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BIOENGINEERING

Educating Thinkers, Leaders and Entrepreneurs

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BIOE NEWS

Fall 2019



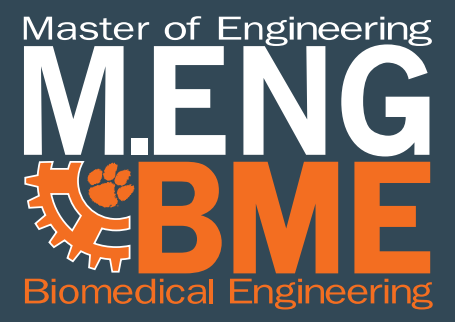
CHARLESTON



GREENVILLE



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Overview

Students are taught the fundamental concepts and techniques of the medical device design, development and commercialization process:

- Attend lectures developed and delivered by faculty and local medical device industry experts.
- Complete hands-on medical device design projects that include iterative design, prototype testing, manufacturing and mock U.S. FDA regulatory submission.

Graduate Skill Sets

- U.S. and international regulatory pathways
- Quality system regulations (21CFR820 and ISO13485)
- Medical device risk management (ISO14971)
- Medical device labeling / packaging
- Dimensioning and tolerancing / design for manufacturing
- Sterilization / recycling and reprocessing
- New product costing models and commercialization plan development
- Basic animal model study design
- Good laboratory practices (21CFR58)
- Techniques for obtaining the voice of the customer
- Logistics and inspection techniques
- CMS medical device reimbursement strategy

WANT MORE INFO ON OUR PROGRAM AND STUDENTS?

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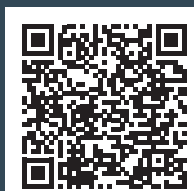


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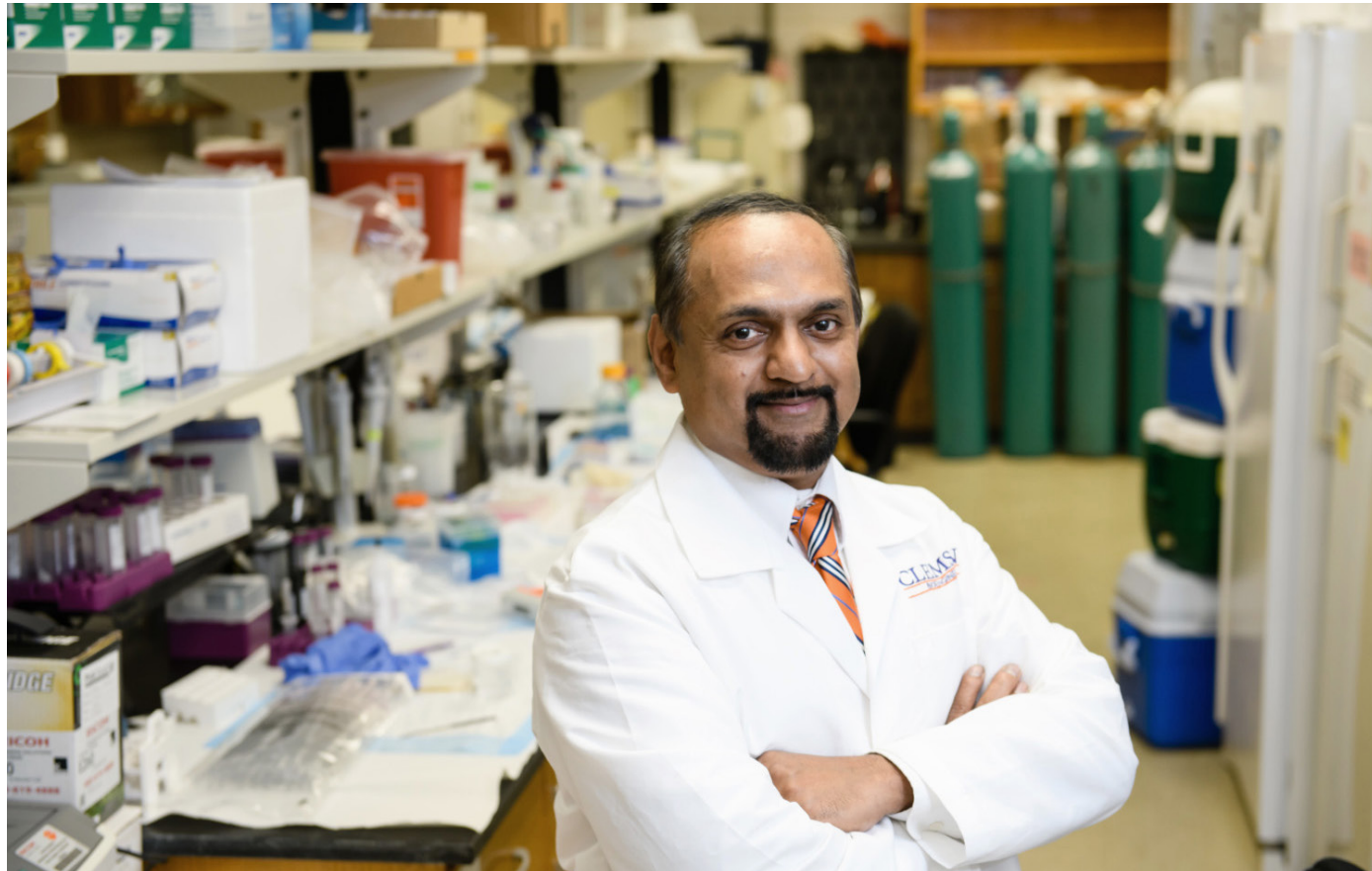
Jenny Bourne, Editor

Olga Reukova, Cover illustration
and magazine design

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NIH COBRE SC BIOCRAFT FUNDED FOR A THIRD FIVE-YEAR TERM

Paul Alongi



Naren Vyavahare, the Hunter Endowed Chair of Bioengineering at Clemson University, is the principal investigator of the grant that created the South Carolina Bioengineering Center for Regeneration and Formation of Tissues.

CLEMSON — A group of South Carolina researchers working on new treatments for a variety of illnesses ranging from diabetes to heart disease cheered the decision to grant five years of funding to a biomedical research center based at Clemson University.

The National Institute of General Medical Sciences is providing \$5.7 million to the South Carolina Bioengineering Center for Regeneration and Formation of Tissues. It's the institute's third round of competitive funding for the center, also called SCBioCRAFT.

In its first decade, the center matched seasoned mentors with 23 early-career researchers. They went on to generate \$35 million for

research into spinal cord injuries, new ways of growing vascular tissue for grafts and a wide range of other biomedical challenges.

Researchers involved in the center have been awarded 24 patents, spun off four start-up companies and generated 304 articles in peer-reviewed publications.

SC BioCRAFT began operating in 2009 under the direction of Naren Vyavahare, the Hunter Endowed Chair of Bioengineering at Clemson.

"It feels good to know that we have junior faculty who have been so successful and have their own independent labs because of this center," Vyavahare said. "SC BioCRAFT is playing a key role in building the biomedical research infrastructure in South Carolina."

The center's primary mission is to increase the number of South Carolina biomedical researchers who receive funding for their work from the National Institutes of Health. The research theme revolves around regenerative medicine, a fast-growing field that offers the promise of repairing and regenerating diseased tissues.

With the latest round of funding, SC BioCRAFT researchers will be able to continue advancing tissue-regeneration research, recruit new faculty and build on collaborations that were established in the first decade.

Researchers with the center are also planning statewide educational programs and a voucher program that will help provide seed funding for new research projects. Further, the grant will give SC BioCRAFT's core facilities a chance to transition from federal funding to a fee-based system.

Martine LaBerge, chair of Clemson's bioengineering department, congratulated Vyavahare and the team for the funding.

"SC BioCRAFT has given researchers early in their careers a chance to pursue innovative ideas, while learning from experienced mentors," she said. "They have produced an exemplary body of work that is helping create a healthier society and nurturing South Carolina's burgeoning biomedical industry. Their funding is well deserved and being put to good use."

The center is a major force for bringing together researchers, clinicians and other health care professionals from across the state to advance biomedical research. Clemson researchers collaborate closely with colleagues at the Medical University of South Carolina and Prisma Health.

Roger Markwald, an MUSC professor, said the funding reaffirms that SC BioCRAFT is succeeding in its mission.

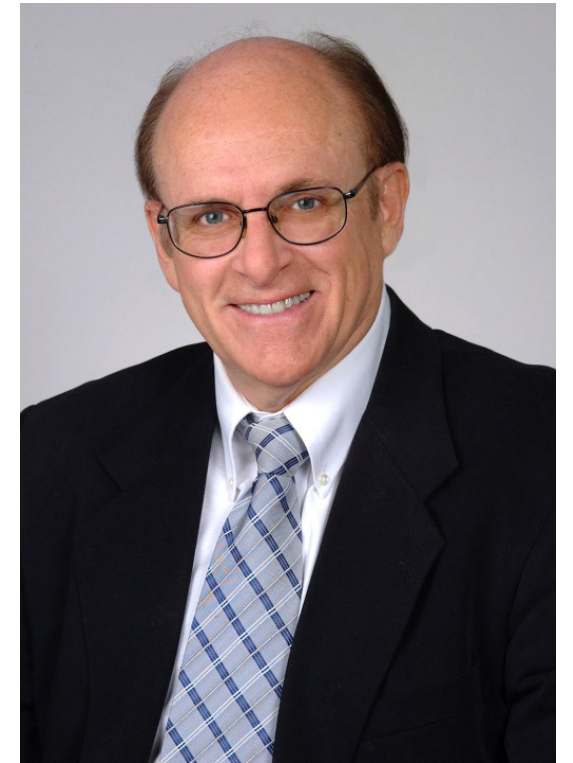
"This collaborative center is helping improve patient care while enhancing biomedical research in South Carolina and encouraging investment in the biomedical industry," said Markwald, who is co-principal investigator on the grant that funds SC BioCRAFT. "At the end of the day, patients and the state as a whole benefit most."

SC BioCRAFT is funded through a National Institute of General Medical Sciences program aimed at establishing Centers of Biomedical Research Excellence in 23 states and Puerto Rico. Funding for the centers comes in three phases.

The latest funding for SC BioCRAFT allows it to move into its third phase. SC BioCRAFT received \$9.3 million in 2009 for its first phase and \$11 million in 2014 for its second phase.

Clemson is now home to three Centers of Biomedical Research Excellence. SC BioCRAFT was the university's first.

Last year, an \$11 million grant funded the South Carolina Center for Translational Research Improving Musculoskeletal Health, or SC-TRIMH, a new research center that will bring together scientists



Dr. Roger Markwald, MUSC professor and COBRE codirector.

from across South Carolina to change the way musculoskeletal disorders are diagnosed, treated and studied.

In 2016, a \$10.5 million COBRE grant funded the Eukaryotic Pathogens Innovation Center, or EPIC. Since the award, EPIC investigators have generated more than \$4.5 million in external funding and produced 35 publications.

Tanju Karanfil, vice president for research at Clemson, said that the success of SC BioCRAFT is helping fuel a trend toward collaboration among institutions.

"Each institution brings its own strengths and ways of looking at the various healthcare challenges we face," he said. "Bringing them together leads to innovative solutions that might have eluded us if we were to work on our own. SC BioCRAFT and our other Centers of Biomedical Research Excellence are great examples of that concept in action."

Anand Gramopadhye, dean of the College of Engineering, Computing and Applied Sciences, said SC BioCRAFT's funding will provide key support for health innovation in South Carolina.

"SC BioCRAFT is enabling a collaborative, multidisciplinary research ecosystem that is helping create a healthier, more prosperous South Carolina," he said. "I congratulate the team on its well-deserved success."

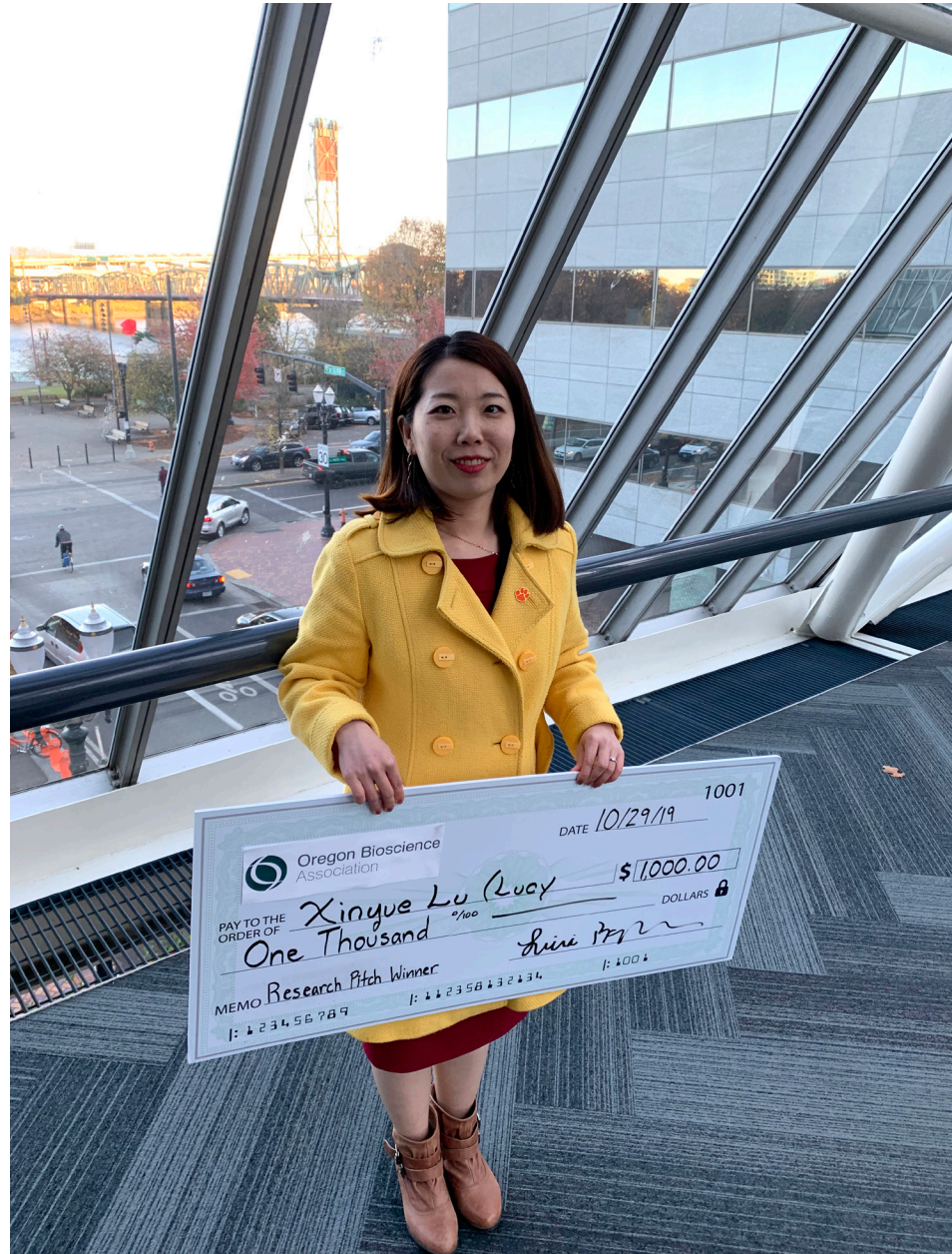
LUCY LU'S PITCH OVERPOWERS SEVEN OTHERS AT OREGON BIO 2019 FAST PITCH

Lucy, a Clemson PhD candidate who lives in Beaverton, OR, received \$1,000 in BioPro courses, free admission to an upcoming Oregon Bio event and legal counsel. She said, "Years of team work have gone into achieving our novel bioadhesive mesh system for hernia repair. I feel lucky to be part of this effort and very honored to present the outcome at Oregon Bio 2019 Fast Pitch. I look forward to seeing the technology being further promoted and commercialized."

At Oregon Bio 2019: Innovating and Scaling for our Region's Growth, industry experts judged winners of the Oregon Bioscience Association's 2019 Research Fast Pitch competition. Entrants competed for cash and prizes designed to further innovative research and commercialization.

"The winners represent the best of our industry, which is dedicated to discovery of innovative healing technologies, addressing unmet medical needs and driving economic development to spur commercialization," said Oregon Bio's Executive Director Liisa Bozinovic. Current estimated annual cost for ventral hernia repair surgery in the US is \$3.2 billion.

As presenter of the winning research project, Xinyue "Lucy" Lu, described development of a unique bioadhesive mesh system for hernia repair. The technology combines two patented Clemson technologies, a hydrogel adhesive and polymer surface modification, developed by faculty in the departments of bioengineering and materials science and engineering. Dr. Melinda Harman of Clemson University, Lucy's research advisor, said, "We propose that during hernia repair surgery, this novel bioadhesive mesh would help prevent pain, other common complications of the use of sutures and surgical tacks and problems of inadequate initial fixation that occur with other tissue adhesives."



This novel bioadhesive mesh would help prevent pain, other common complications of the use of sutures and surgical tacks and problems of inadequate initial fixation that occur with other tissue adhesives.

Dr. Melinda Harman

(Lucy's presentation showed her proposal had the) most promise in being a platform technology/research project. **Judges, Oregon Bio Fast Pitch**

The judges noted Lucy's presentation showed her proposal had the "most promise in being a platform technology/research project. Lucy had the right balance of addressing the problem, her research solution, next steps, and potential impact."

Further development of this technology is being undertaken by a team including researchers at Clemson University and a South Carolina start-up, Circa Bioscience. This team was recently awarded a Small Business Technology Transfer Phase I grant by the NIH. "Lucy's critical thinking and hard work played a vital role in our preliminary experiments, which demonstrated to the NIH that this technology could be effective in improving outcomes for hernia surgery patients," said alumnus Dr. Kevin Champaigne, CEO of Circa Bioscience.

Dr. Will Richardson Awarded an NIH Collaborative Supplement

COBRE and INBRE are NIH programs designed respectively to strengthen institutional biomedical research capacity and to expand research opportunities and increase the number of competitive investigators in eligible states. Ed.

The National Institutes of Health supplement went to Dr. Richardson and his collaborator, Dr. Adi Dubash of Furman University, for a proposed co-investigation supported by COBRE (Richardson) and INBRE (Dubash). The awardees, who met at an INBRE/IDeA meeting in 2018, found that Dubash's work on desmosomal-mediated cell signaling paired well with Richardson's work on fibroblast mechanobiology and matrix remodeling.

With their new INBRE-COBRE Collaborative Project, Regulation of Fibrosis via Cardiomyocyte-Fibroblast Interactions and Desmosomal Signaling, Dr. Dubash will gain exposure to research techniques in mechanobiology, Dr. Richardson will develop an understanding of desmosome biology, and their undergraduate students will be able to participate in studies at both institutions.



Alumna Inducted Into Medtronic's Bakken Society

With her induction, Dr. Julie Trudel O1, Program Director of Renal Denervation at Medtronic Cardiovascular, has been recognized as an employee who has made multiple technical contributions to the company and to the biomedical device industry. Named for Earl E. Bakken, Founder and Director Emeritus of Medtronic, society membership is Medtronic's highest honor for technical contributions.



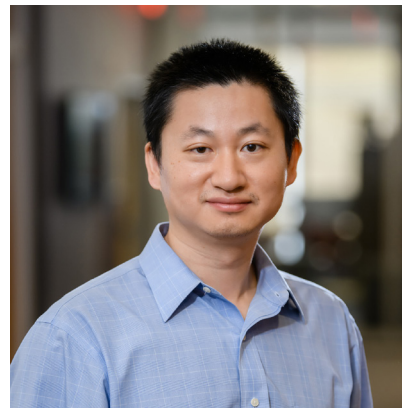
DEPARTMENT OF DEFENSE FUNDS RESEARCH BY DRs. LEE AND WEBB

In collaboration with Dr. Sindhu Madathil of Walter Reed Army Institute of Research, Drs. Jeoung Soo Lee (PI) and Ken Webb (Co-I) were awarded a four-year grant for point-of-injury application of hydrogel-embedded drugs for severe traumatic brain injury. Sponsored by the Combat Casualty Care Research Program, the grant will allow the collaborators to develop for the battlefield anti-inflammatory drug-loaded hydrogels as therapies for traumatic brain injury point-of injury application in a prolonged field care environment.



Dr. Yongren Wu Named Assistant Professor

Dr. Wu's research interests include orthopaedic biomechanics, mechanobiology and tissue engineering. As a member of the CU-MUSC Program, Dr. Wu conducts research at the Medical University of South Carolina in Charleston.



Kansai University-Clemson University COIL program 2019

Dr. Jiro Nagatomi of Clemson (CU) bioengineering and Dr. Yasuhiko Iwasaki of Kansai University (KU) in Osaka, Japan, have formed the Kansai University-Clemson University COIL program. The overall goal of this three-month, cooperative online interactive learning/international virtual exchange program is to enhance participating students' global learning experiences by conducting an international team project each summer. The objective of the 2019 project was to compare and contrast the differences in medical device commercialization processes in Japan and the US.

To prepare for a summer of undergraduate research in Japan, five KU and four CU students met online, forming subgroups to tackle weekly tasks. Once CU students arrived in Japan, they paired with KU students to conduct several weeks of mentored research. Everyone worked together on a presentation given at the Kyocera Shiga Plant. Topics included differences in

- regulatory/approval processes for medical devices
- regulatory agencies (rules, organization structure, scale)
- the number (utilization factor) of artificial hip joint replacements
- health insurance and reimbursement for orthopedic procedures.

CU student Claudia Wong, a national scholar majoring in bioengineering, described her COIL experience, "To me, the most significant part of COIL was these amazing friendships that I formed with my lab mates and COIL members. While I loved the fun and intensive research I conducted, my favorite part of the summer is my awesome friends in Japan."

Rino Watanabe, one of the five KU students, has been at CU since August taking BIOE 4910 with Dr. Aggie Simionescu and auditing a number of courses. "My COIL group studied regulation and approval processes of medical devices. Many differences exist between Japan and the US, but it was really interesting that we also have similarities. Making a presentation in English to an international audience was a very good experience for me!" Describing COIL, Dr. Kyle Anderson, Senior Director of Global Engagement, had this to say, "It is an ideal integration of international virtual exchange: It organically enhances a curricular activity. Other Japanese universities have taken notice and hope to join Dr. Nagatomi's expanding virtual network."



CONVERSATION WITH A LEADER: MARTINE LABERGE LEADS CLEMSON BIOENGINEERING TO NEW HEIGHTS

Paul Alongi

Martine LaBerge said that in her 17 years leading Clemson University's bioengineering department, she has learned something about leadership that she passes on to colleagues who are just starting down the same path.

"I tell them it's all about people," she said. "You get people aligned under one roof to believe in one brand and to have a mission that is focused on something other than themselves."

A new award has brought leadership sharply into focus for LaBerge, who has served as chair of the bioengineering department since 2002.

The Biomedical Engineering Society recently honored LaBerge with the inaugural Herbert Voigt Distinguished Service Award. The honor recognizes her extraordinary service to the society through volunteering and leadership.

It's the latest of many milestones in a career devoted to advancing the field of bioengineering and turning Clemson's bioengineering department into a powerhouse of education and research.

"Dr. LaBerge epitomizes the kind of leadership we seek at Clemson," said Robert Jones, executive vice president for academic affairs and provost. "For our future success it is vital to look at what she has accomplished in bioengineering as a benchmark and instill a similar passion in the next generation. If we do this well, it will strengthen Clemson for decades to come."

LaBerge has helped establish new collaborations with the likes of Arthrex, Prisma Health and the Medical University of South Carolina. She has had a hand in hiring all but one of the department's 30 faculty members, and she has worked with them to develop new curricula.

LaBerge was at the helm when a 29,000-square-foot annex was added to Rhodes Engineering Research Center. And she played



a central role in establishing the Clemson University Biomedical Engineering Innovation Campus, also called CUBEInC.

The department's faculty, with LaBerge's support, lead two separate Centers of Biomedical Excellence, together representing \$37 million in funding from the National Institutes of Health.

Clemson ranks fourth this year among the nation's best value schools for biomedical engineering, according to bestvalueschools.com. And in a separate ranking by U.S News & World Report, Clemson ranked 21st among biomedical engineering programs at public universities nationwide.

I.V. Hall, a former master's student under LaBerge who is now on the department's advisory board, said she has the ability to get people to buy into a vision and deliver what it takes to make it happen.

"Her influence and her passion are the reasons the department is where it is," said Hall, who is worldwide president for the DePuy Synthes Trauma, Craniomaxillofacial and Extremities Division. "She personifies Clemson bioengineering."

Throughout her career, LaBerge has remained in touch with students and their needs.

The commitment to students made an impression on Margarita Portilla, who holds bachelor's and master's degrees in bioengineering and is now pursuing her Ph.D. in bioengineering.

"Dr. LaBerge is very close and always interacting with her students," Portilla said. "I was always fascinated with her. As an undergraduate, I told my friends, 'When I grow up, I want to be like Dr. LaBerge.'"

One of LaBerge's guiding principles is summed up in the department's motto, "exemplifying collegiality."

At the start of each semester, she asks faculty to reflect on how collegial they are, using a short questionnaire and meter they can use to assess themselves. She also gives students a wallet-size card with the department's mission, vision and goals, underscored by the motto in capital orange letters.

LaBerge calls it their "credit card to graduate and be successful in life."

She said that what she likes best about her job is mentoring faculty, networking, building Clemson's academic reputation and working with students.

"There is no better professional than a Clemson bioengineering student," LaBerge said. "It's because of the way we educate them. They're honest, and they have integrity. Our kids leave with emotional intelligence, because they see people doing it. We teach by example, and we lead by example. And I think everybody in this department is like that."

Nicole Meilinger, a senior bioengineering major, credits LaBerge with helping open several opportunities for her.

She said that LaBerge encouraged her to apply for a three-semester rotation at CUBEInC through the Cooperative Education Program.

The position put Meilinger into contact with some of the department's industry partners and gave her the chance to conduct research. Meilinger said her work was published, and she had the opportunity to present her findings at conferences.

LaBerge also introduced Meilinger to a class on developing and selling medical devices and recommended her for an Arthrex scholarship, which she received. Meilinger said that she has secured an internship with Arthrex and plans to start after graduating in May.

"I came into bioengineering not knowing what I wanted to do, and Dr. LaBerge has been the biggest mentor in helping me find different career paths," Meilinger said. "She's always helping us in ways you can't even imagine."

LaBerge, who is originally from Canada, arrived at Clemson as an assistant professor in 1990. She remembers having offers from other U.S. schools within a year. Two years after she arrived at Clemson, she interviewed to be an astronaut, she said.

"That was when they were working on the space station," LaBerge said. "Canada needed a couple of astronauts. I went through the interview process."

Ultimately, another candidate was chosen, and LaBerge said that she admired and followed his career.

What has kept her at Clemson for nearly decades are the opportunities in the department.

"Larry Dooley (retired bioengineering chair and Clemson vice president of research) was a big mentor of mine," LaBerge said. "He always saw positive, he always saw growth, he always saw big. I'm the kind of person who does not like to sit down. I like big things to look after. So, I think Larry was very instrumental with this."

LaBerge has held numerous leadership positions in professional organizations, including president of the Society of Biomaterials, member of the Biomedical Engineering Society Board of Directors and chair of the Council of Chairs of Bioengineering and Biomedical Engineering in the U.S. and Canada.

In Clemson, her leadership positions included seven months in 2013 as acting dean of what was then the College of Engineering and Science, before the current dean, Anand Gramopadhye took the helm.

"Dr. LaBerge's passion inspires students, faculty and staff to aspire to greater heights, learn more and achieve to the best of their abilities," Gramopadhye said. "The Department of Bioengineering is thriving under her leadership. Further, she has exhibited leadership in key professional organizations, helping enhance Clemson's national reputation in bioengineering. I congratulate her on the Herbert Voigt Distinguished Service Award. It is richly deserved."

FACULTY, STUDENTS REPRESENT BIOE AT ANNUAL BIOMEDICAL RESEARCH CONFERENCE FOR MINORITY SCIENTISTS

INAUGURAL JOHN WITHERSPOON GILPIN, M.D., ENDOWED ASSOCIATE PROFESSOR OF BIOENGINEERING NAMED



ABRCMS, one of the largest conferences for underrepresented minorities in STEM, was held in Anaheim, CA, on November 13-16. Clemson's undergraduates, graduates, postdoctoral fellows, faculty and students joined over 4,650 attendees representing more than 350 colleges and universities. For the third year in a row, BIOE participants served as research presenters, recruiters, session chairs, and poster judges.

According to Dr. Angela Alexander-Bryant, Assistant Professor of Bioengineering and Director of Diversity and Inclusion, "ABRCMS is a unique opportunity for our students to present their research in a diverse and supportive environment while receiving quality feedback and competing for annual research prizes. This year, Clemson microbiology senior and BIOE undergraduate researcher, Kayla Shine, was awarded one of the undergraduate research poster presentation awards in the Engineering, Math, and Physics division."

In addition to being a bountiful venue for student professional development, ABRCMS is a unique opportunity to share the Clemson

BIOE brand with students and university representatives from across the country. Past trips to ABRCMS have yielded strong returns with respect to minority graduate student applications to the department. Dr. Jordon Gilmore, Assistant Professor of Bioengineering, noted, "We expect this trend to continue with another strong recruiting effort this year spearheaded by BIOE graduate students Margarita Portilla and Simeon McKelvey.

Dr. Alexander-Bryant served as ABRCMS Vice Chair of the Engineering, Math, and Physics Disciplines. In that role, she facilitated training judges, moderated student oral presentation sessions, and coordinated recruiting efforts for BIOE. She said, "Our greatest take-away from this trip to ABRCMS is that there is a growing positive reputation for Clemson and bioengineering specifically. Several students whom we engaged with mentioned their familiarity with our program and its faculty. As we continue to make an impact in bioengineering, we should be confident that our efforts are making a positive impact on the next generation of bioengineers."

Dr. Jeremy Mercuri

Dr. John Witherspoon Gilpin '82, a philanthropist and leader in providing for students and institutions in medicine and higher education, recently established an endowed associate professorship in bioengineering. Dr. Jeremy Mercuri is the inaugural holder of the professorship. Ed.

It is a privilege to be named the John Witherspoon Gilpin, M.D., Endowed Associate Professor of Bioengineering. This honor supports Clemson's journey to preeminence in medical technology innovation and in educating future generations of medical technology professionals.

As the industry evolves in areas of digital health, wearable technology and regenerative medicine, so do our research and educational foci. Part of my vision for this professorship is to strengthen the growth of our relationships with clinical collaborators within the State of South Carolina and beyond. As Gilpin Endowed Associate Professor, I will contribute to this effort by attending academic division leader meetings and semi-annual research meetings with Prisma Health clinicians. This will facilitate development of additional collaborations among BIOE faculty and clinicians while ensuring our research will have a positive impact on patient care in the near term.

Prominent medical technology companies currently trend toward expanding product portfolios through acquisitions and outsourced product development. I view this as an excellent time to further foster industry-academic partnerships. Our BIOE faculty are expert and broadly experienced at creating new technologies, starting companies and performing innovative applied research: We are poised to supply knowledge and direction for startups and mergers, thereby seizing an opportunity to showcase Clemson BIOE.



The Gilpin professorship will enable me to facilitate the development of such industry-academic partnerships by attending medical device industry-focused conferences, reaching out directly to industry contacts and alumni and serving as a liaison between industry and Clemson faculty. Building such relationships will benefit our department and contribute to the Clemson Forward strategic plan by enhancing extramural funding. In addition, these relationships will contribute to the sustainability of the multiple NIH COBRE cores and other world-class research facilities on our campuses.

I am certain that building industry relationships will ensure that the education we provide our BIOE students continues to be relevant and evolve with industry trends, emerging regulatory paradigms and customer needs. In this professorship, it is my goal to continue expansion of our M.Eng program, which focuses on preparing graduate students for success in the medical device industry. We will look to partner with the Clemson and MUSC technology transfer offices to assist in further developing and vetting promising new technologies and medical device designs born in our research labs and clinical partnerships.

For our curriculum as a whole, our shared leadership with Clemson-MUSC faculty and partnership with experienced medical device innovators, we will continue to evaluate course offerings and specializations to train students via experiential learning opportunities in relevant topics. These will include medical device product development and commercialization, regulatory affairs, entrepreneurship and clinical trial design and management.

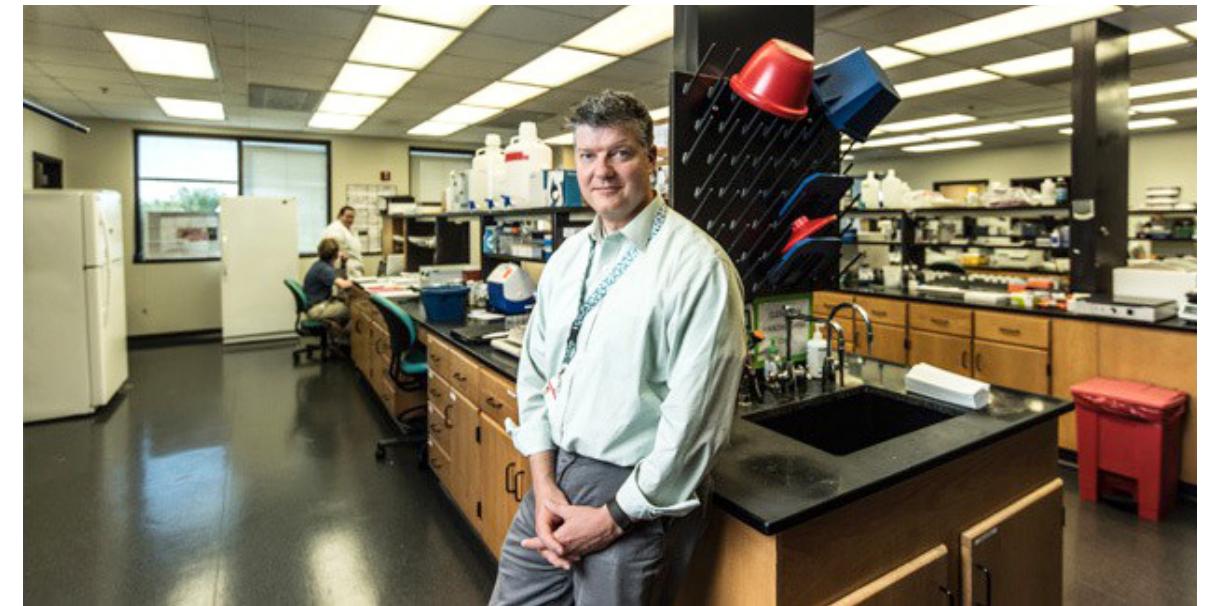
Finally, taking on this role will afford me and my lab additional opportunities to engage with clinicians and academic collaborators to advance research at our CUBEInC facilities aimed at combating musculoskeletal injury and disease. I am very humbled and blessed to have this unique opportunity. Go Tigers!

CLEMSON BIOE RANKED FOURTH AMONG THE NATION'S 50 BEST VALUE SCHOOLS

Clemson University came in fourth among the nation's 50 best value schools for biomedical engineering, according to a new ranking from bestvalueschools.com. The ranking covered a variety of factors, including graduation rate, accreditation date, degree popularity, engineering popularity and net price. According to Anand Gramopadhye, dean of Clemson's College of Engineering, Computing and Applied Sciences, "This is a well-deserved honor that underscores the high return on investment our students receive. The college will continue to offer access to top faculty, world-class facilities and enriching experiences, while ensuring investment returns remain strong for our students and their families."



KIYATEC, COFOUNDED BY ALUMNUS AND CEO DR. MATT GEVAERT, AMONG 20 STARTUPS INVITED TO CAPITOL HILL



CLEMSON — Kiyatec, a Clemson-based company, was among just 20 startups from across the country selected to participate in The University Innovation and Entrepreneurship Showcase that took place on Capitol Hill on April 10.

Hosted by the Association of Public and Land-grant Universities (APLU) and the Association of American Universities (AAU), the event spotlights companies that have created products and services using federally funded, university-based research. Participants were chosen based on the level of student engagement in the startup, the strength of the technology and its relationship to research.

"On behalf of all of the innovators at Kiyatec, it was truly an honor to have our exciting work highlighted on Capitol Hill and to represent the great things that come out of Clemson University," said Matt Gevaert, founder and CEO of Kiyatec. "It was especially gratifying for two of the event speakers to mention us specifically in their podium talks in recognition of the potential impact of our efforts to improve treatment outcomes for cancer patients."

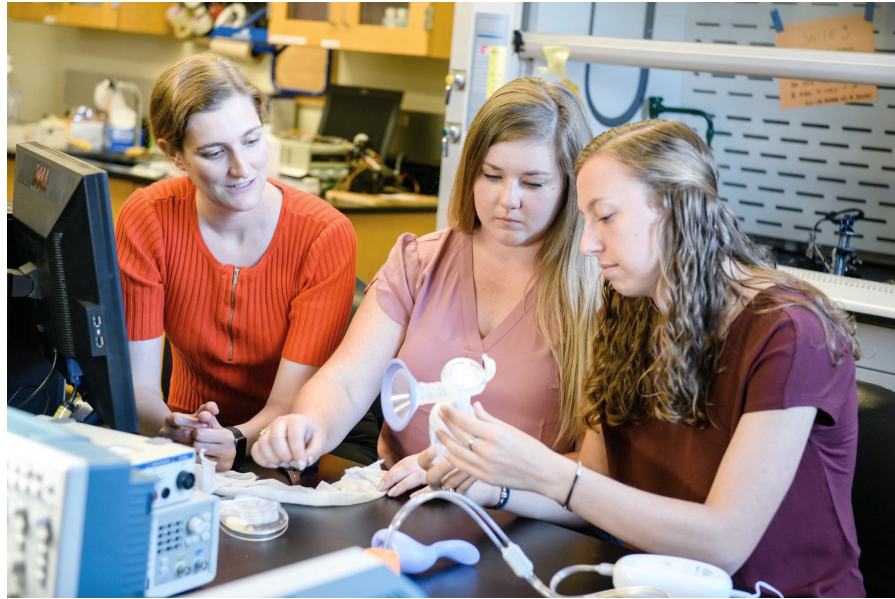
The showcase highlights the impact federally funded research has on driving entrepreneurship and innovation. Speakers at the event included U.S. Patent and Trademark Office Director Andrei Iancu;

National Institute of Standards and Technology Associate Director for Innovation and Industry Services Phillip Singerman; House Science, Space, and Technology Committee Chair Eddie Bernice Johnson and Ranking Member Frank Lucas; APLU President Peter McPherson; and AAU President Mary Sue Coleman.

Kiyatec's innovative research on 3D cell culture began at Clemson University. Its ex vivo 3D cell culture technology allows accurate modeling and prediction of cancer patient response to drug therapies. Kiyatec's 3D-PREDICT clinical study analyzes live cancer cells taken from patients via surgical or biopsy tissues to create a lifelike replication to determine what treatments the patient will respond to prior to beginning the treatment. This validated process is now being used in clinical studies at leading hospitals.

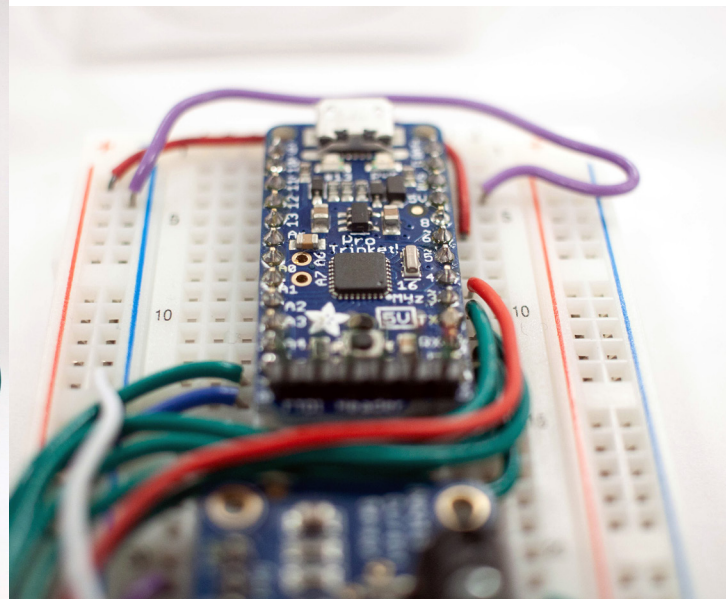
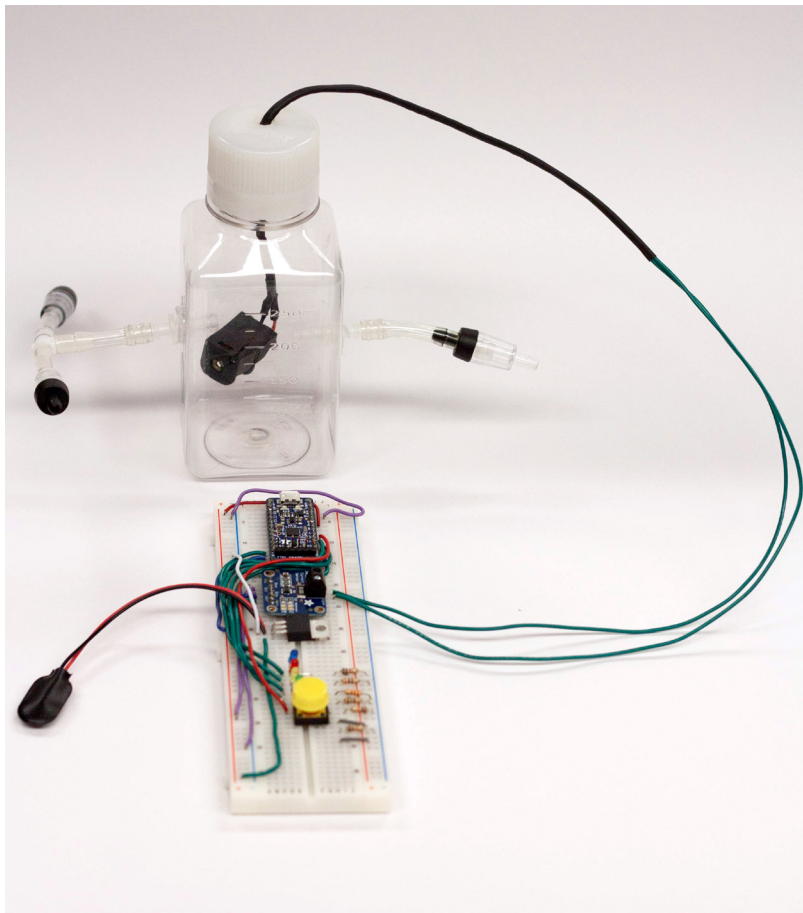
"Kiyatec is a great example of the potential for university-based research to create meaningful, marketable discoveries and technologies," said Chris Gesswein, executive director of the Clemson University Research Foundation. "Recognition and participation in this showcase provided Kiyatec with a fantastic opportunity to get the word out on how innovative and cutting-edge their team is, and we thank Matt for representing Clemson research so well on this national stage."

STUDENT TEAMS WIN 2ND PLACE AND HONORABLE MENTION AT EWG



The Engineering World Health Design Competition invites students to submit innovative designs for medical technology that can make a difference in low-resource settings. The team of Maren Downing, Maggie Elpers and Colleen Martin placed second in the 2019 competition with a Breast Pump to Help Reduce Mother to Child HIV Infections. Dr. Delphine Dean is the team's main advisor.

The team of Diego Nigoa, Sanjana Mandilwar, Alexandra Nukovic and Shenghao Tan received Honorable Mention with A Cost-Effective Oxygen Concentration Sensor from Zinc-Air Batteries. Dr. Delphine Dean is the team's main advisor.

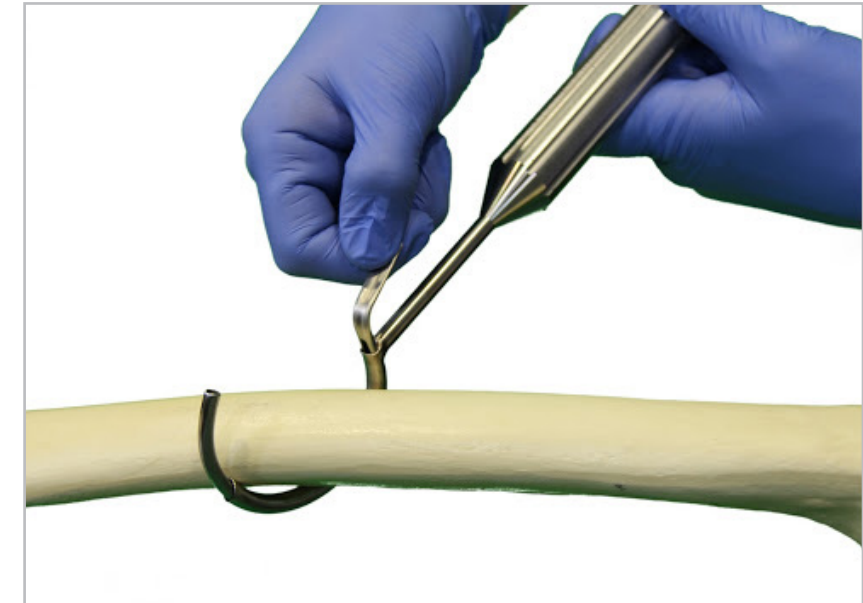


Students awarded Honorable Mention in National Institutes of Health's DEBUT Challenge

The team of Madeline Blankenship, Amanda Chernick, Xavier Peralta and Zackary Richardson won Honorable Mention in the 2019 Design by Biomedical Undergraduate Teams (DEBUT) Challenge with the Apollo, an expedited approach to cerclage cable application.

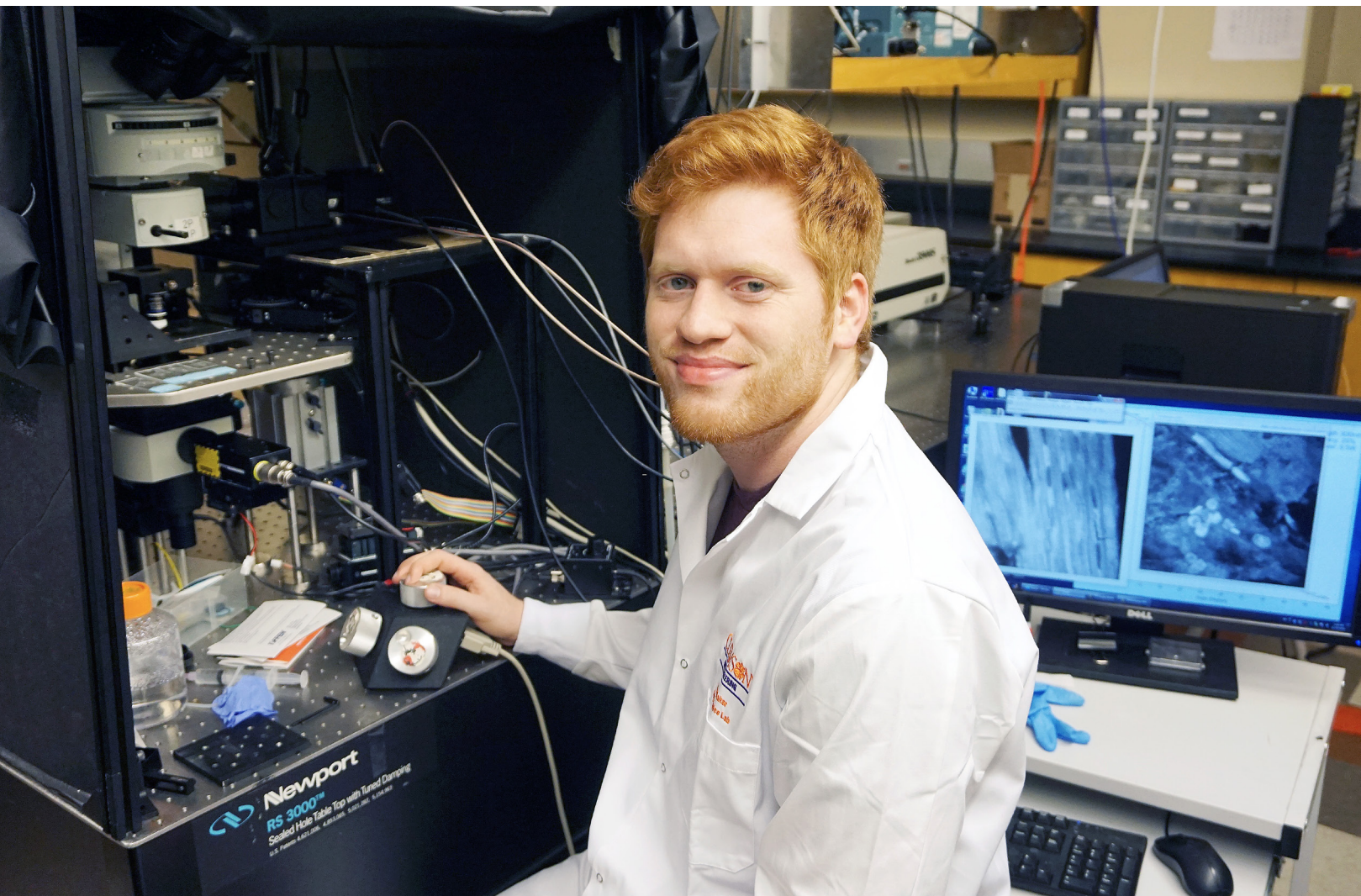
Cerclage cables are used to reduce femur fractures by passing cables around longitudinal fractures and securing them to the bone. Cerclage passers are used to tunnel around the bone and soft tissue to provide a clear pathway for the cable. Current passers, which complete only a half circle around the bone and leave their distal end embedded in the soft tissue, require surgeons to place undue torque on the device and traumatize the soft tissue to find the end.

The Apollo cerclage passer creates a three-quarter loop around the bone to provide easy visualization so the surgeon can pass the cable through in the retrograde direction, decreasing average surgical time per cable and patient soft tissue trauma. The team's award was presented at the Biomedical Engineering Society's annual meeting in Philadelphia.



Adam Baker wins IDEA Graduate Student Poster Competition

Adam Baker, student of Dr. Bruce Gao, won the Graduate Student Poster Competition in the Bioengineering/Nanotechnology category at the Southeast Regional IDEa Conference in Louisville, Kentucky. The National Institutes of Health IDEa (Institutional Development Award) program is designed to broaden the geographic distribution of NIH funding for biomedical research. He is working on pairing high resolution imaging of myocardium to the force map to approximate the degree of tissue death after a heart attack.



Matthew C. Coombs

August 13, 1986-June 28, 2019

In January 2016, Matthew C. Coombs, PhD, came to join us at the Clemson-MUSC Bioengineering Program as an MUSC Dental T32 Postdoctoral Fellow in Dr. Hai Yao's laboratory. Matthew exemplified all of the qualities that we desire in an academic research investigator. He was intellectually gifted and collegial in all his pursuits, whether mentoring students and fellows, collaborating with internal and external research investigators, or improving our program structure and outcomes. Matthew passed away unexpectedly on June 28, 2019. He is survived by his wife, Kanistha (Koni) Chatterjee Coombs, their sons Arya, four years of age, and Ashok, two years of age, and his parents, Mike and Lisa Coombs.

According to Matthew's colleague Tommy Gallien, "Matthew's time with us was brief, but his impact was large!" Before coming to Charleston, Matthew obtained his bachelor's degree in bioengineering and graduate degree in mechanical engineering from the University of Cincinnati. His studies examining biomechanical influences upon spinal diseases allowed him to immediately contribute to Dr. Yao's team by identifying important factors contributing to normal and pathological temporomandibular joint function. Matthew distinguished himself by quickly obtaining NIH F32 and K99 fellowship funding and was well on his way to establishing a rewarding independent career.

Matthew's seminal work elucidating the role of sexual dimorphism in temporomandibular joint mechanobiology and pathophysiology was highly regarded at the annual meeting of the 2019 International Association of Dental Research. The leadership team of the NIH National Institute of Dental and Craniofacial Research noted and commented positively upon the work. As Tommy observed, "Matthew was a rare talent and person. While we will remember him for his outstanding scholastic achievements, it was his selfless interaction and support and mentoring that most touched the hearts of those around him. We were fortunate to have Matthew in our lives, for he made the world a better place."

The Department of Bioengineering is honored to celebrate Matthew's life and professional accomplishments by creating the Matthew C. Coombs Postdoctoral Research Award. It will be bestowed annually on an exceptional postdoctoral fellow in bioengineering, one who exemplifies determination, motivation and inquisitiveness through scholarly work and research. The inaugural award will be announced in April 2020.



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*Happy New Year
from Clemson Bioengineering*

