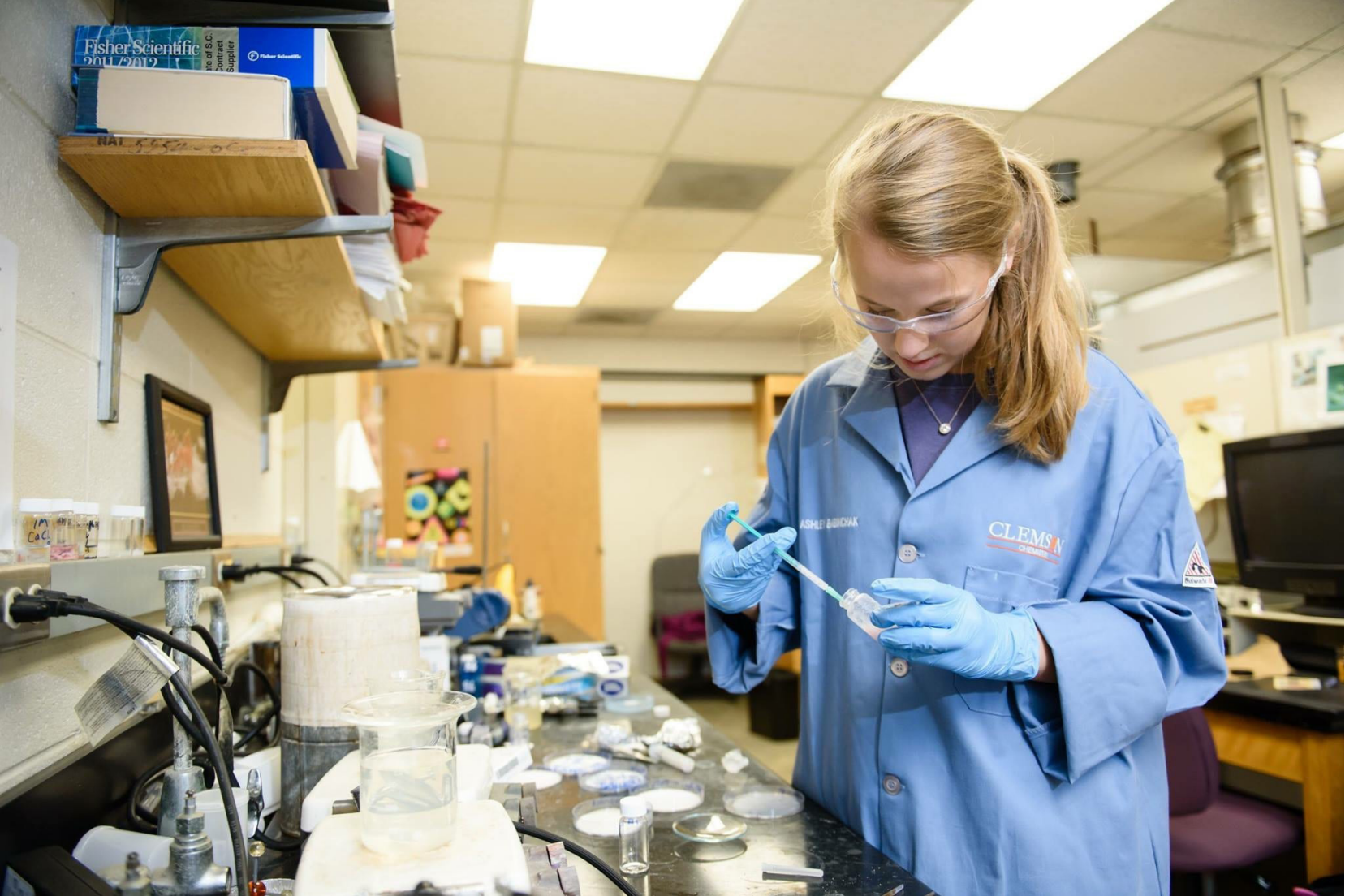
in diabetic comorbidities. I am very grateful for all of Dr. Dean's mentorship and support during my time at Clemson. In my Ph.D. research, I hope to investigate drug delivery systems especially as they relate to immunoengineering.

Outside of the lab, I love to play the cello! I am the principal cellist in the Clemson Symphony Orchestra, and I play in the Clemson University String Quartet. I also love the outdoors, and I go hiking or backpacking whenever I can. I am continually encouraged by the strong community at Clemson in science, engineering and the arts and the strong interdisciplinary focus within Clemson BIOE truly supports this community.



Booth, O'Connell awarded Transformative Research Seed Grant

A proposal by Brian Booth, Ph.D. and John O'Connell, M.D. of PrismaHealth was selected for funding via PrismaHealth's Transformative Research Seed Grant mechanism. The Health Sciences Center at PrismaHealth funds life-changing health services research that aligns with Prisma Health's purpose statement. The grant will support optimization of oscillating electric field delivery in tissue culture with the goal of more safely and effectively eradicating deposits of metastatic cancer in combination with other proven cancer therapies.



ClemsonNews

The ‘Ultimate Clemson Ambassador’

March 8, 2021

She scanned the room, saw only boys and machines and instantly decided she didn’t belong in an engineering class. “I was definitely afraid and thought I had been placed there by accident,” said Ashley Babinchak, describing that day in middle school. “I was a really big girly girl,” she said. “I wore a bow in my hair, did dance and wanted to be a fashion designer.”

What she remembers most about that experience nearly 10 years ago is her teacher. “She was teaching a whole class of boys, and

they all listened to her,” said Babinchak, an Honors College junior who is majoring in bioengineering. “I thought that was so cool.” That teacher in Fort Mill, S.C. was the first in a succession of women role models in STEM careers. She was followed by many professors and peers at Clemson in the College of Engineering, Computing and Applied Sciences, as well as the University at large.

Babinchak arrived at Clemson with an interest in biology and engineering, as well as the drive, resilience and attitude to be

successful. Clemson provided the knowledge, opportunities and mentors to help her discover her strengths and identify her ultimate career goal: medical device sales. She recently accepted a summer internship with Arthrex, a global medical device company that develops products and procedures to advance minimally invasive orthopedics. She’ll be a Sterilization and Biosafety intern at the company’s headquarters in Naples, Fla.

The Seeds of Sales

One of the first hints for Babinchak’s career path came after what some might call a failure. She had applied, but was not selected, to be a counselor for the Honors College undergraduate research program EUREKA!. Babinchak created a marketing campaign for the EUREKA! Instagram account. Instead of being discouraged, she approached the program director and pitched an idea.

“I was stunned when Ashley responded to my hiring decision with ‘even though I won’t be a counselor, please let me know if there’s any way I can be helpful to you or the EUREKA! program this summer,’” said Susan Falendysz, the EUREKA! program director and Honors College admissions manager. Babinchak had participated in the program the previous summer. She wanted to help promote it by creating posts on social media. “I knew Ashley had so much enthusiasm and social media expertise, so I didn’t hesitate to take her up on that offer,” Falendysz said.

Babinchak gathered information from program alumni and research faculty about their EUREKA! experience and planned weekly marketing Instagram posts for the months leading up to the program’s launch. That experience helped her realize she enjoyed communicating with people and helping them understand the value of the program. “I didn’t realize it was marketing,” she said.

Not Afraid to Fail

Babinchak credits her success, in part, to her willingness to fail. It’s a trait her parents, both Clemson graduates, instilled in her. “My attitude has always been to embrace failure as an opportunity for growth; my Clemson journey has been incredibly fulfilling because of that,” Babinchak said. “I apply to a lot of things and just don’t get them.” “My attitude has always been to embrace failure as an opportunity for growth; my Clemson journey has been incredibly fulfilling because of that,” Babinchak said. “I apply to a lot of things and just don’t get them.”

In her first year, she also applied to summer programs for undergraduate research, known as Research Experiences for Undergraduates REUs. “I applied to five summer programs, and I was rejected from all of them, except the one I got at the University of Nebraska-Lincoln.” She knew no one in Lincoln, Nebraska, but she lived there for 10 weeks. As part of the program, she researched the use of stem cells and gene therapy to treat Alzheimer’s.

Spring 2021

18

Clemson Bioengineering

Her story really shows that having women in leadership positions in engineering who are visible to students early on will be a determining and important factor in career path decisions. After all, we teach and lead by example.

Martine LaBerge

The Nebraska experience gave her a peek into graduate school research, and she entered her sophomore year thinking she would pursue a master’s or Ph.D. But that year she took several courses that involved team building activities as part of LEAD Forward, a leadership program for engineers offered by the College of Engineering, Computing and Applied Sciences. She learned she enjoyed roles that allowed her to engage with people, so she applied to be a Bioengineering Department ambassador. During the interview for that role, Babinchak was asked about her career goals after graduation. “I knew I needed a straight answer for this question because I really wanted this position, but I couldn’t think of what to say.”

She responded with an honest, but roundabout answer. “I don’t know if this job exists, but I’d like to show a company’s new medical device to doctors, explaining how to use it,” she told them. “I could design them, but I know I am better at the explaining side.” They told her about medical device sales, a career several of them were pursuing. Babinchak visited the department’s professional development coordinator, who helped her identify Clemson alumni at companies such as Arthrex, Abbott, and Stryker, and she reached out to them. Based on the advice from those conversations with alumni, Babinchak decided to pursue a minor in business administration.

Business Partnerships

She has also met industry leaders as part of her coursework. This semester a representative from Arthrex spoke to her marketing class the same day that she had an interview with the company for her internship.

The marketing class, Professional Selling, is a prerequisite to the Sales Innovation Program, which Babinchak is applying to this Spring. Founded in 2019 within the Wilbur O. and Ann Powers College of Business, the program focuses on being a nationally

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renowned resource for sales education, sales research and valuable academic partnerships. Such opportunities provide students with a competitive advantage, LaBerge said. “In the med tech industry, marketability is largely driven by experiences outside the classroom, engagement and leadership,” she said.

Clemson Family

Both of Ashley’s parents are Clemson graduates. She’s a legacy, but Babinchak chose Clemson because of her first-hand experience of personal attention. One of the first people Babinchak met on campus was Cassidy Barringer, who was a student ambassador. Barringer has since graduated from Clemson with a Master’s in Biomedical Engineering. There were no official department tours the day of Babinchak’s visit, so Barringer gave her a personal tour. She even arranged a lab visit where Babinchak watched students vacuum pig cells.

“That personal attention was a huge factor,” Babinchak said about her decision to attend Clemson. At the end of the tour, she and her parents sat down with the Bioengineering Department Chair Martine LaBerge.

“If it wasn’t for Dr. LaBerge, I might not have even come to Clemson,” Babinchak said. “We talked about BioE, Clemson and choosing a college. Even being able to have a conversation with the department chair for a prospective student (not even committed to Clemson at the time) was huge for me and a great example of putting the “Clemson family” into action.”

She has embraced the Clemson Family by nurturing relationships with faculty, staff, other students and alumni. Even after she completed her work with EUREKA!, Babinchak met with Falendysz regularly. She asked her opinion about REU applications, sent her email updates from Nebraska, and shared stories from her experience once she returned to campus. “It means so much to me that Ashley follows up with me regularly to let me know about her next amazing adventure,” Falendysz said.

Mentee becomes Mentor

This year Babinchak spends a lot of time engaging and leading students — whether she’s organizing a Welcome Back Festival or representing the department on its Student Advisory Council. She also works at the Honors College, where she is often the first point of contact for prospective students and families. “Ashley is professional and positive and is loaded with direct experience concerning the benefits of the Honors College,” Falendysz said.

She’s looking forward to when she can give in-person tours of the Bioengineering Department and will serve as Lead Ambassador next year. In that role, she’ll coordinate the ambassador tours and provide personal tours, the type she attended as a high school



student. According to LaBerge, “As a BIOE ambassador she is the ultimate recruiter – her passion for Clemson and engineering is beyond expectations. She is the ultimate Clemson Ambassador.”

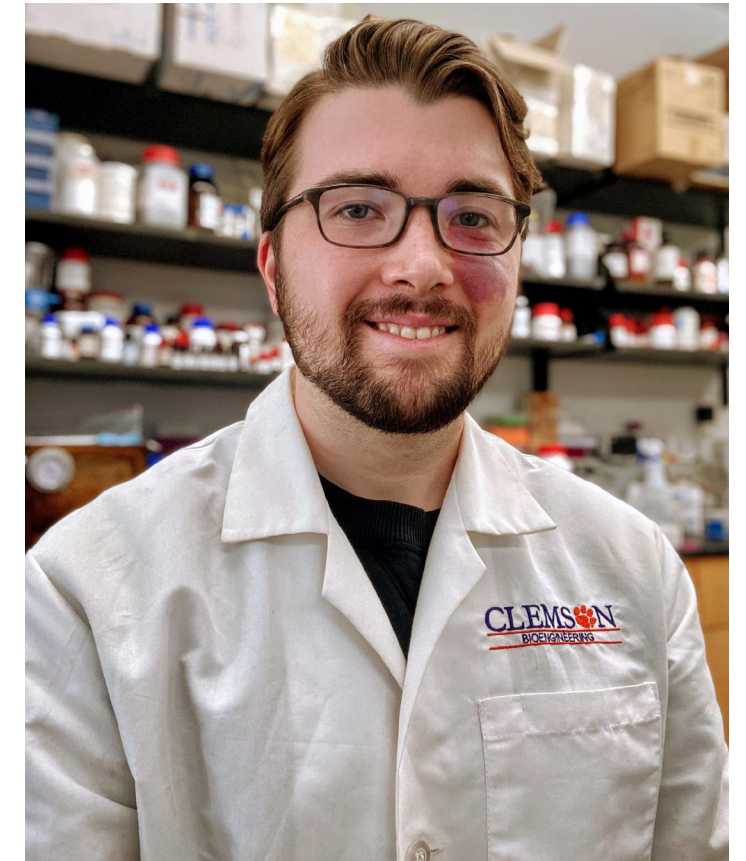
Barringer, who was also the Lead Ambassador, said she could have predicted that Babinchak would serve in that position. “I could tell Ashley would go out of her way to be helpful, ask for opportunities, and give up personal time for our tour guests without a second thought,” she said. “I am truly honored to have made such an impact on Ashley’s Clemson experience. Whether she knows it or not, she is making the same impact on someone else.”

My feeling with the culture at Clemson is that if I do stumble and fall, I’m going to fall into something else that’s going to be a good opportunity for me.

Ashley Babinchak

NIH F31: Ryan Barrs

Ryan Barrs, a Ph.D. student in associate professor Ying Mei’s lab in the Clemson-MUSC Bioengineering Program, has been awarded a National Institutes of Health F31 fellowship. Barrs said, “My first project was developing a bioink for bioprinting vascularized soft tissue. This gave me the experience and expertise to publish a comprehensive review article on biomaterials for bioprinting microvasculature. Currently, my research focuses on cardiovascular tissue engineering and cell therapy. With the support of the F31 award, I plan to develop pharmacological targeting of hypoxia-inducible factors in human cardiac microtissues to improve their therapeutic efficacy in treating myocardial infarction. Clemson’s bioengineering curriculum and the clinical research environment at MUSC have inspired me to use bioengineering principles to develop translational therapies that can directly benefit patients. After graduating, I plan to pursue an academic career and start my own lab developing clinically applicable regenerative therapies for cardiovascular diseases.



Outside the lab, I serve as the MUSC Chair of the Clemson Bioengineering Organization, acting as the liaison between students on the MUSC campus in Charleston and the main Clemson campus. In my free time, I enjoy roasting coffee at home, discovering new music, and playing hurling with the Charleston Hurling Club. I also enjoy science communication as a hobby and have written articles for MUSC Catalyst News and Progressnotes, MUSC’s literary magazine. Bioengineering Department chair Martine LaBerge said, “This speaks highly of Ryan as a researcher and his teamwork skills. Thank you to Dr. Mei for his outstanding mentoring.”

After graduating, I plan to pursue an academic career and start my own lab developing clinically applicable regenerative therapies for cardiovascular diseases.

BOARD MEMBER SPOTLIGHT: STEPHEN AINSWORTH, PH.D. '99



Stephen Ainsworth, Ph.D. '99
Executive Vice President of Strategy and Technology
ChoiceSpine LLC
Knoxville, Tenn.

In the 20 years since I graduated with my Ph.D. in bioengineering from Clemson University, I have had many exciting opportunities working with six different companies in three different states, ranging in size from pure startups to public midsize companies to most recently a privately held company, ChoiceSpine in Knoxville, Tenn. Starting out as an R&D engineer with Guidant Corporation (Santa Clara, Calif.), designing coronary and cranial stents was a natural step for me coming out of my Ph.D. research focused on vascular surgery. This led to working for a startup company focused on the incredible field of minimally invasive cardiac surgery where my background in preclinical studies was extremely useful. My wife Melissa (fellow Clemson graduate) and I enjoyed the Bay Area and California in general, but the East Coast was calling us back home. I had the opportunity to join a new startup in Wilmington, N.C. focused on minimally invasive spine surgery and have been in spine for the last seventeen years.

My passion to this day is still working with surgeons and designing implants. Yet over the years, I have enjoyed being responsible for all aspects of the business from engineering to regulatory, marketing, sales and logistics. I was even pulled into human resources activities this past year as we were all challenged to be creative and flexible in the way we operated while trying to keep each other safe and healthy. The breadth of knowledge I acquired during graduate school at Clemson with respect to materials, research and design has allowed me to advance in my career as an engineer. However, it was the ancillary activities such as surgeon interaction (being in the operating rooms with Dr. Langan, Dr. Pace and Dr. Sullivan), presenting and defending your work in front of peers and advisers and learning to sell an idea or a concept that have allowed me to excel in this rewarding field.

I have served on the Clemson Bioengineering Department External Advisory Board for several years. This has allowed me to keep in touch with faculty and departmental activities as well as act as a judge at the Senior Design Symposium. It is exciting to see what the students can accomplish in a compressed amount of time and the projects they tackle will serve them well in their first job out

of school and beyond. This is just one example of the community/network of fellow Clemson bioengineers created by Dr. LaBerge and other faculty members that I encourage each of you to tap into throughout your careers. The medical device industry can be pretty small, and I always enjoy running into other Clemson bioengineering graduates at conferences, meetings, interviews, the FDA or even as a rival competing for the sale. Lately, we all seem to have a little more swagger in our step after the two recent national championships.

On the personal side, Melissa and I have three great teenagers (Eliza, William and Amelia) who have been cheering for the Tigers since they were born. My nephew, Jared Capuano '20, also just graduated in bioengineering. We have lived in Knoxville for the past six years and are in the thick of the kids' activities including soccer and dance, but enjoy wakeboarding and surfing on the lake as well as visiting the nearby Great Smoky Mountains National Park. This is the closest we have lived to Clemson since we graduated so we enjoy taking trips to Clemson and Charleston whenever we get the chance. Knoxville is a great college town/city that loves its football, which is fun, but nothing compares to Clemson on gameday...Go Tigers!

***My passion to this day is
still working with surgeons
and designing implants.***

NSF CAREER: Angela Alexander-Bryant



Now is an exciting time for the future of nucleic-acid therapeutics.

Assistant professor and director of the department's Committee on Diversity and Inclusion, Angela Alexander-Bryant, has been granted the National Science Foundation's (NSF) Faculty Early Career Development (CAREER) award. The award is considered one of the most competitive for faculty at the beginning of their career.

According to NSF, it is "the National Science Foundation's most prestigious award in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization."

The NSF CAREER award funds Alexander-Bryant's proposal titled "CAREER: Multifunctional peptide nanocarriers for delivery of nucleic acid therapeutics." The funding will support development and characterization of multifunctional peptide-based nanoparticles for delivery of small interfering RNAs and ribonucleoproteins. Alexander-Bryant's research, she said, "addresses one of the grand challenges for engineering: engineering better medicines. Though nucleic acid-based therapy holds significant promise for advancing treatment of disease, a large barrier, particularly for cancer therapy, is insufficient intratumoral uptake and lack of endosomal escape, limiting bioactivity and, ultimately, clinical translation of these therapeutics. The peptide-based systems being developed in my lab are designed to overcome multiple barriers to delivery and enhance targeting to tumor tissue to increase efficacy." If successful, Alexander-Bryant's research will provide a novel platform for targeted delivery of nucleic acid therapies and a personalized approach for the development of clinically relevant siRNA- and RNP-based therapeutics.

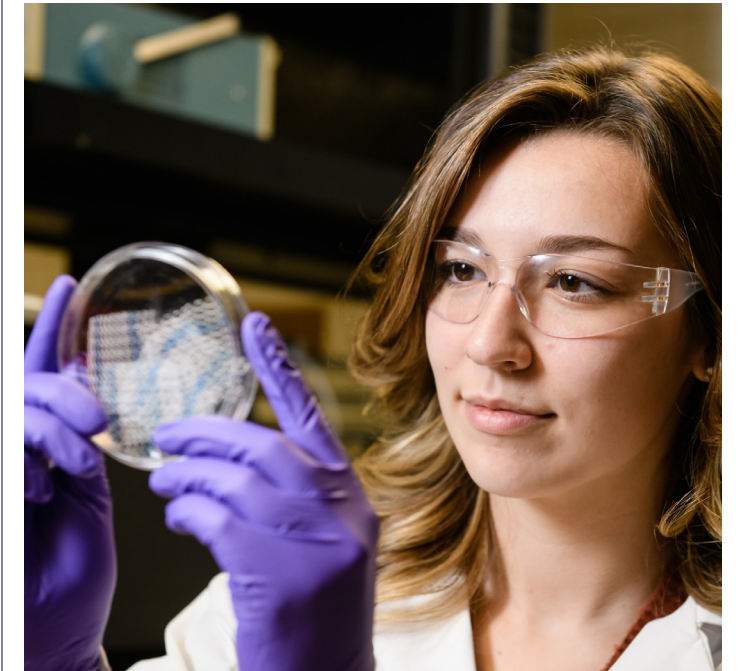
"Now is an exciting time for the future of nucleic-acid therapeutics," said Alexander-Bryant. "With the recent FDA approval of nanoparticle-based mRNA vaccines and millions of people across the country and globe receiving these vaccines, we have all witnessed firsthand the immense potential of

Our work is focused on identifying peptide-based delivery systems for targeted delivery of nucleic acids into cancer tissues.

nucleic-acid therapies. Continued research into delivery systems for other disease- and tissue-specific applications is necessary to expand the translation of these therapies. Our work is focused on identifying peptide-based delivery systems for targeted delivery of nucleic acids into cancer tissues. We aim to use these therapies to downregulate expression of oncogenes whose overexpression contributes to the progression of cancer and resistance to chemotherapy."

In addition to research, a significant component of the CAREER award is integration of the research into an impactful education plan. Alexander-Bryant is looking forward to implementing her proposal's education and outreach activities, which will allow high school, undergraduate and graduate students to contribute to accomplishing the aims of the research plan directly. She added, "We will address the gap in representation of minorities in STEM by providing early exposure activities in local high schools, partnering with minority-serving institutions and providing meaningful research and mentoring opportunities targeted toward underrepresented students."

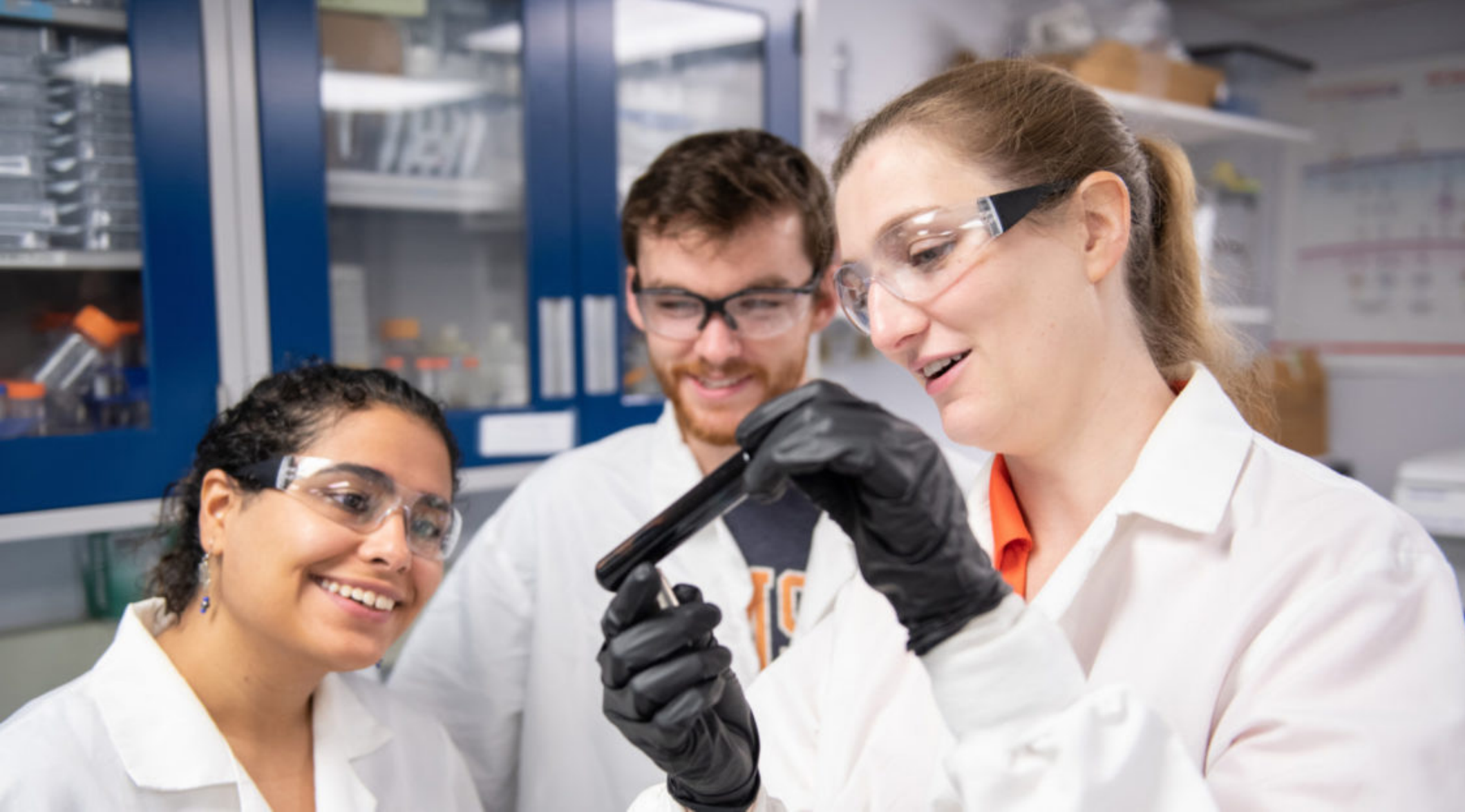
Alexander-Bryant received her bachelor's and master's degrees from Johns Hopkins University in materials science and engineering and her Ph.D. in bioengineering from Clemson University. Other awards Alexander-Bryant has received include being named a Gates Millennium Scholar and a Minority Scholar in Cancer Research by the American Association for Cancer Research. Alexander-Bryant is PI of Clemson's Nanobiotechnology Lab. Its mission is to develop novel, clinically translatable therapeutic delivery strategies to improve targeted treatment of disease by leveraging materials science, nanotechnology, gene therapy, and drug delivery to advance cancer therapies toward cures.



Goldwater Scholarship: Lauren Davis

"I am incredibly honored to be named a 2021 Goldwater Scholar. It is rewarding to have my past research and potential in the field of bioengineering be recognized, and I am excited to continue my research next year. The Bioengineering department has presented opportunities for me to continuously push myself in research and academics to be the best researcher, student and person that I can be. Mentoring from Dr. Harman on our various projects has truly helped me grow into my positions as team leader and outreach coordinator for our labs, during which I have gained vast knowledge on a variety of orthopedic implants and biomaterials. I am currently working on mechanical testing and imaging techniques for the structural analysis of surgical mesh used in hernia repair surgery.

I plan to continue my research and educational experiences in graduate school. Ultimately, I am hoping to pursue a career in the medical device industry. When I am not in lab, I have a variety of creative outlets to keep me going. Music has always been a large part of my life, and I enjoy playing piano in my free time and saxophone in Clemson Tiger Band and our jazz ensemble. I also enjoy spending time in my home state of Minnesota snow skiing and waterskiing."



AIMBE fellows are nominated each year by their peers and represent the top 2% of the medical and biological engineering community.

Delphine Dean receives one of bioengineering's high honors

ClemsonNews
February 18, 2021

One of bioengineering's top honors is going to a Clemson University professor who has played a leading role in South Carolina's response to COVID-19, has led efforts to develop medical devices for low-resource settings and has advised top lawmakers on issues ranging from the pandemic to diversity in healthcare professions.

Delphine Dean, the Ron and Jane Lindsay Family Innovation Professor, is among the newest members of the American Institute for Medical and Biological Engineering's (AIMBE) College of Fellows. Fellows are nominated each year by their peers and represent

the top 2% of the medical and biological engineering community, according to AIMBE. Of the more than 2,000 Fellows around the world, three are Nobel Prize winners, 10 have won the Presidential Medal of Science and 10 have received the Presidential Medal of Technology and Innovation, according to AIMBE. "This is a high honor," Dean said. "I am grateful to be included in a group of such talented, innovative individuals. I

thank all those who have supported me, including mentors, friends, students and family."

Dean led efforts to set up the Research and Education in Disease Diagnosis and Intervention (REDDI) lab, a federally certified clinical diagnostics lab at Clemson, which is now key to the University's COVID-19 testing strategy. She also serves as the Clemson lead on the state's COVID-19 Serological and Diagnostics Testing Taskforce, a group that assembles teams to address the pandemic's challenges. Further, Dean holds regular conference calls with the state's elected leaders and members of Congress to give advice on emerging technologies, screening strategies and testing capacity. Over the summer of 2020, Dean led the Clemson COVID Challenge, a statewide undergraduate research and design program. Participants included more than 500 students, faculty and staff from 15 institutions, along with several policymakers.

In addition to her work with COVID-19, Dean for several years has

led efforts to create medical devices for low-resource settings. She and her students visit rural areas of Tanzania, where they help fix medical equipment and come up with ideas for new low-cost devices that can be made with locally available resources. Those devices have included a breast pump that removes HIV from breast milk and an ink-jet printer reconfigured to print strips that can be used to test blood sugar for diabetics. Dean has presented her work to top Tanzanian officials, including former president, Jakaya Mrisho Kikwete. Her international work has also reached to India, where she traveled in 2015 to establish partnerships between stakeholders in the subcontinent and the United States.

At Clemson, Dean directs the Tigers ADVANCE Pathfinders and Pathway programs, which aim to increase the diversity of faculty hires on campus. She went to South Carolina's State House at the lieutenant governor's invitation to discuss how to create statewide efforts to bring more diversity into healthcare-related careers. Dean also helped lead a workshop arranged by the Governor's Office to help women start entrepreneurship ventures.

Her lab's expertise is in nano- to micro-scale characterization of biological tissues, including experimental techniques, such as atomic force microscopy and mathematical modeling. Dean studies cardiovascular cell mechanics and the effects of low-dose radiation on tissues and cells. She has co-authored 55 journal paper publications, two book chapters, and is an inventor on three patents licensed and practiced.

Martine LaBerge, chair of the Department of Bioengineering at Clemson, said Dean is highly deserving of membership in the AIMBE College of Fellows. "Dr. Dean is an extraordinarily hard worker, who radiates excellence, innovation and a passion for helping others, a record reflected in her many honors and awards," said LaBerge, who is also a member of the institute's College of Fellows. "I offer her my most sincere congratulations."



Quality Science Education Certificate Program

Jeremy J. Mercuri, John Witherspoon Gilpin, M.D. '82 Endowed Associate Professor of Bioengineering

Here, Jeremy Mercuri describes a life sciences certification available to majors and nonmajors. Ed.

Clemson BIOE is constantly looking to give students the knowledge and skills they need for early success in their chosen careers. A new certificate program developed by industry and government leaders, Quality Science Education (QSE), provides critical-thinking skills in quality assurance through immersion in science-based education and real-world experiences. The program delivers

- Conferences with subject matter experts
- Immersive educational experiences and
- Opportunities for internships and employment

Open to graduate students in BIOE and other majors, the curriculum is designed by Pathway for Patient Health, a nonprofit organization funded by the life sciences industry. Upon successful completion of QSE, students receive credit toward their graduate degrees and industry-recognized certification as a Certified Quality Science Professional (CQSP).

Three of the five courses required for certification are offered on demand online. For students working toward the Master of

Engineering in Bioengineering and the department's new Master of Science in Medical Device Reprocessing, most of the five courses count as electives. I manage the on-demand courses through Clemson's course software, releasing content to students in two-week increments. Students work at their own pace within each period and complete a homework assignment and quiz.

One attraction of the certification curriculum is the opportunity to interact online with industry managers who potentially will be hiring for internships.

Details

Program Goals

Enhance the readiness of students entering industry through immersion in science-based education and real-world experiences in Quality Science for the 21st century.

Program Outcome

- Credit toward a graduate degree
- Industry-recognized certification as a Certified Quality Science Professional (CQSP)

Curricular Details

- Open to all engineering, science, applied science and health sciences graduate students.
- The program consists of five graduate-level courses.
- Three online courses offered on-demand through Canvas (Clemson's course software) in Fall and Spring semesters.
 - BIOE 8660: Global regulatory and legal requirements of quality for the MedTech industry (prerequisite for all other on-demand courses)
 - BIOE 8670: Product development, specifications, process and validation for the MedTech industry
 - BIOE 8680: MedTech risk and failure analysis
- Two in-person courses.
 - BIOE 8140: Medical device commercialization/business acumen (offered Spring Semester)
 - BIOE 6380/6381: Sterilization and cleaning engineering for medical devices/microbiology (offered Fall Semester)

For more information, please contact

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 864-656-0978
 jmercur@clemson.edu

Trish Nigro
 Graduate Student Services Coordinator
 864-656-7276
 pnigro@clemson.edu

This industry-recognized certification can be part of a graduate education and adds a great deal of value immediately.



American Heart Association Predoctoral Fellowship: Kelsey Watts

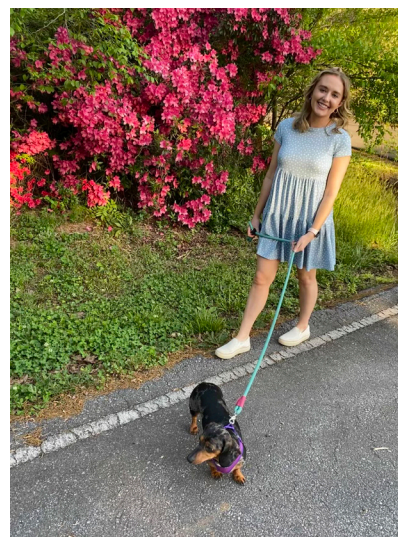
I was awarded for one year the American Heart Association Predoctoral Fellowship, which is worth a total of \$31,520. My project investigates the regulation of sex-specific mechanotransduction in cardiac fibroblasts. Dr. Will Richardson is my sponsor for the project. My plan is to pursue a career in academia with the long-term goal of running my own lab that will create sex-specific computational disease models. I am really interested in the gender data gap and how that will affect the future of precision medicine; I hope to be a researcher and mentor who works towards creating more equitable healthcare. My hobbies include going on walks with my dog and traveling.

Project Summary:

Heart disease is the number one killer in America. Before menopause, women are less likely than men to experience heart disease. After menopause, this relative protection is lost. Although this is likely due to the ovarian hormone, estrogen, long-term hormone replacement therapy (HRT) is not recommended because it has been correlated with increased risk of many adverse effects including cancer and stroke. Estrogen has shown promise in decreasing signs of heart disease at a cellular level. Mechanical factors like stress and strain are also known to play an important role in the development of heart disease. Little research exists on the combined effect of estrogen and strain on cardiac cells. The goal of this project is to expand our understanding of the sex-specific response of the heart at the cellular level. To do this, we will use cell stretching platforms combined with estrogen treatment to measure downstream effects. These findings will be incorporated into a computational signaling network model. This model will be used to screen potential drug targets which could lead to development of new treatment options for both men and women.



I hope to be a researcher and mentor who works towards creating more equitable healthcare.



1 awarded NSF Graduate Research Fellowship, 3 accorded Honorable Mention

A

manda LeMatty was awarded an NSF Fellowship; Honorable Mention was given to Kharimat “Lora” Alatise, Maureen Buckley and Mario Krussig.

LeMatty will pursue a Ph.D. in the biomedical engineering bioInnovate track at the University of Utah. The Summerville, S.C. native has worked in a low-resource medical device design creative inquiry with Delphine Dean, professor, Melinda Harman, associate professor, and John DesJardins, associate professor, for the past three years. LeMatty’s projects include a STEM outreach program, medical device reprocessing research, creation of an umbilical cord care kit and creation and implementation of a low-cost isolation device for COVID patients.

LeMatty’s CI allowed her to travel to Tanzania to conduct needs assessments on diagnosis of noncommunicable diseases and HIV, which is where she discovered a passion for global health.

A technology and innovation intern at SCBIO, LeMatty works on the innovation initiatives which engage, support and develop start-ups and entrepreneurs. She also organized STEM outreach and networking events, including the Young Women in Life Sciences Conference, SCBIO Bootcamp and various Student-Industry

Engagement events. LeMatty was awarded the 2021 Jonathan Black Undergraduate Leadership in Bioengineering Award as well as the 2020 R. Larry Dooley Entrepreneurship Award from the Bioengineering Department.

For the 2021 GRFP competition, NSF received more than 12,000 applications and made 2,074 fellowship offers. The fellowship provides three years of support for graduate education, including a \$34,000 annual stipend and a \$12,000 cost-of-education allowance. Fellows have access to a wide range of professional development opportunities over the course of their graduate careers.

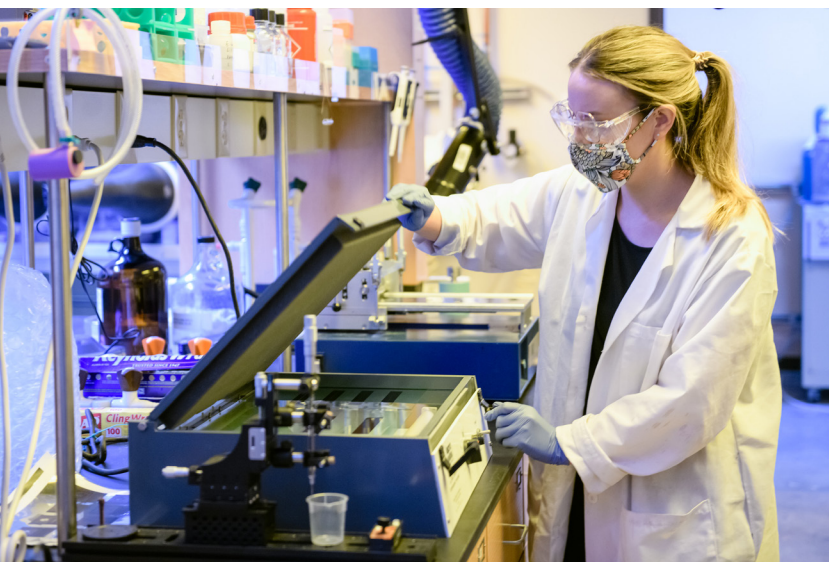
Alatise, a second year Ph.D. student, was a McNair Scholar as an undergraduate and at Clemson, she was awarded the 2020 Call Me Doctor Fellowship. Buckley, a senior and this year’s recipient of the Samuel B. Earle Outstanding Senior Award for the College of Engineering, Computing and Applied Sciences, will pursue a Ph.D. in biological engineering at MIT this fall. Krussig is a Ph.D. student whose research focuses on regenerative therapies for intervertebral disc herniation repair. The NSF accords Honorable Mention to meritorious applicants who do not receive Fellowship awards. This is considered a significant national academic achievement and provides access to cyberinfrastructure resources through the XSEDE. In 2021, 1,829 applicants received Honorable Mention.

Recognition of Stewardship

On February 12, 2021, the department hosted a Zoom event to recognize its philanthropic partners and the fruits of their outstanding generosity. Amy Hunt, senior director of Development and Unit Lead, College of Engineering, Computing and Applied Sciences, coordinated the meeting, which included messages of thanks from Anand Gramopadhye, dean, College of Engineering, Computing and Applied Sciences, and Martine LaBerge, chair, Department of Bioengineering. Gramopadhye described the impact donors have had on the broader community and commented that 65% of the college's IP disclosures and activities come from the department. Further, he stated that BIOE is central to ClemsonFORWARD, the University's 10-year strategic plan. LaBerge, noting that "Our mission is to educate students with passion," listed the following signs of a vibrant department:

- 29 faculty members
- 400% growth in the past 20 years
- Partnerships with Medical University of South Carolina and Prisma Health that extend Clemson's BIOE campus to the entire state
- Ranking of 4th nationally among Best Value Schools in Biomedical Engineering
- The largest extramural funding in the college in 2020
- 1st in the world to offer a medical device reprocessing program for bioengineers

Praising the seminal Harry G. Berry Biomedical Engineering Innovation Program, LaBerge thanked Sr. Associate VP for Development JoVanna King for her work with the Berry family that



supported this gift. Citing the Frank H. Stelling & C. Dayton Riddle Orthopaedic Research Laboratory as the cornerstone of CUBEInC, LaBerge thanked Thomas B. and Nancy M. Pace for this link between engineering and clinicians, which has led to numerous student design projects and applications for patents.

Faculty members characterized the impact that stewardship has on research leading to treatments for otherwise fatal diseases, improvements in quality of life for patients and families, patents by faculty and students, international recognition and networking opportunities that send graduates into careers boosted by outstanding networking opportunities. Describing work the Hunter Endowed Chair in Bioengineering has supported, Professor Naren Vyavahare listed developing therapies for cardiovascular disease including stabilization and reversal of elastin degradation. The late Jonathan Black, F.B.S.E. was the first recipient of the Hunter Endowment.

Ernest R. Norville Endowed Chair in Biomedical Engineering, Professor Hai Yao, recalled the impact of his first conversation with Mitch and Carla Norville. One outcome was that all three of them met with NIH administrators regarding research interests. In the last three years, Yao has been awarded more than \$20M in extramural funding. Now director of the NIH T32 program at Medical University of South Carolina, Yao has overseen creation of outstanding training opportunities for students. He added, "This has led to an increase in cross-talk between departments."

Yao announced that he and Associate Professor Tong Ye, also of the Clemson-MUSC Bioengineering Program, had a manuscript accepted

by Nature Communications in February 2020. Yao added that all 10 co-authors are faculty, students or graduates of the Clemson-MUSC Bioengineering Program. Further, Yao is now a member of the National Academy of Medicine's committee on temporomandibular disorders, which is charged to identify approaches to advance basic, translational and clinical research in the field. Finally, Yao thanked the Clemson Alumni Association for its essential support.

The South Carolina SmartState Endowed Chair in Biofabrication Engineering, Professor Bruce Gao, described his lab's work in two areas. These are, "cell-cell interactions under biofabricated microenvironments, concentrating on cardiac, neuronal, cancer, and stem cells and developing biomedical research devices, such as laser-guidance cell-micropatterning system, nonlinear and coherence optics-based bioimaging systems, and microfluidics-based biochips." Currently, Gao is leading a multi-university initiative to discover and establish new, sustainable approaches to design and manufacture biomedical devices with artificial intelligence-enabled customized performance.

Ron and Jane Lindsay Family Innovation Professor, Delphine Dean, who was recently chosen by Clemson's faculty to be a member of the Class of '39, described her collaborative work on COVID-19. This includes development of a laboratory certified by the Clinical Laboratory Improvement Amendments. The University received a commitment of \$6.9 million through Governor Henry McMaster and the State's Joint Bond Review Committee to assist in the development and expansion of the Lab. In addition to her leadership on COVID-19, Dean leads students in her Rhodes Engineering Center lab dedicated to using AFM, scanning probe microscopy and nano and micromechanics to understand how small-scale phenomena affect large scale tissue properties.

Robert B. and Susan B. Hambricht Leadership Professor, John DesJardins, said the endowment "gives him the flexibility to truly let students and their ideas flourish at both the department and college level." In addition to his research on total joint replacement, orthopaedic biomechanics and sports engineering, DesJardins directs the annual Bioengineering Senior Design EXPO. Student teams and research groups showcase their novel biomedical technologies and compete for design awards. These design and technology achievements are supported by laboratory research, clinical collaborations and industry partnerships.

McQueen-Quattlebaum Professor Bob Latour said the endowment provides discretionary funding to pursue ideas and listed two specific research directions. The first direction is the development of a urine test for at-home monitoring of blood phenylalanine levels for individuals with the rare genetic condition known as phenylketonuria (PKU), which can lead to irreversible brain damage. Latour's lab has developed the first at-home test method, which is expected to have worldwide impact. It has been patented and licensed and is expected to be commercially available within a year. The second direction is the development of a test for at-home monitoring of the ammonia



concentration in exhaled breath, with application to patients suffering from chronic kidney disease and for individuals with a urea cycle disorder.

Jerry E. and Harriet Calvert Dempsey Professor, Dan Simionescu, described the joy and honor he felt in being able to work with the late Jerry Dempsey, who encouraged collaboration between Clemson's College of Engineering, Computing and Applied Sciences and Prisma Health-Upstate. Simionescu, a Fellow of the American Institute for Medical and Biological Engineering, leads studies on biocompatibility and tissue regeneration.

John Witherspoon Gilpin, M.D. '82 Endowed Associate Professor of Bioengineering, Jeremy Mercuri, said, "Dr. Gilpin's vision is to have an impact on students to expand their opportunities toward success." Mercuri's lab focuses on development of regenerative medicine technologies to restore the anatomy and physiology of damaged or diseased musculoskeletal tissues including intervertebral discs, articular cartilage and tendons. Mercuri noted that Dr. Gilpin's endowment "affords me the opportunity to collaborate with innovators around the country."

Professor Jeremy Gilbert, Hansjorg Wyss Endowed Chair for Regenerative Medicine, noted his lab's leadership in studies on effects of metallic biomaterials and implants in the body. The primary objective in Gilbert's lab at MUSC, where he directs the Clemson-MUSC Bioengineering Program, is to foster interdisciplinary biomaterials research related to advanced and specialized metals, polymers, ceramics and composite materials. Gilbert is a member of the Medical Devices Committee of the Food and Drug Administration for Orthopedic and Rehabilitation Devices.

Our mission is to educate students with passion.
Martine LaBerge

Seed funding to restore vascular health

Clarissa Austin, Marketing Manager, CURF

Elastrin Therapeutics Inc. and Kizoo have partnered to develop therapeutics that render calcified tissue and organs supple again.

A rejuvenation biotech investor founded in Berlin, Germany, Kizoo focuses on reversing age-related damage on a cellular and molecular level. Elastrin and Kizoo have joined forces to further develop a platform that can restore vascular health by removing pathological calcification, specifically from sites where elastin has been degraded. Led by Clemson University Hunter Endowed Chair Naren Vyavahare, an expert in elastin degradation and stabilization, the Elastrin team will work to create a new way to repair significant tissue damage caused by aging.

“Elastin fibers are critical for homeostasis of tissues around the body, including the skin and vasculature and pulmonary tissues. As elastin fibers become damaged over time, arterial walls weaken, and the body’s physiological response results in aortic wall stiffening, aneurysms, and hypertension,” said Naren Vyavahare, Ph.D. Chief Scientific Officer at Elastrin.

Elastrin is a biotechnology startup that develops technologies designed to restore hardened and damaged arteries and tissue by targeting the elastic fiber that makes them work. Their mission focuses on improving quality of life by restoring damaged tissue to healthy resilience. Through the partnership with Kizoo, Elastrin aims to target albumin nanoparticles loaded with therapeutic agents directly to the tissue site by utilizing Elastrin’s proprietary anti-elastin monoclonal antibody created by Vyavahare and cocreated by Clemson University biological sciences professor and Elastrin team member, Charles Rice.

“This targeted delivery promises to improve the efficacy of therapeutic payloads as well as reduce side effects due to otherwise systemic administration. In addition, the nanoparticles result in slower release characteristics that improve the biodistribution of pharmaceuticals at the targeted exposure site,” said Douglas Mulhall, Elastrin co-founder.

Located at Clemson University, Elastrin was born out of Vyavahare’s research on understanding the reason behind calcification and stiffening of heart valves and their replacements. What he discovered led to several inventions that are still being used at Elastrin today.

“Cardiovascular diseases are the number one cause of death globally, taking an estimated 18 million lives each year. On top of that, everyone above 30 years old is suffering from damage to the cardiovascular system, which will result in severe symptoms one day. Our technology can reverse damage to the arteries and heart and bring the body back to the state before the damage even

occurred. This is a true game-changer in the industry and one of the puzzle pieces towards healthy aging. Nobody wants to live forever in an old and sick body, but we do want to live long in a healthy one,” said Matthias Breugelmans, CEO of Elastrin.

“We are proud to help Elastrin to open a new category in repairing significant damage from aging–tissue calcification and damage to elastin fibers. This will allow substantial rejuvenation of the cardiovascular system and restore organ function and skin elasticity to youthful levels,” said Frank Schueler, Managing Director of Kizoo Technology Capital.

About Elastrin Therapeutics Inc.

Elastrin Therapeutics is a South Carolina biotechnology company that develops novel therapies to reverse cardiovascular disease. Its underlying technology was developed during the last 20 years at Clemson University by Naren Vyavahare in collaboration with Charles Rice, who developed the antibody. The team built a proprietary platform that targets and restores degraded elastin by removing the harmful calcification that stiffens arteries. The platform significantly improves the efficacy of drugs and eliminates side effects by combining particle design with elastin targeting.

About KIZOO

KIZOO provides mentoring and seed and early-stage financing with a focus on rejuvenation biotechnology. Having been entrepreneurs, venture capitalists and mentors in both high-growth technology and biotechnology companies ourselves for many years with multiple exits and massive value created for the founders, Kizoo now brings this experience to the emerging field of rejuvenation biotechnology. We see it as a young industry that will eventually outgrow today’s largest technology markets.

As part of the Forever Healthy Group, Kizoo directly supports creation of startups turning research on the root causes of aging into therapies and services for human application. Investments include Cellvie, Underdog, Revel Pharmaceuticals, Elevian, LiFT BioSciences, MAIA Biotechnology, Turn.bio and others.

Forever Healthy’s other initiatives include evaluating new rejuvenation therapies, applying evidence-based curation of the world’s cutting-edge medical knowledge, funding research projects on the root causes of aging and hosting the annual Undoing Aging Conference.

Bioengineering faculty earn funds for technology development



CLEMSON — The Clemson University Research Foundation (CURF) has announced seven researchers will be awarded fiscal year 2020 Technology Maturation Fund grants to support them as they embark on the crucial last stage needed to move their technology from innovation to commercialization.

“The Technology Maturation Fund initiative assists in shaping a pathway for innovation and providing Clemson faculty with the unique opportunity to further their technological development,” said Chris Gesswein, CURF’s executive director. “The program has repeatedly demonstrated that targeted, strategic investments can have a significant impact on the probability of commercial licensing, industry collaboration or follow-on research dollars. Congratulations

to the recipients for their dedication to academic research and for the innovative contributions they have made to the Clemson University research enterprise.”

Since the Technology Maturation Fund program launched in 2014, CURF has awarded more than \$870,000 in maturation funds to Clemson researchers.

This year’s awards range from approximately \$6,000 to \$39,000 and were granted among others to:

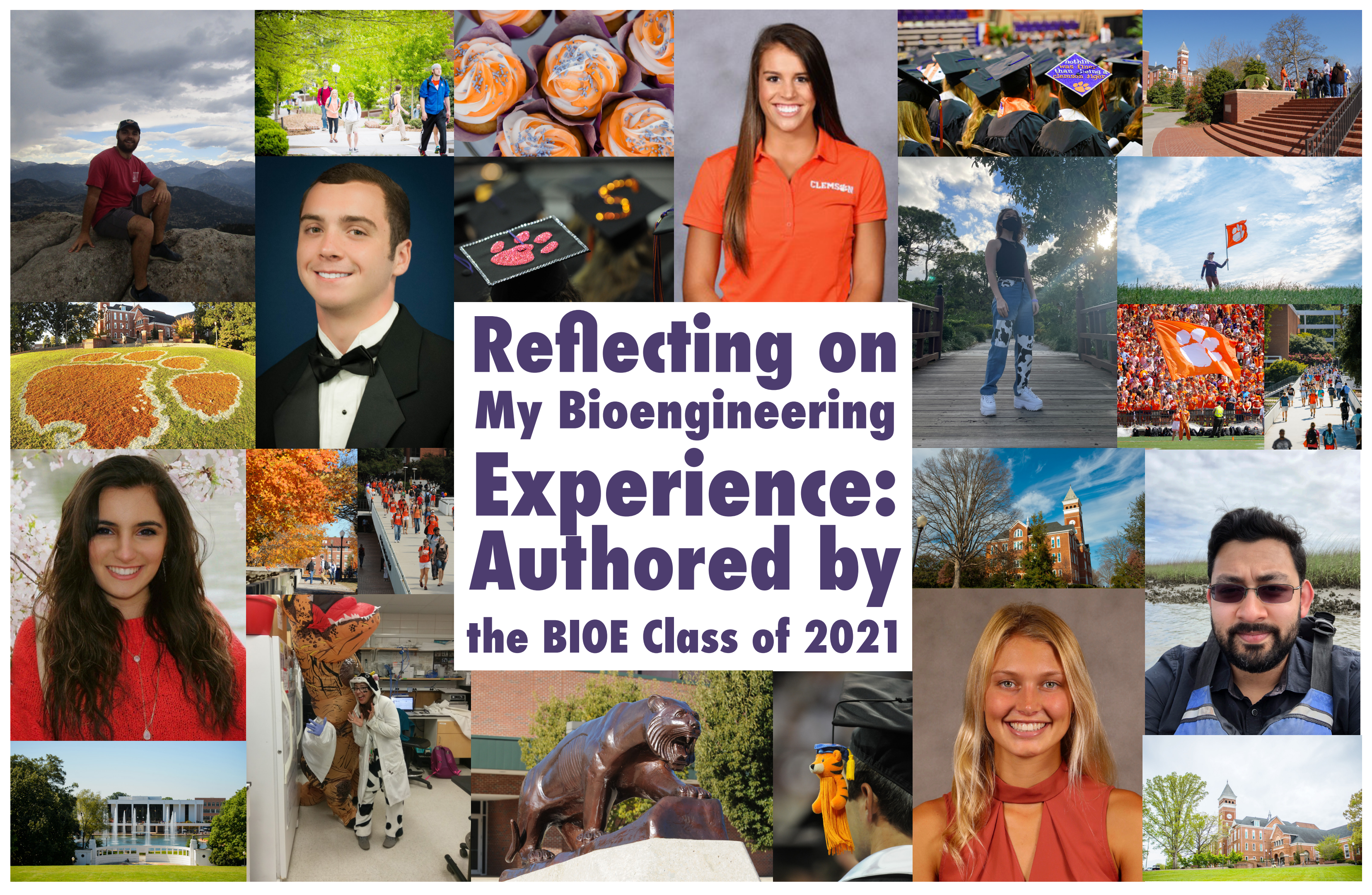
- Jeremy Mercuri, John Witherspoon Gilpin, MD ‘82 Associate Professor of Bioengineering, to further develop a new biomimetic osteochondral construct to be used in the repair of critically sized focal osteochondral defects through testing. This method doesn’t have the traditional drawbacks many other treatments do that can lead to lower quality repair tissue, complications at the donor site, higher costs and the inability to integrate repair tissue with the surrounding healthy tissue.

- Dan Simionescu, Harriet and Jerry Dempsey Professor of Bioengineering, to further develop a technology that efficiently seeds cells into scaffolds or tissues at multiple locations with high efficacy. Current methods of seeding cells are limited to static or injection seeding, which do not ensure uniform cell distribution or penetration of cells into scaffolds. This technology can seed millions of cells in a controlled pattern via a roller, which can improve regenerative medical and cellular therapy techniques.

**This project was funded in conjunction with the Department of Bioengineering.*



Reflecting on My Bioengineering Experience: Authored by the BIOE Class of 2021



- Abdulrahman Adam
- Addy Connor
- Aulabaugh Marah
- Bai Yuchen
- Bailey Chase
- Bakle Curtis
- Bartlett Emily
- Bartro Sarah
- Baucum Stephen
- Becker Tyler
- Blakney Tykia
- Brown Sydney
- Buckley Maureen
- Burruss Noah
- Camargo Maria Eduarda
- Carrouth Thomas
- Cassidy Grace
- Channel Madison
- Christensen Rachael
- Coon Erin
- Cox Ethan
- Crim Andrew
- Cruse Taylor
- Daniel John
- Daniels Katrina
- Detrick Jacob
- Edenfield Joshua
- Edwards Joshua
- Eskridge Leslie
- Falconer Robert
- Foulger Isabell
- Furman Grace
- Gambill Julia
- Gardner Samantha
- Gavin John
- George Drake
- Gerrald Luke
- Gillespie Ryan
- Golding John
- Haley Kimber
- Hamilton Emily
- Hannah Lindsay
- Hedge Melanie
- Hollon Brooklyn
- Hoskins Erica
- Hummel Christina
- James Erin
- Jeziorski Stephanie
- Johnson Sarah
- Kelly Danielle
- Kodikara Samantha

Clemson has been very great to me and has allowed me to grow not only as a professional, but also as an individual. **I feel my time here has thoroughly prepared me for the real world by building relationships and learning necessary skills for the workplace.** *Clemson BIOE has given me the confidence in my ability to handle professional level problem solving.*

I think choosing to attend Clemson University was the best choice that I have made in my life. The bioengineering program has challenged me to become the best engineer I can be and the best overall student I can be.

Clemson Bioengineering feels like family. Apart from learning a lot and feeling extremely prepared as I take my next steps, I met the best study partners, senior design team and my best friends in this department.

I have nothing but positive things to say about the bioengineering department and my experiences with it in my time at Clemson. The professors I have had over the past 4 years have cultivated such a passionate environment that has allowed me to develop a strong love for research and the vast field of bioengineering. The resources I have been provided have exposed me to so many different realms of research, and the support I have received is the reason I have made it to where I am today as both a student and a person.

You just can't beat Clemson University. The people, the environment, facilities, staff, the list goes on and on. I couldn't say one bad thing about this place and wouldn't change a single thing from my experience here.

Clemson has been a great University to attend. **Clemson and Creative Inquiry helped me find my passion: Go Tigers!**

I make sure that I am never the smartest person in the room by surrounding myself with people smarter than me so that I can grow. I may be a bioengineer, but boy, am I a bioengineer!

The BIOE department has given me amazing opportunities to travel and meet new people, and I'll always treasure the memories I have. Furthermore, throughout my experience as an undergraduate student, my classes constantly taught me so many different things about the human body and modern medicine. Even through the pandemic, I was still able to learn and conduct research.

My experience at Clemson gave me opportunities to pursue research projects not only in the department, but also at other universities! My Clemson education helped make me competitive for REUs and grad schools across the country.

The bioengineering department has provided me with so many opportunities to grow intellectually and to make connections that created an experience that will remain with me as I go into the world.

Clemson offered me an amazing atmosphere that helped me achieve the perfect balance between education and experience.

The Clemson bioengineering department gave me the confidence to step into the world prepared to change it.

Clemson University has not only given me incredible friendships and memories, but also an amazing education that has prepared me confidently for anything life throws at me.

One of the many things I love about Clemson BIOE is how prepared I am to jump into any opportunity I am given after graduation. I've made lasting connections with my professors and peers, as well as gained invaluable experience in manufacturing (co-op with J&J's Ethicon), research (study abroad to Tokyo) and device development (senior design). Everyone truly wants to see us succeed and provides us with every possible opportunity to learn and grow. As much as I'm ready to graduate, I never want to leave!

After five years of vigorous course curriculum, three Creative Inquiries, three research projects, three COOP rotations, one internship and two national football championships, Clemson University surpassed every expectation I had for my undergraduate career.

The bioengineering department has given me the opportunity to further my studies in subjects relevant to my degree while presenting me with options and tips for determining my future career path.

Clemson has always felt like home. I am so grateful for such an amazing bioengineering program and the Clemson family I gained during my time here.

Clemson bioengineering is like a family! Everyone is always there for each other and extremely supportive! I would not want to be in any other major!

Clemson provided me with so many opportunities to find and foster my passions. **Clemson has been an incredibly welcoming home that I will be sad to leave. I know that I will always be welcome and accepted whenever I am able to come back.**

Clemson's bioengineering program cultivates an environment that encourages growth and success. I'm thankful for the faculty and students who helped me achieve this degree!

There's something in these hills — community.

I have loved getting to know my peers in bioengineering. I have made life-long friends and had amazing experiences that are all due to this outstanding department at Clemson University.

As a woman in a STEM field, I appreciated how many intelligent and confident women there are in Clemson's bioengineering department. This made me feel more comfortable and confident in my ability to succeed as a bioengineer.

- Lafavor Donovan
- Laird Corrina
- Jamison Azrin
- Ledbetter Ashton
- Lematty Amanda
- Leopard Bailey
- Lewis Sara
- Lindhurst Brianna
- Long Alexander
- Lynn Jeffrey
- Mahendranath Aparna
- Martin Brice
- Matney Freddy
- Mcateer Justin
- McCarty Hannah
- Messing Annmarie
- Miller Mariana
- Moreno-Reyes Aldo
- Munford James
- Norris Lane
- Nukovic Alexandra
- O’Leary Kaela
- Perry Sydney
- Pham Damea
- Plucinski Brandon
- Reeves Meredith
- Reno Mary
- Rodrigues Natalie
- Rossow Kayla
- Sawvell Emily
- Segars Margaret
- Seilkop Alexis
- Shah Milan
- Smallwood Allison
- Smith Alexandra
- Stegura Carol
- Stepp Ryan
- Swafford Brittany
- Tobin Brendan
- Walsh Benjamin
- Ward Kathryn
- Watts Liam
- Wentworth Maggie
- White David
- Wiles Carter
- Willis Emily
- Wong Claudia
- Wong Kerri

Participating in the EUREKA program for the honors college set me up to be successful by allowing me to network and gain friends that I have kept throughout my experience, as well as introducing me to research early on in my college career and setting me on the right path for my degree concentration and ultimately directing me toward the kind of work I want to pursue in the future.

My favorite part about bioengineering at Clemson was all of the incredible people I was about to meet and share the experience with.

Clemson was my home for the past four years, but I feel that I will always belong here. Go tigers!

I switched majors pretty late and was a little behind my peers who had started in BIOE, but after joining in, everyone was so willing to help me whenever I needed.

Clemson allowed me to explore my foremost passions in bioengineering and research while also providing me with multiple opportunities to grow as an individual and a leader. It is amazing that after these four amazing years, Clemson has also led me directly to my dream career, dentistry.

The Clemson setting is a peaceful getaway with a beautiful small-town aesthetic.

Clemson’s bioengineering department as pushed me to become the type of student that I did not know I was capable of becoming. The department has taught me how to have a passion for what I am doing and how to continuously have a desire to learn.

My time at Clemson has not only allowed me to grow as a student but also as a person.

Clemson has truly been the most rewarding 4 years of my life. I am so grateful for all my family, friends, professors and colleagues who have challenged and encouraged me to become the best version of myself. GO TIGERS!

The staff and TAs are always willing to help and want to see you succeed and do well both in and out of class.

Clemson sculpts its students to have self-confidence while remaining humble, to help others while continuing to love yourself, to work hard while still enjoying your rest and to always be all in.

Tough problems lead to elite problem solving.

Clemson has provided me with an engaging and diverse knowledge base, all the while giving me the best four years of my life, and for this I will be forever grateful.

Clemson is a place that truly feels like HOME. It’s a place you’ll always want to come back to, and when you do, you’ll feel like you never left.

Clemson bioengineering has offered me so many opportunities inside and outside of the classroom that have made my college experience incredible. This department has challenged me to be the best engineer, scientist and person I can be. Through classes, research opportunities, and professional development activities, I can confidently say that Clemson bioengineering has made me well-prepared for my future.

The Clemson community and family atmosphere have impacted my Clemson experience greatly. I always felt like the faculty and staff were there for me when I needed help and were responsive to my questions and concerns. Everyone wants you to succeed at Clemson and the faculty and staff take pride in our accomplishments. Being involved with BIOE, PEER and WISE, and other organizations has given me a sense of community at Clemson and has allowed me to find my place at Clemson.

Clemson Bioengineering was a program that tested and pushed me many times throughout my 4 years. When I considered what I might major in otherwise, I found that there was no major I’d enjoy and want to study for as much as bioengineering.

Clemson has provided me with both the professional and interpersonal skills I need to succeed in bioengineering endeavors.

Choosing Clemson has been the best decision of my life. Here I have gotten the best education and some of my best friends. I will forever be grateful for these hills.

When I look back, I am amazed at how much Clemson has given me: an amazing engineering program, a host of extracurriculars and friends for a lifetime. I can only hope that I have given back to the Clemson community as much as it has given to me.

Clemson University’s bioengineering department truly shaped me for any career that I plan to pursue. I would not have the skillset and mindset that I have today without the wonderful faculty and staff.

The Creative Inquiries Clemson bioengineering offers help you explore interests and projects early on.

Alam Fouzan
 Bain Nicholas
 Conner Kelsey
 Dicillo Isabella
 Donley Elizabeth
 Eibel Scott
 Gillenwater Trent
 Hutt Emily
 Jallepalli Rithwik
 King Kylie
 Kumar Bevin
 Losier Andrew
 McCullough Melissa
 Musial Emilia
 Namouz Wael
 Ndalama Andrew
 Nikkila Jacob
 Northup Scott
 Owen Meredith
 Patterson Karley
 Rapert Riley
 Rodriguez Bruce Maria
 Rogers Jesse
 Ratterree Lanie
 Roberts Fletcher
 Rucker Alexandra
 Rylance Cameron
 Sama Vineeth
 Schindler Kyle
 Schrader Braden
 Sloger Adam
 Smith Karena
 Stewart Brendan
 Sykes John
 Ward Michael
 Webster Jefferson
 Westlund Walker
 Zhu Dongkai

Joining the bioengineering department is the best decision I made as a Clemson student!

The best decision I made while at Clemson was getting involved early. Being in the Tiger Band since freshman year and joining a research lab has provided me with so many good friends and an emotional base to help me through college especially during the rough times.

Clemson engineering stands out because of the staff and faculty that help you every step of the way to be the best.

I have had so many wonderful experiences as a result of my time at Clemson. From the time I stepped foot on campus, I was very involved: membership in the Honors College, becoming a finalist at Nationals for the Clemson Club Swim team, undergraduate research, the Greek community, especially my position working for the Clemson football team in the Clemson Applied Science Lab(CASL) and more! I'm so proud of what I've done and all that I've become! As for a favorite memory, nothing beats a fourth quarter in Death Valley.

A great place to learn and be prepared for the real world.

The bioengineering department at Clemson is top tier. Its small class sizes allow students to get to know their professors and distinguish themselves, which can be difficult at a school as large as Clemson. There is a diverse array of research and Creative Inquiry opportunities, so everyone can find something they are interested in.

Clemson University's Bioengineering has pushed me in challenging but still amazing ways that have made me grow into the person I am today.

My greatest experience at Clemson was learning collaboration with fellow students and understanding that we are all working together to improve human quality of life.

Being a Clemson University bioengineering major, I have never had a boring day. Whether it is learning biomechanics with Dr. Nagatomi or differentiating cells in Tissue Engineering Lab, I have always felt my time as less of "being a student" and more of a "learning experience." The professors are great, the TAs are fun, and I can't believe it is almost over.

The Clemson bioengineering department provided its student with support and encouragement during an unforeseen global pandemic. As a student, I feel that my education was not jeopardized or diminished in any way by the bioengineering faculty here at Clemson during Covid-19.

Bioengineering is the best department I could ask for. Resources and help abound, and they truly care about your future.

Majoring in bioengineering at Clemson has been an incredible experience and has given me the opportunity to enter the medical field with a unique perspective.

Clemson has the unique ability to make a large community feel like a family.

Clemson's bioengineering program has provided resources to help me develop useful skills and has helped me feel prepared to take the next steps in my career.

Clemson has given me access to so many amazing opportunities and has allowed me to meet so many incredible people, both of which have allowed me to truly discover myself and realize my full potential.

Clemson has been a great opportunity and allowed me to grow into the man I am today, and I owe everything to my parents, my PEER & WISE family, and my BIOE family.

The people that I have met through Clemson Bioengineering, professors and peers, are invaluable to my college experience!

My most meaningful experience in the department has been my involvement in the Creative Inquiry program. Through this program and through my mentor Dr. Alexander-Bryant, I have been able to explore the world of research and have developed a passion that I look forward to continuing in my future career as a physician.

Clemson bioengineering has given me so many unique opportunities! Because of this department, I have been able to connect with professionals in our field and meet people who share the same passions as I do.

Being awarded the opportunity to work in one of Clemson's research laboratories, expanding my knowledge in bioengineering and making so many new friends is my favorite part about Clemson University, and I was able to make memories here that I will never forget.

I loved Clemson because I was able to earn a hard but rewarding degree and meet lifelong friends at the same time.

The experiences and lessons I have learned at Clemson have equipped me for the future in the field of bioengineering.

The Clemson Bioengineering department has taught me how to be an effective, ethical engineer and has given me the skills and abilities to become successful in my field.

Clemson has always felt like home, since I grew up down the road, but being a student in Clemson's bioengineering program has made me feel like part of a family of very smart, motivated, talented individuals who have taught me so many important life skills and have made me feel so loved. It has been an honor learning, working and growing in the bioengineering department at Clemson through my participation and leadership in my classes, in the Clemson Bioengineering Organization, and in Dr. Singapogu's lab.

Clemson has just been such a great fostering environment, allowing me to pursue multiple routes of my interests so graciously. I'm grateful for all of the mentorship that I received here during my undergraduate studies.

When I came to campus, it was clear to me that Clemson has a strong community where I could authentically explore my interests, make lifelong friends and engage in strong academics. The Bioengineering Department consistently reminds me that I made the right decision.

The Department of Bioengineering has introduced me to some of my life-long best friends and given me so many memories I'll cherish.

2021 Student Awards

We congratulate our awardees for their dedication in pursuit of excellence!

Department of Bioengineering

Undergraduate Awardees

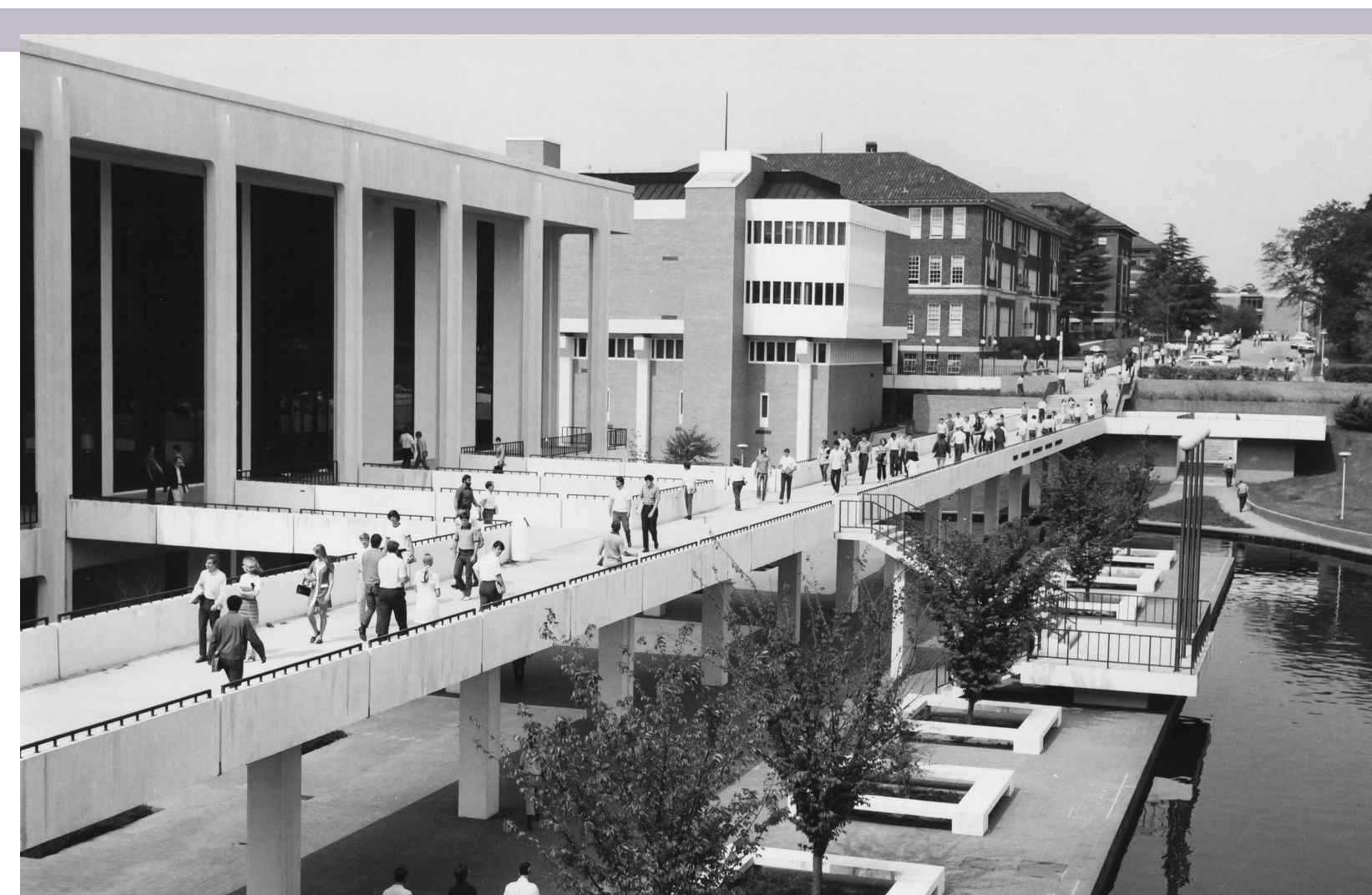
- S. W. Shalaby Outstanding Bioengineering Sophomore Award* — Shreya Thammana
- Larry S. Bowman Outstanding Bioengineering Junior Award* — Sophia Hennessy
- PolyMed Outstanding Bioengineering Senior Award* — Christina Hummel
- JBarry W. Sauer Outstanding Bioengineering Undergraduate Researcher Award* — Alexandra Nukovic
- Jonathan Black Undergraduate Leadership in Bioengineering Award* — Amanda LeMatty
- C. William Hall Undergraduate Departmental Honors Award* — Lauren Davis
- JR. Larry Dooley Entrepreneurship Award* — Robert Falconer
- Eugene M. Langan III Service Award* — Alexandria Tedeschi

Graduate Awardees

- Austin T. Moore Leadership Award* — Timmy Samec
- Outstanding Graduate Bioengineering Teaching Assistant Award* — Andrew DeMaria and Amirreza Yeganegi
- Page Morton Hunter Bioengineering Graduate Researcher Award* — Dongkai Zhu
- R. Larry Dooley Entrepreneurship Award* — Fouzan Alam
- Eugene M. Langan III Service Award* — Toni Warnick

College of Engineering, Computing and Applied Sciences

- Samuel B. Earle CECAS Outstanding Senior Award* — Maureen Buckley





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Clemson, SC 29634

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