

April 2021 Board of Trustees

RESEARCH REPORT



Division of

RESEARCH



A **Carnegie R1** Research Institution

Dear Board of Trustees Members,

First of all, I hope you and your loved ones remain healthy as the world continues to battle the COVID-19 pandemic.

The theme of this Board of Trustees meeting is **relevance**. I hope the relevance of our research enterprise has been on full display in all of my research reports, but I am excited to include some more specific examples of relevant research activity in this report. Through research, our faculty have created teacher training programs and educational curriculum that helps more than 10,000 K-12 students in South Carolina each year. Our faculty developed a smartphone app that is being used by farmers throughout the East Coast to diagnose and treat crop disease. Our faculty have worked to develop a program to help spare infants the pain of opioid addiction. Our faculty have developed technology that uses artificial intelligence to detect manufacturing defects on an assembly line. These are just a few examples of Clemson research being put to use in the world. There are more examples on [pages 7-15](#).

Additionally, we are earning more grant awards, especially very competitive federal awards, we are publishing more results and we are being cited more frequently by the academic community, all signs of the increased relevance of our research and discoveries ([see pages 5-6](#)).

Amid all of this exciting news, we continue to monitor potential disruptions in research activity due to COVID-19. While some faculty members and students continue to work in labs and offices, for example, others still can't access off-campus sites that are essential for their research. Schools, hospitals and other community sites have limited access and in-person interaction still. Some faculty members and students have missed important travel opportunities and events. We are comparing research metrics before COVID-19 to metrics during the pandemic, as you will see in charts throughout our Research Metrics section. While we monitor COVID-19's impact on research, we continue to see positive signs in our research metrics:



Tanju Karanfil

- Total research and development expenditures continue to increase, reaching \$229 million in 2020, the most recent year data is available ([see page 18](#)).
- Research awards were up 46 percent through the end of February when compared to the same period a year ago ([see page 20](#)).
- Proposal submissions remain strong, reaching \$534 million through the end of February, up 17 percent from the prior-year period ([see page 24](#)).

Clemson faculty have earned several high-value awards in the past several months. In fact, as an institution, we just received our 4th Center of Biomedical Research Excellence (COBRE) grant from the National Institutes of Health ([see pages 31-32](#)). Each COBRE brings an investment of up to ~\$30 million in biomedical research. Additionally, a team of 65 faculty members will be working on a major \$18 million project with the U.S. Army to prototype the next-generation of autonomous military vehicles ([see pages 45-46](#)). Director of that project, Zoran Filipi, plans to provide additional details at the upcoming Research and Economic Development Committee meeting.

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These are exciting new endeavors, and Clemson faculty continue to earn even more high-value projects. You can view details on our top recent awards on [pages 21-23](#).

While our research enterprise grows, so does our reputation and our list of achievements. I have included two examples of recent books published by faculty ([see page 34](#)), and Clemson faculty and students are earning significant national and international recognition. For the first time ever, a Clemson University student has been named a Gates Cambridge Scholar ([see page 35](#)). A Clemson professor received an international award for creative writing ([see page 39](#)). Another Clemson professor was recognized with a national 40th Anniversary Award for his wetlands research ([see page 40](#)). Numerous examples of significant honors and achievements are provided on [pages 35-44](#).

Finally, I would like to close by encouraging you to read more about the accomplishments of our faculty members in the Focus on Faculty section ([see pages 48-68](#)). I believe this section will provide many examples of the relevance of our research and the impact our Clemson faculty are having in their fields and on society. As I read their stories and learn of their passion for scholarship, I become increasingly excited about our future.

Respectfully submitted,



Tanju Karanfil, Ph.D., PE, BCEE, IWA Fellow
Vice President for Research, Clemson University



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RESEARCH RELEVANCE



This section reviews the relevance of Clemson's research endeavors.

Executive Summary

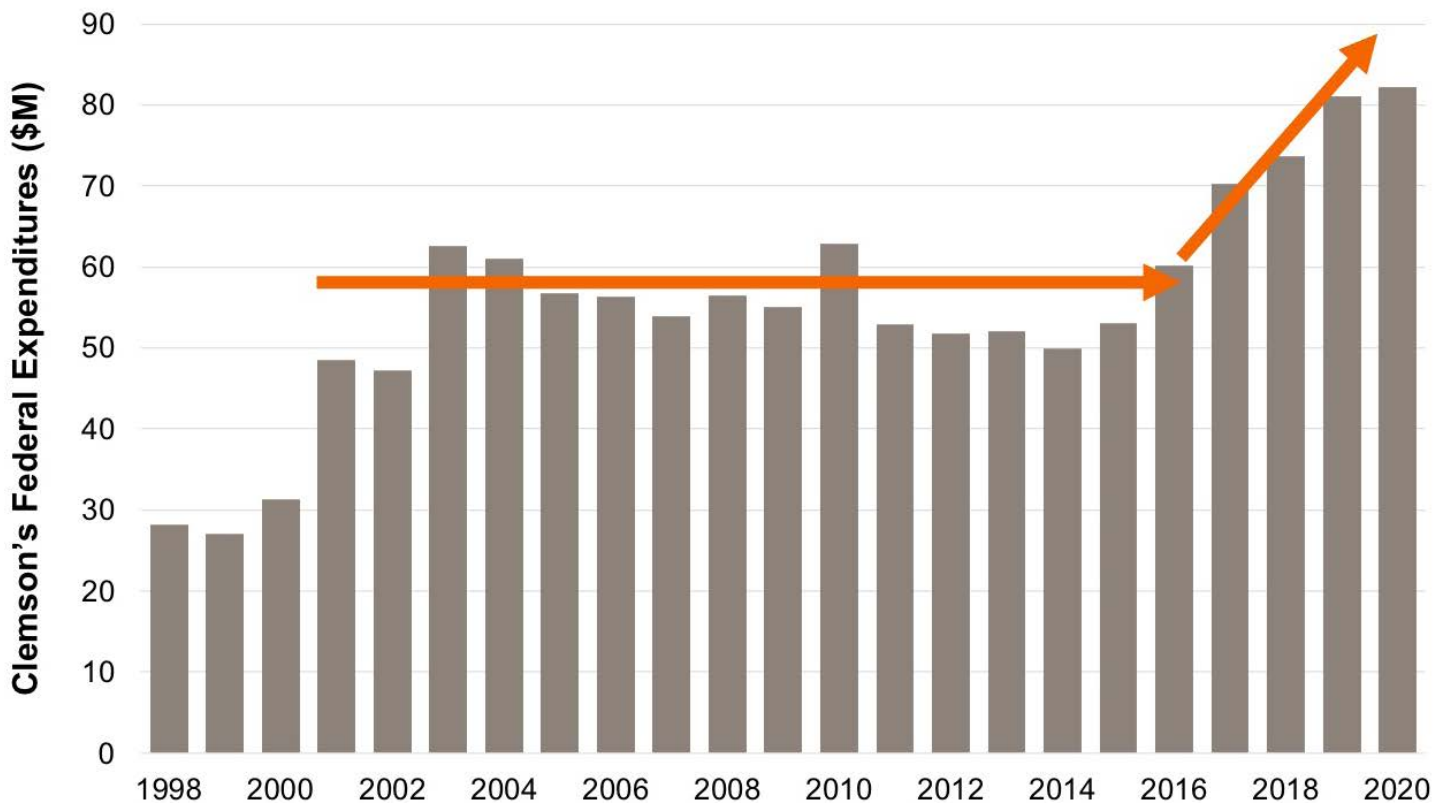
- Federal expenditures, which account for a significant portion of university research expenditures, have grown considerably at Clemson since 2016 ([see page 5](#)). This is a sign of federal agencies increasingly rewarding relevant ideas from Clemson faculty.
- Clemson faculty are publishing more peer-reviewed articles and their work is being increasingly cited by the scholarly community, a sign that research findings are relevant ([see page 6](#)).
- Clemson researchers are putting their work to use in society by supporting better education and health care, and fueling innovation in the private sector to improve manufacturing, agriculture and more. Examples of this societal impact are included on [pages 7-14](#).
- The Clemson University Research Foundation is working to move Clemson innovations to market to make even greater impact ([see page 15](#)).
- Early-career faculty at Clemson have become increasingly competitive at winning young investigator awards since 2016. These are highly competitive programs that serve as catalysts to jumpstart careers. These are signs of relevant research ideas and signify great things to come for Clemson's early-career faculty ([see page 16](#)).

Federal Expenditures

→ Highly competitive federal programs reward relevant ideas

Grants from the federal government are highly competitive, attracting applications from the top academic minds from the top academic institutions across the country.

Clemson faculty have been increasingly successful at winning federal grants, as evidenced by an increase in our federal expenditures (see chart below). Clemson posted big increases in federal expenditures in the early 2000s but then expenditures remained relatively flat until 2016. At that time, we start to see Clemson's federal expenditures begin to climb. From 2016 to 2020, federal expenditures at Clemson increased 37 percent. Meanwhile, overall federal research and development expenditures in higher education were fairly flat over that time.



*2020 totals preliminary

SOURCE: NSF Higher Education Research and Development (HERD) Survey

Publications and Citations

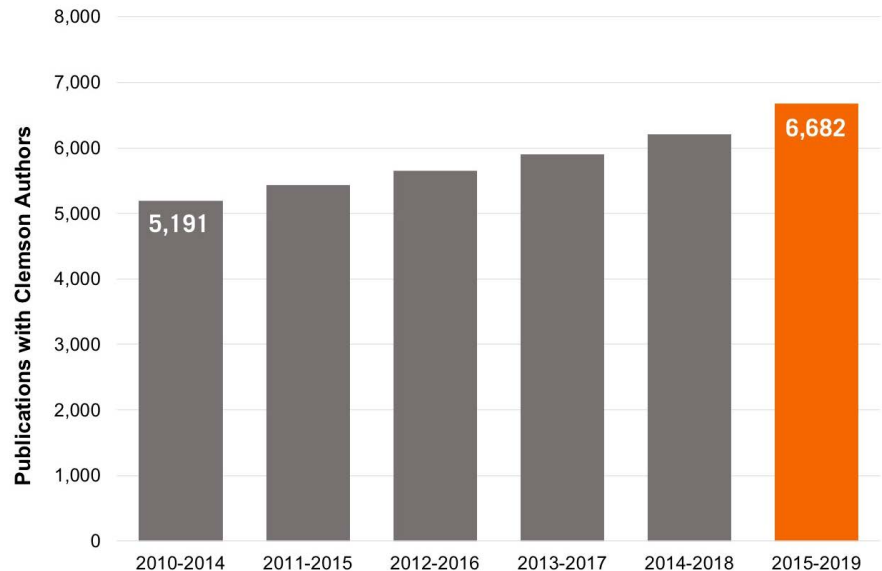
→ Journals publishing more Clemson research

Peer-reviewed journal articles provide needed research findings to the scholarly community and contribute to ongoing discovery and innovation.

When journals publish Clemson articles, they are confirming the relevance of the work and declaring it a worthwhile contribution that others should read.

As Clemson has earned more grant awards and increased expenditures, its scholarly output in the form of journal articles has increased also.

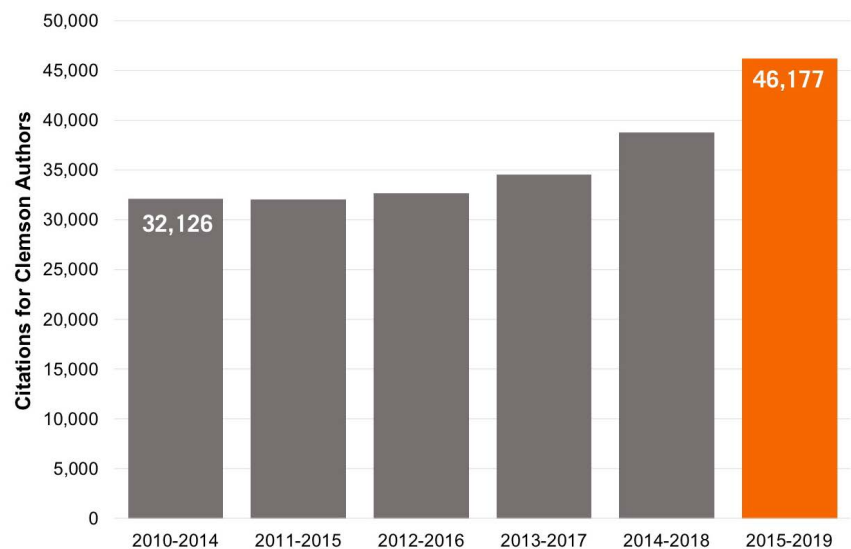
The chart at right shows the annual average number of publications by Clemson authors over four-year periods. From 2015 to 2019, Clemson faculty authored an average of 6,682 publications annually. That's an increase of 29 percent from the 2010-2014 period, according to Web of Science, which tracks the data.



SOURCE: Web of Science

INCREASING CITATIONS

When researchers publish articles on their findings, other scientists often cite the information in their own research. These citations affirm the relevance of Clemson's findings and help to advance discovery across the world. Over the past decade, findings from Clemson research have been increasingly cited by the scholarly community. The chart at right shows annual average citations for Clemson authors over four-year periods. From 2015 to 2019, Clemson authors were cited 46,177 times annually on average. That's an increase of 44 percent from the 2010-2014 period, according to Web of Science, which tracks the data. The scholarly community is finding Clemson research increasingly relevant.



SOURCE: Web of Science

Making an Impact

→ The stories below highlight Clemson research put to use in society

Nearly 500 teachers in the state of South Carolina have been trained in the past few years by the Clemson University Reading Recovery and Early Literacy Training Center.

Led by director C.C. Bates, the center's unique curriculum enables students to overcome struggles with reading and writing, from an early age, by empowering teachers with professional tools. The coursework is designed to function as an intervention program to help first graders sail through difficulties faced in reading and writing.

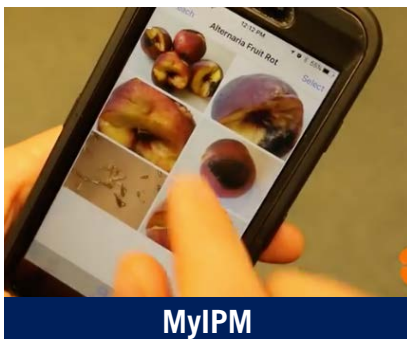


C.C. Bates

The program has expanded its outreach across South Carolina by partnering with other institutions in higher education and has recorded a high success rate. About 10,000 students benefit each year by improving their ability to read.

Effortless learning helps boost the confidence of children and accelerate their emotional growth. With focus on impoverished households, Clemson University continues to make a difference in the lives of thousands of children statewide. Training teachers fosters professional development, in this case for reading recovery teachers and primary grade classroom teachers in the area of early literacy assessment and instructional strategies.

Fruit growers throughout the Southeast and beyond are using a smartphone app developed by Clemson's Guido Schnabel to identify and treat crop disease while promoting environmental sustainability.



MyIPM

Schnabel uses an approach called Integrated Pest Management (IPM), which combines biological, cultural and chemical options to control problems caused by pests and disease while minimizing environmental impacts.

The MyIPM Smartphone App Series provides growers along the East Coast with diagnostics and diverse treatment options for fruit crop diseases, pests and disorders. App content is maintained in collaboration with fruit extension

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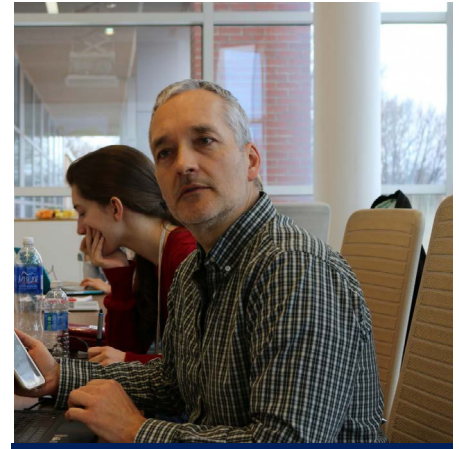
Making an Impact

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specialists at Clemson, Cornell University, University of Massachusetts, Pennsylvania State University, University of Maryland, North Carolina State University, the University of Florida and the University of Georgia. MyIPM is a free app available in the Apple Store and Google Play.

Pest issues are managed by preventing, monitoring and controlling the pests, by eliminating or gravely reducing the use of pesticides, without necessarily discouraging its usage. The emphasis is on the usage of non-chemical pest management methods such as sanitation first, with chemical methods being used only when necessary.

With the program's interdisciplinary effort involving the development of research-based information, it has successfully extended its usage to the public through a variety of extension, education and outreach programs.



Schnabel



Shuffler

Prisma Health is working to reduce employee burnout with help from Clemson's Marissa Shuffler, associate professor of psychology. Health care providers across the country are suffering from burnout that is leading to poor quality of care, absenteeism, costly turnover and, in some cases, suicide. Shuffler is helping hospitals identify the causes of provider burnout and implement the organizational solutions.

The National Academy of Medicine notes that more than half of U.S. health care providers experience substantial symptoms of burnout, and burnout symptoms can be prevalent among nurses, other health care professionals and students as well.

Shuffler has helped Prisma Health implement organizational changes to address issues that can be unique to specific practices and departments.

Shuffler, the first behavioral scientist at Clemson to receive the National Science Foundation's Faculty Early Career Development Program grant, is also helping the U.S. Army build stronger, more adaptive teams and working with NASA to develop new organizational structure needed for longer space missions.

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Making an Impact

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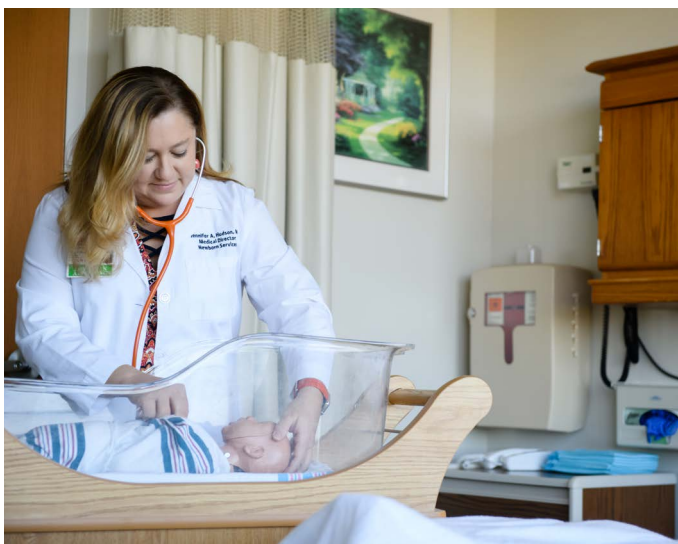
South Carolina manufacturers are using Clemson technology that uses artificial intelligence (AI) to detect defects on the assembly line.

Led by Amy Apon, director of the School of Computing, researchers have worked with industry partners to develop deep stream analysis for a production system that uses high-definition cameras to scan vehicles for faults as they move through the assembly line. The project uses a type of artificial intelligence called deep learning to recognize faults.

The project was motivated by BMW. The company is in full production with an industrialized system at its Greer Plant, and started rolling out the system at other BMW locations globally.

An otherwise labor-intensive process was replaced by an automated system using the camera-based system, which can reduce operating expenses. This method developed by Clemson researchers could help apply to different kinds of visual inspection processes.

Infants have been spared the pain of opioid addiction through a collaboration between Clemson University researchers and Prisma Health.



Infants exposed in utero to opioids taken by substance-dependent mothers can suffer from fever, seizures, hyperactive reflexes, vomiting, diarrhea, sweating, and dehydration, common symptoms of withdrawal. These infants are born with neonatal abstinence syndrome. The high-pitched crying and trembling make breastfeeding or bonding with a mother more difficult, and seizures can lead to lack of oxygen and even death if unrecognized.

Researchers from Clemson's College of



Apon

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Making an Impact

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Behavioral, Social and Health Sciences have helped inform Prisma Health's Managing Abstinence in Newborns (MAiN) program, an early intervention model for babies born to opioid-dependent mothers. The program offers an innovative model of care that combines early treatment, rooming-in of babies and mothers at the hospital, interdisciplinary care and outpatient medication weaning, which combine to reduce the need for neonatal intensive care. MAiN is now being expanded to multiple hospitals across South Carolina. [READ MORE](#)

The Clemson Composites Center led by Jenkins Endowed Professor Srikanth Pilla has developed a new thermoplastics composite door that not only improves fuel economy for consumers but reduces parts usage and assembly time for manufacturers.

Working with Honda and the U.S. Department of Energy, Pilla and his team have engineered a door that weighs 42.5 percent less than standard vehicle doors, is 100 percent recyclable, uses 30 percent fewer parts to assemble and reduces assembly time by 50 percent.

The thermoplastics composite door has the potential to reduce greenhouse gas emissions, pioneer automotive fuel efficiency, improve manufacturing efficiency and help the U.S. meet corporate fuel economy standards.



Pilla (in back)



This is just one innovative product in the works at the Clemson Composites Center, which features an equipment setup unlike any other university setup in the world. The research, innovation and development facility is equipped to design, manufacture and test all kinds of composites and lightweight materials.

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Making an Impact

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Innovative treatments for some of the world's most deadly diseases are being released by Clemson researchers at the S.C. Bioengineering Center for Regeneration and Formation of Tissue (BioCRAFT).

Formed in 2009 and led by Endowed Chair Naren Vyavahare, the center has received nearly \$30 million in funding through the National Institutes of Health's Center for Biomedical Research Excellence (COBRE) program.

During that time, BioCRAFT has trained dozens of Clemson scientists, secured more than 20 patents and led to the spin-off of four startup companies with medical devices and treatments for heart disease, which is the leading cause of death in the United States; kidney disease, which affects about 10 percent of the global population; and lung diseases, which affect approximately 800,000 South Carolinians alone.

One of the companies, Aptus Bioreactors, is further contributing to research by providing cardiovascular bioreactor equipment and consulting services to help laboratories develop and test living tissue replacements and other medical devices. These technologies will be used to build patient-specific, living heart valves that utilize a patient's own stem cells and will grow and regenerate for their entire lifetime.

Some of the first rehabilitation tools that use driving simulators to improve the quality of life of patients with motor, visual and cognitive impairments were developed right here at Clemson.

Johnell Brooks, an associate professor of automotive engineering who has her doctorate in psychology, has partnered with Utah-based DriveSafety Inc. to develop therapy tools used by thousands of patients at more than 60 clinics worldwide.

"We are creating rehabilitation exercises performed on a driving simulator that can help patients regain visual, motor and cognitive function, as well as assess patients' fitness to drive," Brooks says.

The simulators track patients' responses to various stimuli using steering wheels,



Vyavahare

Making an Impact

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pedals and speedometers. Great care and more than a decade of research went into its ergonomics, displays and vehicle controls, ensuring the most accessible experience for patients and clinicians.

Brooks has submitted more than 100 invention disclosures to the Clemson University Research Foundation. The majority of those disclosures has led to licensed commercial technologies with DriveSafety.

Brooks and DriveSafety are helping stroke patients better understand their new limitations, and they're developing new products and services to aid veterans with post-traumatic stress.

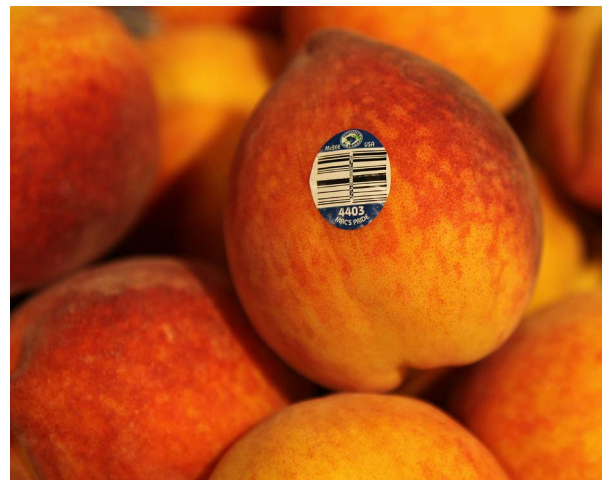


Approximately 85 percent of peaches grown in the Southeast are grown from rootstock developed by Clemson University researchers and the U.S. Department of Agriculture.

Guardian rootstock offers a solution to Peach Tree Shortlife, the sudden spring collapse and death of young peach trees aged 3 to 7 years. The complex condition is caused by numerous factors, including cold damage and bacterial canker, as well as fertilization application, pruning and other management practices.

Before Guardian, Peach Tree Shortlife was the No. 1 tree killer in the Southeast and was costing South Carolina farmers \$15 million annually. To combat this, numerous varieties of peach trees with favorable fruits are grafted to Guardian rootstocks grown in nurseries and then planted.

Clemson grows around 2 million Guardian rootstock seeds annually. They're sold through the S.C. Crop Improvement Association, which licenses the rootstock. The sale of the seeds generates approximately \$120,000 for Clemson research each year.



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Making an Impact

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Clemson is helping journalists, policymakers and fellow academics around the world gain a more complete understanding of the complex social media landscape.

The University recently opened a Media Forensics Hub, a flexible space for collaboration, innovation and project development at



**Media
Forensics Hub**
LAUNCH VIDEO OUT NOW

the Watt Family Innovation Center. The Media Forensics Hub goes beyond educating those who study media. It also is designed to empower all users of Facebook, Twitter, Instagram and other social media sites to better understand disinformation: how it works, how to spot it and how stop it from spreading.

The project stems from research by Darren Linvill, an associate professor in Clemson's Department of Communication, and Patrick Warren, an associate professor in Clemson's John E. Walker Department of Economics. Linvill and Warren collaborated to uncover and expose more than 3 million Russian Twitter troll tweets during the 2016 election and now the researchers have become international experts in identifying and exposing social media disinformation campaigns. [READ MORE](#)

An app that is designed to help victims of conflict organize their own first response is bringing another dose of international attention to Clemson University.

P2PR2P was among five projects to win funding through a European Commission-connected program, NGIatlantic.eu Open Calls. The award comes a little more than a year after a prototype of the app was showcased at the Paris Peace Forum, a conference whose attendees included French president Emmanuel Macron.

The app was conceived by the French non-governmental organization Danaïdes. An interdisciplinary group of Clemson faculty and students created the app to securely connect civilians in conflict and natural-disaster zones with people who can provide food, medicine, transportation and other aid.

The Clemson team is partnering on the app with France's Institut d'études politiques de Toulouse and the project's lead, Danaïdes.

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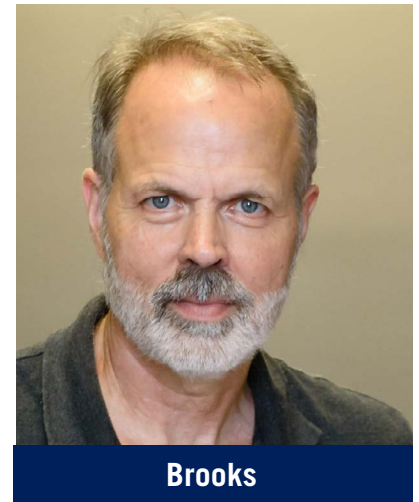
Making an Impact

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The award will allow Danaides to verify the security, privacy and trust aspects of the app, said Richard Brooks, a professor in Clemson's Holcombe Department of Electrical and Computer Engineering.

"The award gives us more visibility," said Brooks, who is also chief technology officer for Danaides. "Also, the support for the verification allows us to do the alpha and beta testing and then start fielding the app in Chad for use by a legal collective fighting violence against women and children."

[READ MORE](#)



A new web-based calculator from Clemson University is helping farmers better manage fertilizer applications.

The online Clemson Center Pivot Fertigation Calculator is designed to help agricultural producers make more precise fertilizer applications, which will save money and increase crop productivity. This app was developed by Kendall Kirk, a Clemson precision agriculture engineer, with "good advice" from many members of the South Carolina farming community.

"This resource was developed to help producers easily calculate the flow rate of liquid fertilizer and injection pump settings needed to fertigate through a center pivot irrigation system," Kirk said. "It is designed to make the math a little easier."

Jacob Oswald of Allendale is one of several people who work in South Carolina agriculture who helped develop the calculator. Oswald works with growers across the state to determine how to maximize their yields while still maintaining an efficient economic investment in their farming operations.



"I find this calculator particularly useful because calculating the correct application rate for nutrients injected through irrigation systems can be a difficult process," Oswald said. [READ MORE](#)

Market Innovation

The Clemson University Research Foundation is working to move the results of Clemson research from the lab to the marketplace where they can provide real-world benefit. Here is a sample of new Clemson technologies available to commercialize.



1 | Ying Mei (bioengineering) has developed a method to help treat patients who have suffered from heart attacks or strokes. By taking a small tissue sample from the patient, doctors can create a miniature 3D tissue “organoid” that can help assess which prescription drugs will be most beneficial.

2 | Ken Marcus (chemistry) and **Terri Bruce** (Light Imaging Facility) have created a novel shaped fiber which can be used in medical diagnostics and disease detection. These “C-CP” fibers trap cellular exosomes, which are produced by a patient’s body in response to certain medical conditions and infections. These exosomes provide doctors an early method of detecting chronic disease.

3 | Kevin Finneran (environmental engineering and earth sciences) has developed a new bioremediation technology that can eliminate the common pollutant known as hexavalent-chromium. This new method uses animal byproducts as electron donors, which enable naturally occurring bacteria to break down and eliminate the pollutants. This approach has been shown to perform better and cost less than the current bioremediation materials based on soybean oil. Worldwide, millions of people are affected by contaminated drinking water.

4 | Mark Thies (chemical and biomolecular engineering) has developed an approach to purify and control the molecular weight of lignin for use as carbon fiber and other plastic materials. Lignin is a wood-derived “biopolymer,” which is a byproduct of the paper-making process. Carbon fiber and plastics made from lignin provide a renewable way to create common materials and products without reliance on limited petroleum resources.

5 | Alexey Vertegel (bioengineering) and **Igor Luzinov** (materials science and engineering) have engineered a mechanically stable antibiotic coating that can reduce the amount of infections associated with bone fractures. Severe bone fractures may require external pins and wires to provide stabilization during healing. However, these “external fixation” techniques often result in a high amount of complications due to infection.

For a full list of Clemson innovations available, visit curf.clemson.edu.

By The Numbers

Numbers below include data from FY2017-2021

276

Invention Disclosures

77

Patents Issued

65

Licenses/Options

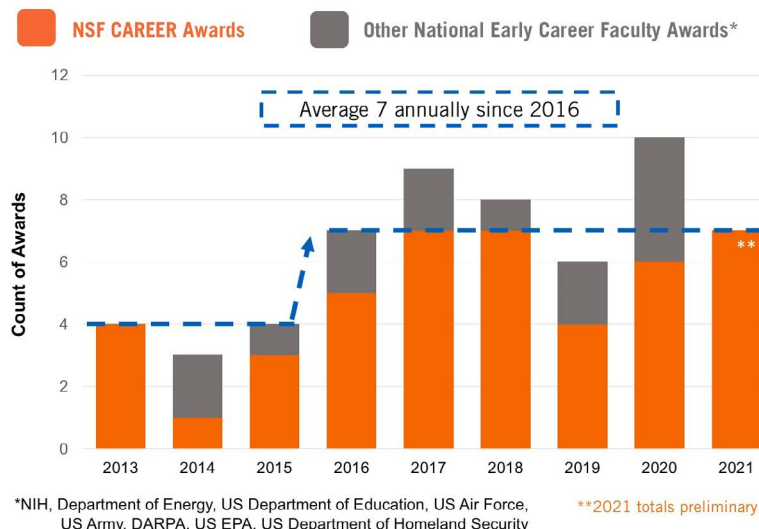
\$1.9M

Licensing Revenue

Early Career Awards

Numerous funding agencies offer grant programs available to early-career faculty. These highly competitive programs serve as catalysts to jumpstart the careers of the nation's most promising young faculty. The chart at right shows the number of early career awards received by Clemson faculty each year.

Seven Clemson faculty have earned such awards this year. All are NSF CAREER Awards.



Angela Alexander-Bryant
Assistant Professor, Bioengineering

Angela is working to develop new therapeutics and enhance drug delivery.



Ioannis Karamouzas
Assistant Professor, School of Computing

Ioannis's research revolves around robotics, interactive virtual worlds, and data science.



Bart Knijnenburg
Assistant Professor, School of Computing

Bart is researching the principles of human-computer interaction.



Yingjie Lao
Assistant Professor, Electrical and Computer Engineering

Yingjie is working to protect Artificial Intelligent systems from cyber attacks.

***Additional proposals are pending for 2021.**



Jessica Larsen
Assistant Professor, Chemical and Biomolecular Engineering

Jessica is working to develop materials for drug delivery applications in neurodegenerative disease and other brain disorders.



Judson Ryckman
Assistant Professor, Electrical and Computer Engineering

Judson is working on improved sensors that could make it possible to run a wide range of diagnostic tests without needing large, expensive scientific instruments.



Xin Zhao
Assistant Professor, Mechanical Engineering

Xin is creating manufacturing techniques for improved materials, such as eyeglasses that won't fog or windshields that won't ice over.

RESEARCH METRICS



This section covers institutional research productivity with data on proposal submissions, awards and expenditures.

Executive Summary

- Research expenditures continue to increase. Total research and development expenditures have increased 50 percent from 2013 to 2020 ([see page 18](#)).
- Research awards have nearly surpassed FY2020 levels with four months left in FY2021 ([see page 20](#)).
- Clemson faculty have been successful earning high-value grants. Brief descriptions of the highest-value grants recently received are listed on [pages 21-23](#).
- Proposal submissions remain high, with \$534 million in proposals submitted through February of FY2021 ([see page 24](#)).
- Despite positive trends in metrics, COVID-19 has caused disruptions to research activity ([see page 25](#)).
- The Research Report Card includes additional details on awards, expenditures and proposals by college and unit on [pages 26-29](#).

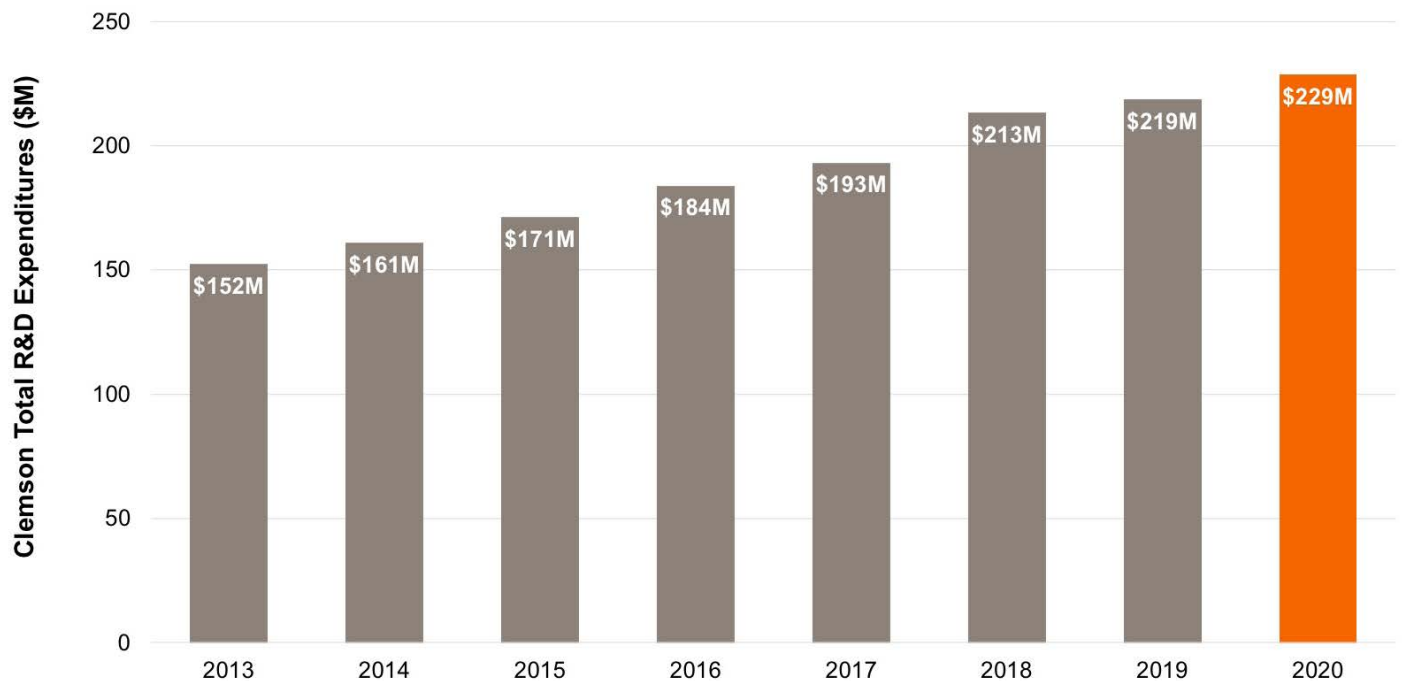
Research Expenditures

→ Total R&D expenditures continue to climb

Reported to the National Science Foundation and used in the Carnegie Classification, total R&D expenditures are important to track and provide apples-to-apples comparisons to peer institutions.

These expenditures include revenue from state support, gifts, external research services and other sources, including competitive awards.

Clemson has posted 6 percent average annual growth in total R&D expenditures since 2013. Total R&D Expenditures have increased more than 50 percent from 2013 to 2020, the latest year for which data is available.



SOURCE: NSF Higher Education Research and Development (HERD) Survey

* 2020 totals preliminary

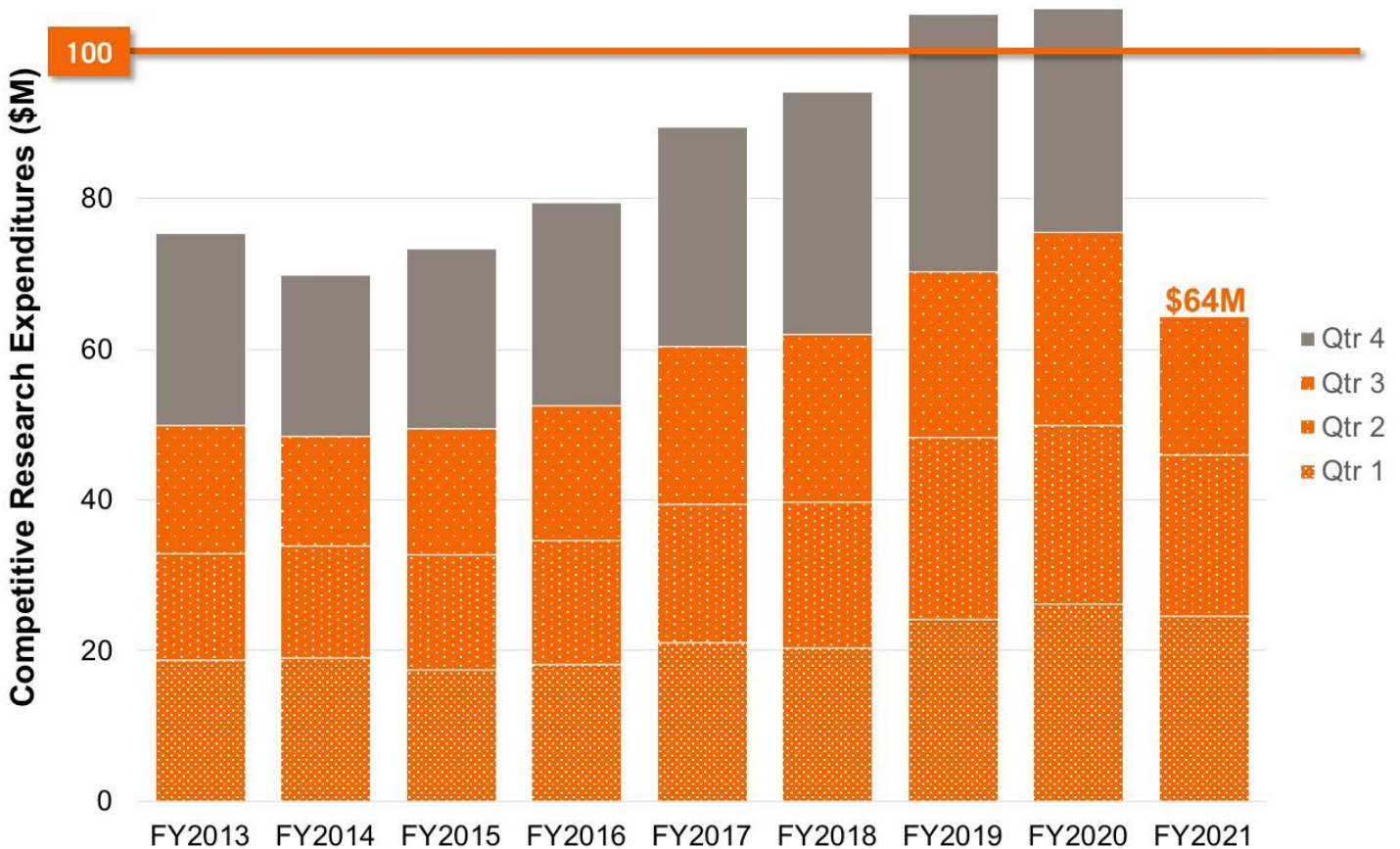
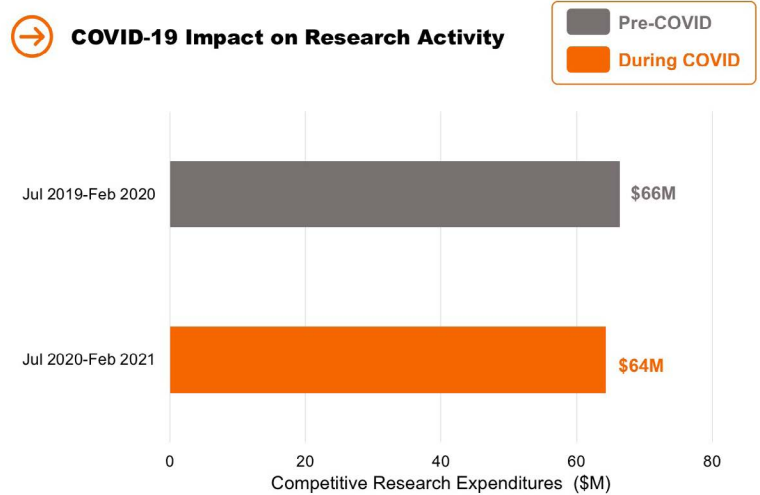
Research Expenditures

→ Competitive expenditures again top ClemsonForward goal

ClemsonForward set a 10-year goal in 2016 to top \$100 million in annual competitive expenditures. Clemson achieved that goal (marked on the graph with an orange line) seven years ahead of schedule in 2019. In FY2020, Clemson topped \$100 million for the second consecutive year. Competitive expenditures include funds from competitively bid projects, such as federal grant awards.

The orange bars show expenditures through February for each fiscal year. The gray bar shows year-end totals.

The chart at right shows COVID-19 impact on expenditures.

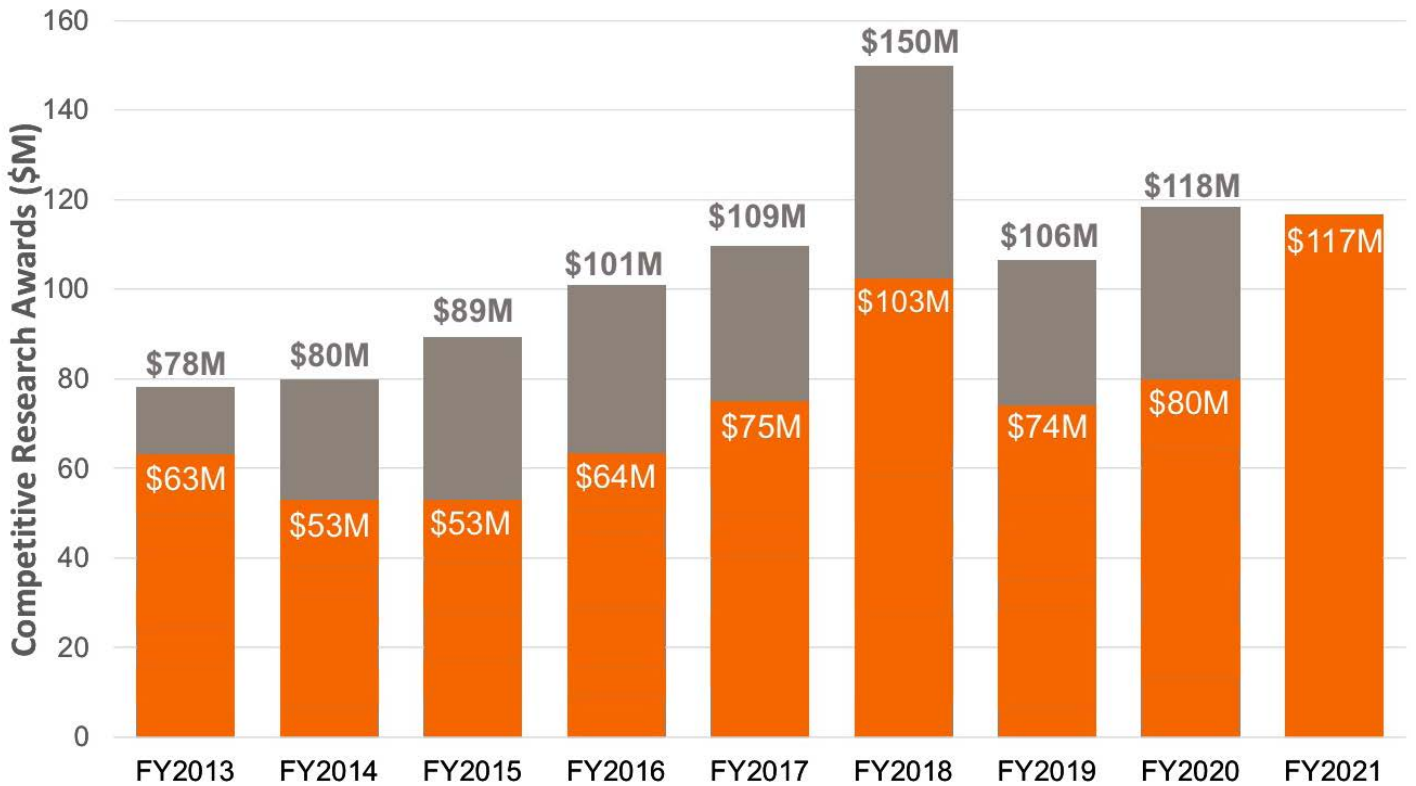
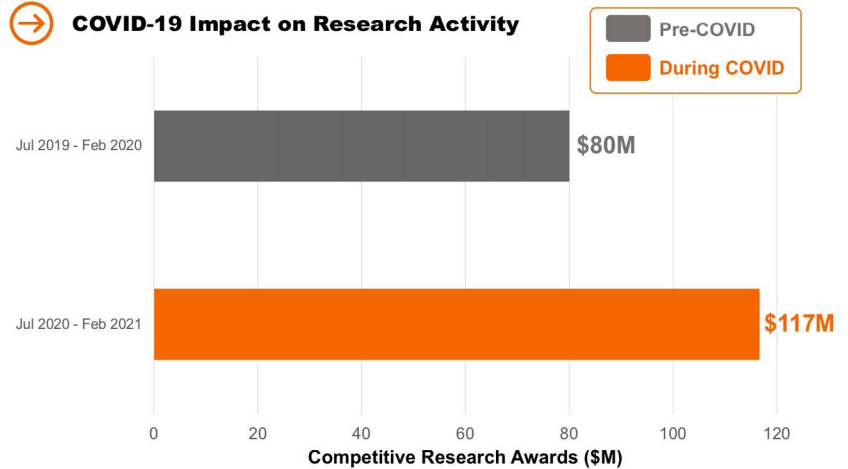


— As of the end of February

Research Awards

→ Research awards up 46% from prior-year period

Clemson faculty continue to be increasingly successful earning competitive research awards. Awards in FY2018 were heightened due to two major industry contracts. Excluding that year, FY2020 was the top year for awards of the past eight years and FY2021 is on pace to surpass that mark. The gray bars show year-end totals for each year. The orange bar shows awards received through the end of February. The chart at right shows the impact from COVID-19.



56 RESEARCH AWARDS OF AT LEAST \$2M WON SINCE 2015

THE TOTAL VALUE OF THESE PROJECTS IS **\$275 MILLION**

Research Awards

Top Competitive Grants (received between Nov. 10, 2020 and March 24, 2021)

Trudy Mackay, Self Family endowed chair of human genetics, received \$10.6 million from the National Institutes of Health to establish a Center of Biomedical Health Research Excellence (COBRE) in Human Genetics. Genetic diseases impact a large proportion of the world's population, but the genetic underpinnings of disease risk are still largely unknown. This Center for Biomedical Excellence (COBRE) project strives to better understand the mechanisms – genetic, genomic and epigenetic – by which genetic variation impacts rare and common diseases. Clemson University partners with faculty from the Greenwood Genetics Center.



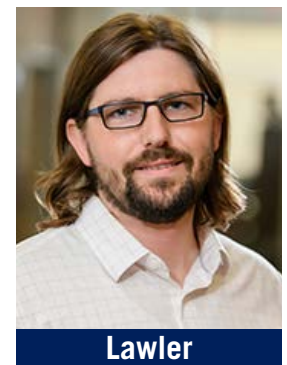
Mackay



Jia

Yunyi Jia, McQueen Quattlebaum assistant professor of automotive engineering, received \$1.7 million from the U.S. Department of Energy to evaluate the adaption and improvement of pooled rideshare services. Rideshare networks like Uber and Lyft appear to be everywhere, and the rideshare model promises to provide a needed service while diminishing energy consumption. However, adoption of pooled rideshare services has not grown as expected. This project aims to discover the reasons why the rideshare model is not more widely adopted and aims to investigate technologies which might support wider use of pooled rideshare.

Benjamin Lawler, associate professor of automotive engineering, received \$1.3 million from the U.S. Department of Energy, via Achates Power Inc., to design and test a more fuel-efficient, environmentally friendly engine. Transformation of commercial vehicle engine configuration is key to realizing increased energy efficiency while reducing the production of greenhouse gases. Clemson University's CU-ICAR will model and test the next generation of internal combustion engines and will develop a novel powertrain configuration which promises fuel and power efficiency with decreased emissions.



Lawler



Wang

Kuang-Ching Wang, professor of electrical and computer engineering, received \$1.2 million from the National Science Foundation, via University of Utah, to continue his part of a national effort to expand cloud computing. In its third phase, this project, begun in 2017, extends the development of a multi-campus testbed for cloud computing architecture research. In this project phase, an expanded CloudLab system will be deployed at Clemson University's data center, one of three major project sites.

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Research Awards

Top Competitive Grants **continued** (received between Nov. 10, 2020 and March 24, 2021)

Paris Stringfellow, research assistant professor, received \$1 million from the U.S. Department of Energy, via University of Texas San Antonio, for her role as part of the Cybersecurity for Manufacturing Innovation Institute (CyManII). Automating supply chains promises energy efficiencies as decision-making processes become the domain of computers. At this point in its evolution, supply chains are not fully automated and include human decisions. These decisions can strip efficiency and security from supply chains by introducing decision-making error. Clemson University researchers will model the role human error in supply chain vulnerabilities.



Stringfellow



Sharkey

Thomas Sharkey, professor of industrial engineering, received \$1 million from the National Science Foundation to evaluate strategies to disrupt human trafficking. This project models the impact on victims of human sex trafficking when a trafficking network is disrupted by law enforcement. Researchers will simulate sex trafficking networks and examine the efficacy of disruption strategies while monitoring the well-being of survivors. Clemson University is joined by the University of Minnesota, Northeastern University and the Research Triangle Institute for this project.

Diana Vanegas, assistant professor of environmental engineering and earth sciences, received \$900,000 from the National Institutes of Health to develop an automated diagnostic platform used to detect COVID-19 and other viruses. Clemson is joined by researchers from the University of Hawaii, University of Florida and Iowa State University to develop an automated system of coordinated biosensors with the ability to detect SARS-CoV-2 in collected saliva samples. This new system will aid public health by detecting COVID-19 and other viruses rapidly and efficiently in human populations.



Vanegas



Powell

Brian Powell, Fjeld professor in nuclear environmental engineering and science, received \$900,000 from the U.S. Department of Energy, via the Savannah River National Laboratory (SRNL), for research related to the safe storage of nuclear waste. Clemson University continues its long-standing relationship with experts at Savannah River Site (SRS) as they work to model and assess radionuclide contamination risk to humans and to the environment.

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VPR letter

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Research Awards

Top Competitive Grants **continued** (received between Nov. 10, 2020 and March 24, 2021)

Lesley Ross, SmartLife endowed chair in aging and cognition, received \$800,000 from the National Institutes of Health to examine cognitive training methods that could help patients of degenerative diseases remain at home. Loss of independence, difficulties in everyday function, cognitive decline, Alzheimer's Disease and Alzheimer's Disease Related Dementias are areas of great concern for older adults and their families. Successful efforts that enable older adults to age within their homes, as compared to nursing homes, will save an estimated \$80 billion dollars per year. This project examines the benefits of cognitive training, a low-cost, non-invasive intervention. Cognitive training interventions have the potential to improve safety for seniors as they age.



Jeoung Soo Lee, associate professor of bioengineering, received \$700,000 from the U.S. Army to develop a point-of-injury treatment for brain injuries suffered during combat. For injured soldiers on the battlefield, medical support is often not immediate, and for soldiers who have suffered traumatic brain injury (TBI), that immediate medical attention can make an immense difference. Clemson researchers are developing a hydrogel containing anti-inflammatory agents which can be applied to injured soldiers in the field. The hydrogel has the potential to improve long-term outcomes for soldiers with TBI.

So far in FY2021...

CLEMSON FACULTY HAVE RECEIVED

10

RESEARCH AWARDS OF AT LEAST \$2M

THE TOTAL VALUE OF THESE PROJECTS IS

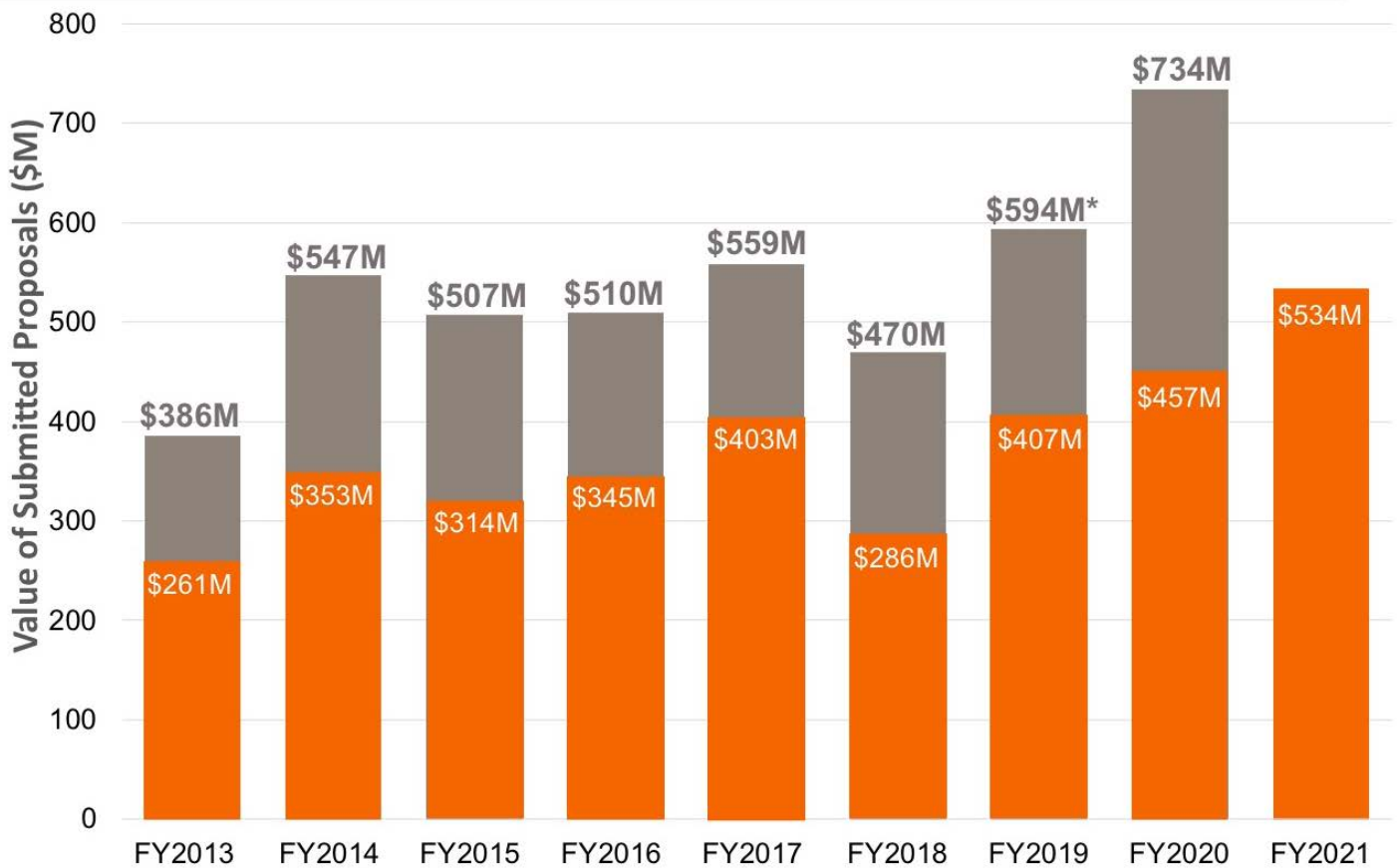
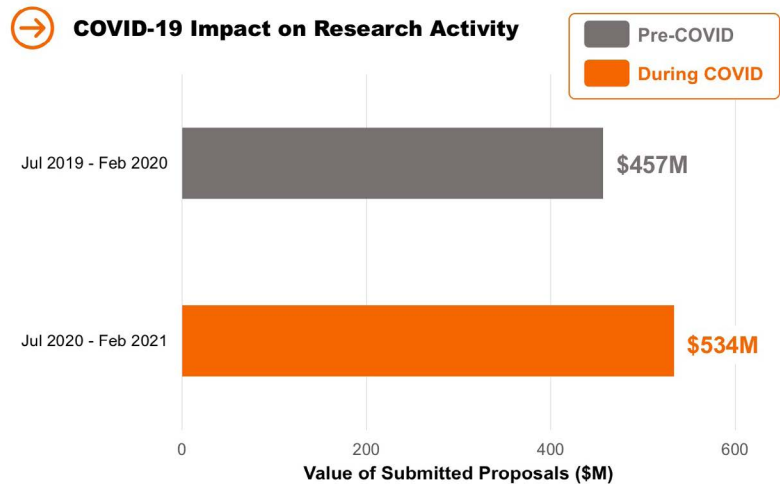
\$59M

Proposal Submissions

Proposals spiked in FY2020 as Clemson faculty submitted proposals for several high-value projects, a trend that has continued in FY2021.

The chart shows FY2021 through the end of the February. Data on the orange line provide figures for the same period in the prior years. The gray lines shows year-end data.

The chart at the right compares proposals before and during COVID-19.



*This chart includes a large \$107M multidisciplinary proposal submitted in FY2019

As of the end of February

“ COVID-19 Disruptions Reported by Clemson Faculty

While research metrics remain strong, COVID-19 has caused disruptions to research activity. The list below details some of the disruptions reported by Clemson faculty.

Delivery of equipment purchased for a new project was delayed due to broad disruptions in manufacturing/shipping, thus causing delays in system set up. I am now off on my timeline of work completion, and some of the preliminary data we hoped to collect for future grant proposals is delayed.

A major disruption I can identify is a delay in training new personnel (both graduate and staff level) and being able to offer research experience to undergraduate students.

An experiment that would have been started in the fall had to wait due to an inability to be trained by collaborators at another institutions. Even now, we are unable to be at full research capacity.

Delayed research means delayed publications means delayed grants means more delayed research, which disrupts pre-tenure faculty from building research programs. Additionally, some graduate students have lost months of work.

Hospital partners have put research on hold as a safety precaution.

Students have lost critical opportunities to present work at conferences, which is critical for professional development and networking opportunities.

Industry-funded research has suffered from back logs in the supply chain caused by COVID. Shipping for masonry block has been extremely delayed and lower production levels at the plants necessitated building some elements at the University that would have typically been provided by industry sponsors.

I, for one, am not taking on any additional students until it is safe for us to be fully in person. Given that I just don't have many virtual experiments to be done and most of our training requires close contact, it just isn't feasible.

The lack of professional travel is hurting professional development of junior faculty, who rely on professional meetings to build their networks. Online meetings are useful but not as good for younger persons still building a reputation.

It has been a struggle to hire lab technicians. Some months you can borrow someone else's technician for a few days or find a grad student willing to volunteer their help, but this is not sustainable.

When K-12 schools closed, school-based education research projects were suspended by school districts. For many education researchers, the school classroom is their "lab."

Face-to-face research with medical patients was discontinued as a COVID prevention strategy. Research on the effect of performing exercise on a diabetic patient's blood-sugar level after eating is a face-to-face event between patient and researcher. The blood specimen is tested; observation is made of the exercise performed.

The pandemic has slowed down the review and evaluation process of grant proposals as well the disbursement of the funds for external funding.

Research Report Card (FY2021 through February)

INDEX

CAAH: College of Architecture, Arts & Humanities**CAFLS:** College of Agriculture, Forestry & Life Sciences**CBSHS:** College of Behavioral, Social & Health Sciences**CECAS:** College of Engineering, Computing & Applied Sciences**COE:** College of Education**COB:** College of Business**COS:** College of Science**CCIT:** Clemson Computing & Information Technology**PSA:** Public Service & Agriculture

		2013	2014	2015	2016	2017	2018	2019	2020	2021	
RESEARCH INPUTS										through February	
a. Proposal Submissions by Number		1,414	1,443	1,489	1,478	1,529	1,451	1,417	1,729	1,069	
1	CAAH	38	51	65	62	69	64	69	76	46	
2	CAFLS	235	230	224	222	241	229	377	473	238	
3	CBSHS	81	93	102	104	112	101	105	143	102	
4	CECAS	549	555	582	617	618	587	562	672	425	
5	COE	51	54	39	45	46	37	39	42	27	
6	COB	7	15	13	15	7	10	5	11	12	
7	COS	242	247	263	239	230	227	186	219	158	
8	CCIT	12	12	6	3	5	1	1	1	-	
9	PSA	88	90	118	97	170	163	33	37	15	
10	VP for Res & Interdisc Inst	31	17	7	17	14	12	25	29	24	
11	All Other	80	79	70	57	17	20	15	26	22	
b. Proposal Submissions by Dollar Value (in millions)		\$386M	\$547M	\$507M	\$510M	\$559M	\$470M	\$486M*	\$734M	\$533.8M	FY2021 Targets
12	CAAH	N/A	N/A	\$9.4	\$8.6	\$3.1	\$5.7	\$4.4	\$5.9	\$4.4	\$6.6
13	CAFLS	N/A	N/A	\$42.6	\$23.8	\$43.4	\$37.1	\$64.1	\$92.9	\$50.0	\$68.6
14	CBSHS	N/A	N/A	\$28.4	\$40.1	\$41.4	\$25.9	\$47.9	\$41.1	\$43.3	\$51.3
15	CECAS	N/A	N/A	\$260.5	\$281.2	\$306.4	\$235.5	\$255.3	\$405.9	\$240.4	\$310.9
16	COE	N/A	N/A	\$13.8	\$14.7	\$18.1	\$19.1	\$10.1	\$18.9	\$15.9	\$14.3
17	COB	N/A	N/A	\$7.5	\$4.3	\$2.8	\$1.8	\$2.1	\$2.9	\$3.0	\$2.3
18	COS	N/A	N/A	\$100.2	\$111.3	\$95.9	\$100.4	\$73.8	\$129.3	\$125.2	\$95.6
19	CCIT	N/A	N/A	\$4.3	\$2.0	\$4.0	\$0.9	\$0.4	\$3.0	\$0.03	
20	PSA	N/A	N/A	\$23.3	\$10.4	\$31.3	\$25.8	\$11.4	\$6.4	\$4.8	\$15.3
21	VP for Res & Interdisc Inst	N/A	N/A	\$5.6	\$7.7	\$6.0	\$12.7	\$9.5	\$19.8	\$19.7	
22	All Other	N/A	N/A	\$11.4	\$5.6	\$6.0	\$5.0	\$7.4	\$7.7	\$27.1	

*This figure excludes a large \$107 million proposal from Clemson and Prisma Health.

VPR letter

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Research Report Card (FY2021 through February)

		2013	2014	2015	2016	2017	2018	2019	2020	2021
RESEARCH INPUTS continued										through Feb.
c. Research Awards (in millions)		\$78.0M	\$79.7M	\$89.3M	\$100.9M	\$109.5M	\$149.8M	\$106.3M	\$118.3M	\$116.7M
23	CAAH	\$0.2	\$0.6	\$0.7	\$1.4	\$0.5	\$1.9	\$2.0	\$1.4	\$1.2
24	CAFLS	\$7.3	\$6.7	\$14.1	\$8.6	\$10.9	\$13.9	\$14.2	\$22.3	\$16.0
25	CBSHS	\$2.7	\$3.4	\$4.8	\$5.1	\$4.6	\$8.1	\$5.9	\$7.7	\$7.5
26	CECAS	\$34.2	\$37.7	\$48.2	\$45.5	\$54.0	\$80.8	\$50.4	\$48.0	\$59.1
27	COE	\$2.6	\$4.1	\$3.2	\$2.9	\$2.8	\$4.5	\$3.3	\$2.3	\$4.8
28	COB	\$2.0	\$1.1	\$1.3	\$0.8	\$1.2	\$1.1	\$0.8	\$1.2	\$0.1
29	COS	\$10.3	\$7.8	\$9.9	\$15.6	\$19.9	\$14.7	\$18.7	\$14.2	\$17.2
30	CCIT	\$1.6	\$5.7	\$0.7	\$0.8	\$0.5	\$1.3	\$0.1	\$0.3	\$0.7
31	PSA	\$14.8	\$12.3	\$9.6	\$13.0	\$7.9	\$6.6	\$4.0	\$4.1	\$4.5
32	VP for Res & Interdisc Inst	\$1.8	\$0.3	\$0.6	\$5.1	\$5.0	\$15.1	\$6.2	\$14.6	\$5.0
33	All Other	\$0.3	\$0.2	\$1.2	\$2.0	\$1.2	\$1.7	\$0.7	\$2.2	\$0.5
d. National Young Investigator Awards		4	3	4	7	9	8	6	10	7*
34	NSF CAREER Awards (by start date)	4	1	3	5	7	7	4	6	7*
35	NIH KO1	-	-	-	-	1	1	-	1	-
36	Air Force Young Investigator Awards	-	-	1	2	1	-	1	-	-
37	Army Young Investigator Awards	-	-	-	-	-	-	-	1	-
38	DARPA Young Investigators Awards	-	-	-	-	-	-	-	1	-
39	EPA Earley Career Awards	-	-	-	-	-	-	1	-	-
40	DOE Early CAREER Awards	1	-	-	-	-	-	-	-	-
41	Department of Homeland Security	-	1	-	-	-	-	-	-	-
42	Dept. of Ed. Inst. of Educational Sciences	-	-	-	-	-	-	-	1	-
e. Supporting Workforce										
43	Graduate Student Enrollment	4,206	4,372	4,670	4,664	4,425	4,985	5,282	5,627	5,538
44	Sponsored Graduate Research Assistants	822	745	707	693	696	761	558	637	546
45	Postdoctoral Fellows	48	64	83	85	90	97	98	98	106
46	Research Faculty: Permanent 100% Non-E&G Funded	6	6	6	11	17	14	11	18	12
47	Research Faculty: Temporary 100% Non-E&G Funded	18	18	15	14	24	27	29	54	45

* Additional proposals pending

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Research Report Card (FY2021 through February)

		2013	2014	2015	2016	2017	2018	2019	2020	2021
RESEARCH PROCESS										through Feb.
f. Sponsored Research Expenditures by Business Unit (in millions)		\$75.4M	\$70.0M	\$73.3M	\$79.5M	\$89.5M	\$94.2M	\$104.5M	\$105.3M	\$64.4M
48	CAAH	\$0.5	\$0.4	\$0.4	\$1.1	\$1.3	\$1.4	\$1.7	\$1.6	\$0.6
49	CAFLS	\$8.8	\$7.7	\$6.8	\$8.6	\$11.1	\$11.0	\$14.1	\$16.4	\$8.6
50	COB	\$1.2	\$1.2	\$1.1	\$1.0	\$0.9	\$0.8	\$0.8	\$0.7	\$0.5
51	CECAS	\$35.0	\$35.0	\$35.0	\$37.5	\$42.9	\$45.1	\$50.3	\$46.4	\$28.8
52	CBSHS	\$3.1	\$2.8	\$3.7	\$4.1	\$4.4	\$4.9	\$5.3	\$6.7	\$5.0
53	COE	\$3.3	\$3.3	\$3.8	\$2.5	\$2.6	\$2.2	\$2.5	\$2.4	\$1.3
54	COS	\$13.2	\$10.5	\$9.3	\$11.3	\$14.8	\$16.7	\$17.2	\$17.3	\$9.3
55	CCIT	\$2.0	\$1.6	\$3.4	\$2.8	\$0.4	\$0.6	\$0.2	\$0.1	\$0.2
56	PSA	\$4.7	\$4.9	\$5.8	\$5.6	\$5.7	\$5.9	\$3.7	\$3.9	\$3.5
57	VP for Res & Interdisc Inst	\$1.9	\$1.3	\$1.9	\$3.5	\$3.9	\$3.9	\$7.1	\$9.5	\$6.2
58	All Other	\$1.7	\$1.7	\$2.2	\$1.5	\$1.5	\$1.6	\$1.5	\$0.4	\$0.3
g. Sponsored Research Expenditures by Innovation Cluster (in millions)		\$75.4M	\$70.0M	\$73.3M	\$79.5M	\$89.5M	\$94.2M	\$104.5M	\$105.3M	\$64.4M
59	Advanced Materials	\$14.3	\$11.3	\$10.7	\$10.4	\$10.7	\$12.1	\$15.4	\$13.5	\$7.3
60	Cyberinfrastructure & Big Data Science	\$10.3	\$10.5	\$10.1	\$8.9	\$8.1	\$9.6	\$6.9	\$4.4	\$3.5
61	Energy, Trans. & Advanced Manufacturing	\$4.7	\$5.7	\$7.2	\$7.6	\$17.8	\$16.8	\$17.1	\$14.5	\$9.9
62	Health Innovation	\$13.1	\$10.2	\$10.2	\$12.5	\$16.3	\$17.8	\$23.8	\$27.1	\$15.9
63	Human Resilience	\$8.2	\$7.7	\$9.7	\$9.8	\$7.8	\$8.6	\$9.0	\$9.7	\$7.2
64	Sustainable Environments	\$18.3	\$16.9	\$17.9	\$21.7	\$18.9	\$19.5	\$20.6	\$23.9	\$12.7
65	Other	\$6.5	\$7.6	\$7.4	\$8.6	\$9.9	\$9.6	\$11.7	\$12.1	\$7.8
h. Sponsored Research Expenditures by Funding Source (in millions)		\$75.4M	\$70.0M	\$73.3M	\$79.5M	\$89.5M	\$94.2M	\$104.5M	\$105.3M	\$64.4M
66	Federal Government	\$62.9	\$56.9	\$58.5	\$65.1	\$74.6	\$78.2	\$85.1	\$85.2	\$52.8
67	Foundations, Societies, and Associations	\$4.2	\$4.3	\$4.7	\$4.1	\$4.7	\$5.1	\$7.4	\$6.9	\$4.0
68	Industry/Other	\$4.9	\$5.6	\$6.1	\$6.9	\$6.8	\$6.3	\$5.3	\$5.5	\$2.6
69	International	\$0.8	\$0.6	\$0.8	\$0.8	\$0.5	\$0.4	\$0.3	\$0.3	\$0.1
70	Local Government	\$0.6	\$0.6	\$0.6	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5
71	State Government	\$1.9	\$1.9	\$2.7	\$2.0	\$2.4	\$3.7	\$5.7	\$6.8	\$4.4

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Research Report Card (FY2021 through February)

		2013	2014	2015	2016	2017	2018	2019	2020	2021
RESEARCH PROCESS cont.										through Feb.
i. Sponsored Research Expenditures per T/TT Faculty by College										
72	CAAH	\$3,299	\$2,264	\$2,343	\$5,841	\$8,177	\$8,945	\$10,159	\$10,003	\$3,850
73	CAFLS	\$88,570	\$81,120	\$69,612	\$84,618	\$105,396	\$103,814	\$134,555	\$137,438	\$75,507
74	COB	\$14,415	\$13,047	\$11,510	\$9,683	\$8,855	\$8,269	\$8,200	\$6,991	\$4,292
75	CECAS	\$169,754	\$160,698	\$163,406	\$163,685	\$194,323	\$214,280	\$225,620	\$201,553	\$118,696
76	CBSHS	\$27,982	\$26,853	\$33,764	\$42,376	\$34,751	\$39,532	\$40,301	\$50,495	\$37,426
77	COE	\$54,779	\$51,688	\$62,195	\$38,037	\$44,483	\$40,197	\$47,371	\$47,742	\$26,503
78	COS	\$95,724	\$72,421	\$61,912	\$77,589	\$95,956	\$110,206	\$118,600	\$116,020	\$62,746
RESEARCH OUTPUTS/ OUTCOMES										
79	NIH R01-Equivalent Awards (by start date)	-	-	2	2	2	3	6	1	1
80	Doctorates Awarded (Aug, Dec, May)	187	217	237	233	231	234	301	249	70
81	STEM Doctorates Awarded (Aug, Dec, May)	118	153	165	138	156	171	174	162	51
82	Disclosures	102	129	70	60	65	51	62	68	30
83	Patents	16	15	15	14	18	11	18	12	18
84	Licenses/Options	9	7	7	5	10	11	19	13	12
85	Licensing Revenue	\$1,134,289	\$762,811	\$360,131	\$354,827	\$539,490	\$461,755	\$398,136	\$315,578	\$203,232
86	Start-up Companies (based on licenses/options)	1	4	4	2	3	3	5	1	-



This section highlights the latest research news and achievements.

Executive Summary

- Clemson University has earned its fourth Center of Biomedical Research Excellence (COBRE) grant from the National Institutes of Health ([see pages 31-32](#)).
- Clemson remains on track to maintain its Carnegie R1 status. The Carnegie Classification is expected to be released in early 2022 ([see page 33](#)).
- Clemson faculty and students have earned significant national and global recognition:
 - » For the first time ever, a Clemson University student has been named a Gates Cambridge Scholar ([see page 35](#)).
 - » A Clemson professor received an international award for creative writing ([see page 39](#)).
 - » A Clemson professor was recognized with a national 40th Anniversary Award for his wetlands research ([see page 40](#)).
 - » Numerous examples are provided on [pages 35-44](#).
- More than 65 Clemson faculty are collaborating on a major U.S. Army project to prototype next-generation military vehicles ([see pages 45-46](#)).
- Clemson recognized its researchers of the year for significant impacts on their fields and society ([see page 47](#)).

COBRE in Human Genetics

 **National Institutes of Health awards \$10.6M to Clemson for Center of Biomedical Research Excellence (COBRE) in Human Genetics.**

Genetic networks define an individual's unique characteristics that – coupled with lifestyle habits and other environmental factors – determine susceptibility to cancers, hypertension, high cholesterol, arthritis, diabetes, Alzheimer's disease and numerous other ailments. The National Institutes of Health (NIH) has tasked Clemson University with unlocking these genetic codes through a new \$10.6 million grant to establish the Center of Biomedical Research Excellence (COBRE) in Human Genetics in collaboration with the Greenwood Genetic Center (GGC).

The award funds an initial five-year phase of a COBRE, which can continue for 15 years, positioning the Clemson-GGC collaboration as a global leader in the scientific advancement of human genetics. The NIH COBRE program provides a long-term investment in the advancement of medical research around a central theme. This is NIH's first COBRE specifically focused on human genetics.

“Imagine having the opportunity to immediately sequence the genome of a baby and being able to quickly identify their susceptibility to disease. We can't change their genes, but we can change their environment, significantly improving preventative care. If we know the susceptibility, we can make non-pharmaceutical interventions to improve many people's quality of life. And of course, knowing the underlying biology can help guide pharmaceutical intervention as well,” said Trudy Mackay, director of the Clemson Center for Human Genetics in Greenwood.

Mackay, the Self Family Endowed Chair of Human Genetics, will lead the COBRE in Human Genetics along with Robert Anholt, provost's distinguished professor of genetics and biochemistry, and Richard Steet, director of research at Greenwood Genetic Center (GGC).

At the heart of the COBRE in Human Genetics is a robust mentoring platform for early-career faculty. Leading scientists at several of the nation's premier laboratories will serve as project mentors, including St. Jude Children's Research Hospital, the National Cancer Institute, Duke University and the Center for Comparative Genomics and Bioinformatics at The Pennsylvania State University.



Clemson's Robert Anholt, left, and Trudy Mackay will lead the new Center for Biomedical Research Excellence in Human Genetics along with Richard Steet of Greenwood Genetic Center.



Self Regional Hall, home to Clemson's Center for Human Genetics, opened in 2018.

Clemson's 4th COBRE

COBREs are awarded in three phases. Each institution is allowed only three COBREs in phases one or two. Once a COBRE reaches phase three, a university can earn another phase one COBRE.

Clemson's first COBRE – the South Carolina Bioengineering Center for Regeneration and Formation of Tissues (SC BioCRAFT), formed in 2009 – has reached its third and final phase, opening the door for Clemson to apply for the COBRE in Human Genetics. SC BioCRAFT has been a great success. It has spawned four startup companies, 25 patent awards and more than 400 articles in peer-reviewed publications. The research theme revolves around regenerative medicine, a fast-growing field that promises to repair and regenerate diseased tissues.

In 2016, a \$10.5 million COBRE grant funded the Clemson Eukaryotic Pathogens Innovation Center (EPIC). Since the award, EPIC investigators have generated more than \$5.9 million in external funding and produced 75 publications. In addition, EPIC secured the first-ever NIH training grant at Clemson.

In 2018, NIH approved an \$11 million COBRE grant to establish the South Carolina Center for Translational Research Improving Musculoskeletal Health, or SC-TRIMH. Led by bioengineers at Clemson, SC-TRIMH combines orthopedics and other clinical expertise from Prisma Health and the Medical University of South Carolina with computer scientists, computational engineers, biophysicists and other experts to understand musculoskeletal disorders better and to design and evaluate new devices, interventions and drug therapies.

The COBRE for Human Genetics is Clemson's fourth COBRE.

A Timeline of COBREs at Clemson

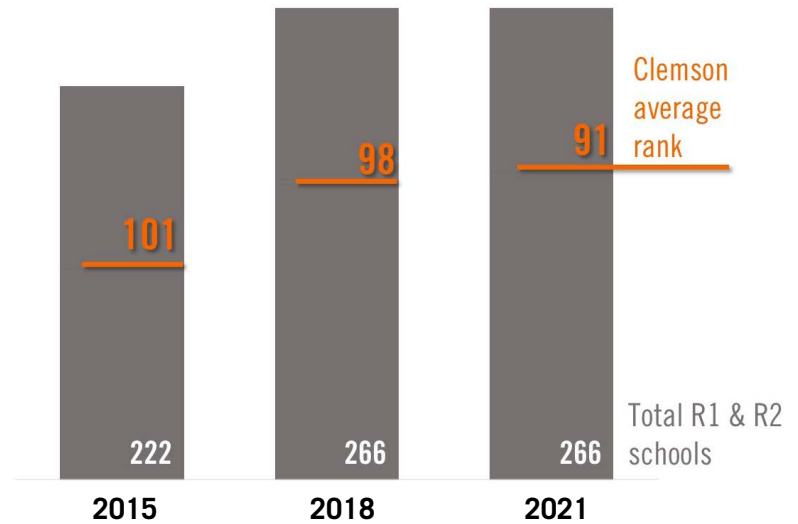
		No. of COBRE	Total Funding
2009	BioCRAFT awarded Phase I \$9.2M	1	\$9.2M
2014	BioCRAFT awarded Phase II \$10.2M		\$19.4M
2016	EPIC awarded Phase I \$10.5M	2	\$29.9M
2018	SC-TRIMH awarded Phase I \$11M	3	\$40.9M
2019	BioCRAFT awarded Phase III \$5.7M		\$46.6M
2021	Human Genetics awarded Phase I \$10.6M	4	\$57.2M

Carnegie R1

→ Carnegie Classification to be released 2022

Carnegie is expected to release its latest classification in early 2022. Given Clemson’s progress in the metrics tracked by Carnegie (see chart below), the R1 designation is likely to be reconfirmed.

Carnegie does not rank schools, but the Division of Research has been analyzing Clemson’s performance in Carnegie metrics to estimate its position among Carnegie institutions. Based on that analysis, Clemson’s average rank among Carnegie peers has improved since 2015 (see chart at right).



TRACKING CARNEGIE METRICS

The table below charts Clemson’s performance from 2018 to 2020 among the 10 metrics Carnegie tracks. Clemson has improved in all but two metrics since 2018, when the last Carnegie Classification was released. That classification included Clemson as in R1 institution. Data for the upcoming classification has been submitted. Carnegie is expected to release its classification in 2022.

Metrics	Clemson 2018	Clemson 2020	Δ Metric 2018-2020
Science & Engineering Expenditures	\$145M	\$165M	↑ \$20M
Non-Science & Engineering Expenditures	\$49M	\$54M	↑ \$5M
Postdoc & Non-Faculty Researchers	111	162	↑ 51
PhD Humanities	8	7	-1
PhD Social Sciences	20	25	↑ 5
PhD STEM	170	156	-14
PhD Other	33	55	↑ 22
Per Capita Science & Engineering Expenditures	\$159K	\$174K	↑ \$15K
Per Capita Non-Science & Engineering Expenditures	\$53K	\$56K	↑ \$3K
Per Capita Postdoc & Non-Faculty Researchers	0.122	0.170	↑ 0.048

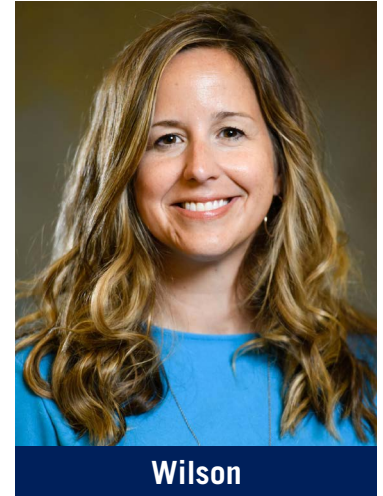
Books in Print

Faculty and students in the College of Architecture, Arts and Humanities create new knowledge through research in many ways: the creative work of artists, designers and performers; scholarship in the humanities; and empirical studies in planning and construction science. The College's research is characterized by original thought and communication of results through peer-reviewed outlets. Here are examples of the latest publications from faculty of the College of Architecture, Arts and Humanities.

Wilson, Lee. *Bonds of Empire: The English Origins of Slave Law in South Carolina and British Plantation America, 1660-1783*

Lee B. Wilson, assistant professor of history and geography, is a historian of colonial British America and the early modern Atlantic world. Her research interests include the legal history of early American slave societies, colonial property law, and legal discourse.

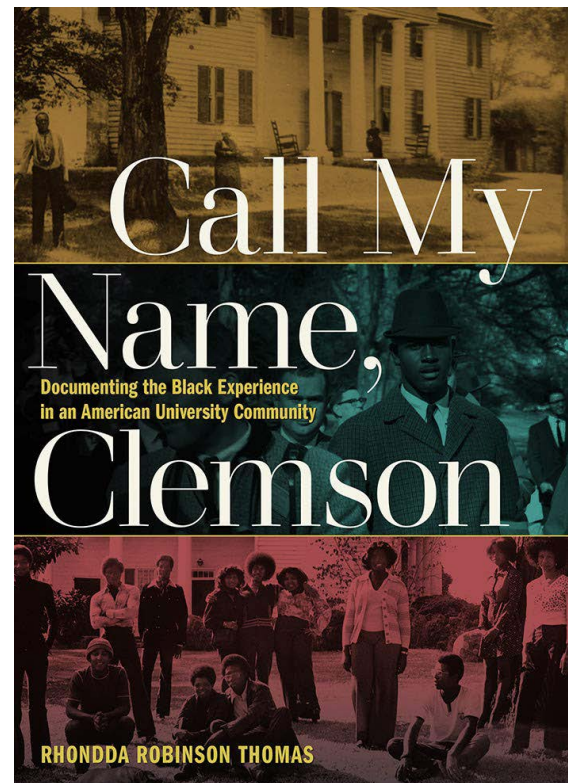
Her latest book manuscript, entitled *Bonds of Empire: The English Origins of Slave Law in South Carolina and British Plantation America, 1669-1783* (forthcoming, Cambridge University Press), examines how colonists adapted English law to commodify enslaved people and how this process ultimately facilitated the dehumanization of people of African descent.



Thomas, Rhondda. *Call My Name, Clemson: Documenting the Black Experience in an American University Community, Humanities and Public Life Series*

The Calhoun Lemon professor of literature, Rhondda Thomas's research and teaching interests are early African American literature and culture, politics of black identity, autobiographical scholarship, African American literature and the Bible, race and culture studies, African American historiography, migration narratives, and African American women writers.

Her latest book, *Call My Name, Clemson: Documenting the Black Experience in an American University Community, Humanities and Public Life Series*, University of Iowa Press, November 2020, examines the inextricable link between the history and legacies of slavery and the development of higher education institutions in America.



Honors & Achievements

➔ **Clemson faculty and students are earning significant recognition and prestigious awards. Recent examples are highlighted in this section.**

For the first time ever, a Clemson University student has been named a Gates Cambridge Scholar, one of only 24 chosen nationwide for the prestigious postgraduate award.

Venkata “Anish” Chaluvadi, an Honors College senior majoring in materials science and engineering, was chosen for his academic accomplishments as well as his leadership and commitment to improve the lives of others.

“We are so proud of his accomplishments,” said Provost Bob Jones. “This marks a milestone in Clemson University’s student success in the international arena.”

Clemson is among six institutions that have for the first time produced a Gates Cambridge Scholar. The others are Bowdoin College, Bucknell University, Temple University, the Universitat Politècnica de Catalunya and the University of Houston.

“His selection reflects his research accomplishments and his passion for materials discovery, which have impressed a worldwide audience of fellowship reviewers,” said Kyle Brinkman, chair of Clemson’s Department of Materials Science and Engineering.

Anish’s interest in developing sustainable material solutions for environmental problems stems from his understanding of the rural South as well as his travels to India, where both his parents were born and raised.

He will pursue graduate study in Nanoscience and Nanotechnology, the study and application of extremely small things (nanometers). Nanotechnology can be used across all the other science fields, such as chemistry, biology, physics, materials science and engineering. Anish will have an emphasis in Computational Modeling.

“To me, being awarded the Gates Cambridge Scholarship gave me the confidence to continue the pursuit of advanced energy solutions,” Anish said.



Chaluvadi

A paper that a Clemson University chemistry student first-authored is on the 2020 Hot articles list featured by the journal Materials Advances.

Charini Maladeniya’s article titled “A role for terpenoid cyclization in the atom economical polymerization of terpenoids with sulfur to yield durable composites” is among 26 papers and review articles selected by the journal’s editors.

Charini Maladeniya’s research involved terpene derivatives, which are readily available from many plants, bacteria and algae sources.

Maladeniya’s research focuses on improving the sustainability of building materials.



Maladeniya

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Honors & Achievements

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“We prepared building materials using sulfur and plant-derived terpenoids as a substitution for cement. The new building materials show significant strength and high acid resistance. More importantly, it is a renewable, recyclable material. These materials can also improve the acid resistance of Portland cement,” said Maladeniya, a graduate student in the College of Science’s Department of Chemistry.

Portland cement is a basic ingredient in concrete.

Chemistry professor Rhett Smith explained that Maladeniya uncovered a previously overlooked mechanism for terpenoid cyclization during radical-involving polymerization routes.

“Her discovery should prove insightful to a range of researchers interested in terpenes as sustainable materials,” said Smith, who is Maladeniya’s mentor.

Maladeniya came to Clemson from Gampaha, Sri Lanka.

A Beckman Scholar in the College of Science is playing an important role in a high-level research project on glutathione, a potent antioxidant that might help prevent diseases such as cancer, Alzheimer’s and Parkinson’s.

The research of one of Clemson University’s Beckman Scholars, Luke Broughton, centers on how to measure and increase its concentration in the human body.

The concentration of glutathione in cells drops with age and many diseases such as Parkinson’s disease, HIV, cataracts, and autism.

“Glutathione depletion correlates with poor disease prognosis,” said Broughton, a junior from Lancaster, South Carolina who is a biochemistry major in the College of Science Department of Genetics and Biochemistry. “Our job is to determine how we can increase the intracellular concentration of antioxidants like glutathione so we can combat these diseases from starting.”

The body’s normal metabolic functions — such as digesting food, exercising, and fighting off viruses and bacteria — produce free radicals. Since electrons like to be in pairs, free radicals seek electrons from other molecules, such as DNA and proteins, thereby damaging the cell. Antioxidants, such as glutathione that is produced by cells and others that might be consumed as part of a healthy diet, neutralize free radicals by giving up one of their electrons and protecting the molecules that are important to protecting the cell from damage.

“I think the research bug has really bitten him. It is something he very much enjoys doing. His work on measuring and understanding glutathione redox balance in my group has opened his eyes to the impact such research can have on entire fields,” said Julia Brumaghim, a bioinorganic chemistry professor and Broughton’s Beckman Scholars mentor. Broughton has worked with Brumaghim’s group



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Honors & Achievements

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and graduate student Nicole Hostetter since the 2019 Fall semester and plans to continue working with the laboratory through his senior year.

The Arnold and Mabel Beckman Foundation selected Clemson as a Beckman Scholars Program institution in 2019. This program provides select undergraduates with a unique 15-month mentored laboratory research experience. Clemson students must have one year of research experience to apply and are expected to continue research through their senior year. The University has awarded five of its six prestigious scholarships. The sixth Beckman Scholar will begin research in 2021.

The National Oceanic and Atmospheric Administration (NOAA) has selected its 2020 Ernest F. Hollings undergraduate scholars, with two rising juniors from Clemson University receiving scholarships. Korianna Hays and Kathleen Wirth are two of the 123 recipients this year. They were selected out of a pool of more than 700.

The Ernest F. Hollings Undergraduate Scholarship was established in 2005 in honor of Senator Ernest F. Hollings, who was well known for supporting ocean policy and conservation. As 2020 Hollings undergraduate scholars, Hays and Wirth will receive academic funding for two years, paid summer internship opportunities with the NOAA and the ability to participate in two national scientific conferences.

Hays, a biological sciences major, has worked with associate professor Michael Childress on two of his Creative Inquiry projects focused on marine conservation. According to Childress, Hays “was a natural for a NOAA Hollings Scholarship due to her strong interest in marine conservation and her commitment to marine science community outreach.” Hays plans to begin marine field work as part of her departmental honors thesis. Her proposed project will likely involve coral transplant in communities of reef fish.

“I have already been able to make connections with other Hollings scholars and NOAA employees and will have the opportunity for future NOAA employment, which has always been a dream of mine,” said Hays. “I am so glad I put myself out there and applied for such a competitive scholarship.”

Wirth, a biochemistry major, has been involved in research projects with funding from the U.S. Air Force, NASA and the National Science Foundation. Her mentor, professor Ya-Ping Sun, describes Wirth as “a highly motivated and hardworking student, passionate about learning, scientific research, and many other extracurricular activities, and always takes her personal responsibility very seriously to excel in all her endeavors.” Sun is confident that Wirth will continue to achieve impressive accomplishments in the future.

“I think the Hollings Scholarship is an incredible opportunity both academically and financially. It is clear the NOAA team cares a great deal about the Hollings scholars’ professional development



Hays



Wirth

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Honors & Achievements

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and care for improving the world in line with NOAA's mission," said Wirth. "The team has been very involved, and I am thrilled to be a Hollings Scholarship recipient, as well as participate in the NOAA internship that is a part of this great opportunity."

Oliver Myers of Clemson University is receiving one of mechanical engineering's highest professional honors.

Myers, associate dean of equity and inclusion in the College of Engineering, Computing and Applied Sciences, has been named Fellow of the American Society of Mechanical Engineers (ASME).

The honor recognizes ASME members with at least 10 years of membership for significant engineering achievements. The nonprofit professional organization has more than 148,000 individual, student and early-career members from more than 140 countries, according to its website.

Oliver Myers serves as associate dean for inclusive excellence and undergraduate studies in Clemson University's College of Engineering, Computing and Applied Sciences.

"It's a privilege to be recognized among such a distinguished group of individuals," Myers said. "I thank all those who have taught and supported me and those who nominated me. With such an achievement comes the responsibility to help others reach their full potential, and that's what I'm here to do."

The Fellow honor is the latest accolade for Myers. In February, he also received the Dr. Eugene Deloatch Legacy Award at the BEYA STEM Global Competitiveness Conference.



Myers



de la Garza

Jesus M. de la Garza of Clemson University is winning a 2021 Outstanding Projects And Leaders (OPAL) Award from the American Society of Civil Engineers (ASCE).

de la Garza serves as the chair of the Glenn Department of Civil Engineering, where he leads 28 faculty members and oversees the education of 500 undergraduate and graduate students.

The ASCE award is in the construction category and recognizes him for "innovation and excellence in construction of civil engineering projects and programs" over a career spanning more than three decades.

de la Garza said it's his highest honor.

"I believe that the best years of my life are in front of me," he said. "I intend to earn this amazing and humbling distinction every single day. Furthermore, one does not get to this stage alone. I believe that this distinction belongs to the village of all my mentors, colleagues, students, and family who have scaffolded me."

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Honors & Achievements

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Weise

Clemson University professor of creative writing Jillian Weise has been awarded the PEN Oakland Josephine Miles Award for her collection of poems, *Cyborg Detective*.

The award is given under the American center of PEN International, a worldwide association of writers founded in London in 1921. PEN America is the largest of more than 100 centers worldwide with more than 7,200 members.

The Josephine Miles Award is given to American multicultural writers to “promote works of excellence by writers of all cultural and racial backgrounds and to educate both the public and the media as to the nature of multicultural work.”

Weise’s prolific, honest, and often deeply personal writing made her a nationally renowned voice for disability rights. Being a disabled person herself, she says receiving this award is profoundly meaningful to her for many reasons.

“For one thing, the award is for multicultural work and therefore recognizes disability as a culture,” she said. “For another, the award is named after Josephine Miles – or ‘Jo Miles’ to her friends – and she’s an icon to me. Growing up disabled, she encountered many obstacles. In high school, she wanted to take poetry classes, but all the classes were held on the third floor. And no elevator. So instead, she took math and science on the first floor. She wrote a poem called ‘To Dr. Edwards, On Getting to the Third Floor.’ This resonates because I was recently invited to hold a prestigious position as visiting writer for one year at a small liberal arts college in the northeast. Clemson supported this opportunity for me. But I was surprised to find out the Department of English was on the third floor. No elevator.

Weise says she was told she could teach in the school’s library, but knew she had to decline the position, even though she wanted it.

“It’s been 75 years since Jo Miles wrote that poem, and I will not accept the same conditions she had to accept,” said Weise.

That same determined spirit runs through the poems of *Cyborg Detective*, Weise’s third collection of poems.

In his glowing review of the book, Craig Morgan Teicher of NPR Poetry Review said, “With a voice that is sassy, funny, and justifiably bitter, Weise sets ableist America — and America’s literary subcultures — straight about a number of things in her third collection, in which every line snaps and many of them sting.”

Weise has been awarded residencies or fellowships from the Fine Arts Work Center, the Fulbright Program and the Lannan Foundation. She has edited at *The Paris Review* and *The Iowa Review*. Her work has appeared in *The Atlantic*, *The New York Times*, *Narrative Inquiry in Bioethics*, *Granta*, the *Huffington Post*, *Tin House* and elsewhere.

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Honors & Achievements

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Conner

Clemson University Professor William Conner was recently honored with a special Society of Wetland Scientists 40th Anniversary Award for his high level and sustained contributions to wetland research, practice, education, communication and support to the Society.

Conner is based at Clemson's Baruch Institute of Coastal Ecology and Forest Science (BICEFS) in Georgetown, S.C.

"A selection committee read all of the applications, and I must say it was inspiring to see the breadth and depth of the contributions that Dr. Conner has made over the years. We are in his debt for the commitment he has shown to furthering the vitality, growth and well-being of the Society," said SWS

awards committee chair Siobhan Fennessy, professor of biology at Kenyon College.

After earning his Ph.D. in Forestry from Louisiana State University in 1988, Conner arrived at BICEFS, located on the 16,000-acre Hobcaw Barony where scientists have studied the coastal environment for over 50 years, two years later just after Hurricane Hugo struck the South Carolina coast. [READ MORE](#)

One of electrical engineering's highest honors is going to Ganesh Kumar Venayagamoorthy, the Duke Energy Distinguished Professor of Power Engineering and Professor of Electrical and Computer Engineering at Clemson University.

Venayagamoorthy was elevated to Fellow of the Institute of Electrical and Electronics Engineers (IEEE), a professional society with 419,000 members and 7,614 Fellows. IEEE is recognizing him for contributions to the application of artificial intelligence to power systems.

"It's an honor to be recognized among my peers and to be included in this group of distinguished individuals," Venayagamoorthy said. "I offer my most sincere thanks to my nominator and all those who have supported me."

Fellow is Venayagamoorthy's latest honor from IEEE. He has received Young Engineer awards from the IEEE Power & Energy Society, the IEEE Industry Applications Society and IEEE Saint Louis Section.

He also received the IEEE Region 5 and IEEE Saint Louis Section Outstanding Member Awards and more than 10 best paper awards, including at IEEE's International Joint Conference on Neural Networks in 1999 and 2001. [READ MORE](#)



Venayagamoorthy

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Honors & Achievements

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The National Endowment for the Humanities has awarded a \$400,000 grant to Clemson University English professors Rhondda Robinson Thomas and Lee Morrissey to support a touring exhibition of Thomas' research, "Call My Name: The Black Experience in the South Carolina Upstate from Enslavement to Desegregation."

The exhibition, which is being developed by Thomas and several academic and community partners, will trace African American history in the greater Clemson area from the antebellum era to the 21st century.

"This National Endowment for the Humanities grant is an affirmation of all the hard work that has been put into this project, not just for me but for all of our community partners," said Thomas, the Calhoun Lemon Professor of Literature.

"This is the culmination of a 13-year journey, and I'm humbled and excited to be able to share Clemson's story with a much broader audience," she said.

Morrissey, the assistant project director and co-principal investigator for the NEH grant, has been a longtime supporter of Thomas' research, as a past chair of the English department and as founding director of the Humanities Hub at Clemson.

Together, the two professors have reached out to neighboring African American communities and fostered relationships with civic leaders and cultural institutions.



Thomas



Morrissey

"This story has always been here to tell," Morrissey said. "This exhibition is about making these stories visible, these lives visible."

The interactive exhibition is an extension of Thomas' "Call My Name: African Americans in Early Clemson University History" initiative, which has digitized more than 2,000 primary documents related to Clemson history, including slave inventories, prisoner records, labor contracts, photographs and correspondence.

Before touring to museums and other institutions in several states, the exhibition will be presented first on the Clemson campus. Plans call for the project to be completed by February of 2022, although COVID-19 could postpone its opening.

Several museums in South Carolina, North Carolina, Georgia and Virginia have expressed interest in hosting "Call My Name."

[READ MORE](#)

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Honors & Achievements

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Pilcher

June J. Pilcher, Alumni Distinguished Professor of psychology at Clemson University, was recently elected to serve on the board of directors for The Honor Society of Phi Kappa Phi—the nation’s oldest and most selective collegiate honor society for all academic disciplines.

In this role, Pilcher will represent the membership of Phi Kappa Phi while also working to support the mission and goals of the society. She will serve a two-year term during the 2020-2022 biennium.

According to Pilcher, Phi Kappa Phi is active in representing and assisting all members and students; assisting with the board will provide opportunities she wouldn’t ordinarily have. She said she looks forward to working with the other board members and the Phi Kappa Phi leadership team to help it continue to move forward as an honor society but also as part of society as a whole.

“We are in challenging times for higher education not only due to the ongoing pandemic and resultant economic fallout but also due to concerns of systemic racism,” Pilcher said. “It is important to me to be in a position where I can help our society better value higher education and lifelong learning. I also hope I can successfully represent Clemson University as part of this prominent national honor society.”

Pilcher has been an active leader of Phi Kappa Phi at the local and national levels. She has served as the chapter president and past president at Clemson University. Pilcher was also a member of the national fellowship committee and most recently served as the chair of the Phi Kappa Phi Scholar/Artist/Sylvester Distinguished Service award committee.

The College of Behavioral, Social and Health Sciences (CBSHS) is celebrating faculty research through recognition of selected outstanding journal publications. College leaders will recognize each faculty member with a plaque displayed outside of the dean’s office in Edwards Hall.

“Our college has a robust research focus to help achieve the mission of building people and communities,” said Rachel Mayo, associate dean of research and graduate studies. “It’s important for us to recognize faculty for their outstanding work that has influenced their field of study on a national and international level.”

The outstanding journal publications selected for 2020 are as follows:

- “School green space and its impact on academic performance: A systematic literature review,” by co-author Matthew Browning, an assistant professor in the Department of Parks, Recreation and Tourism Management, published in the International Journal of Environmental Research and Public Health.
- “Innovative use of service-learning to enhance baccalaureate nursing education,” by co-author Tracy Fasolino, an associate professor in the School of Nursing, published in the Journal of Nursing Education.
- “Associations of adverse childhood experiences and suicidal behaviors in adulthood in a U.S. nationally representative sample,” by co-authors Kip Kingree, a professor in the Department

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Honors & Achievements

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of Public Health Sciences, and Marti Thompson, a professor in the Department of Psychology, published in the *Child: Care, Health and Development* journal.

- “A developmental approach to cyberbullying: Prevalence and protective factors,” by co-authors Susan Limber, a professor of psychology, and Robin Kowalski, Centennial Professor of Psychology, published in the *Aggression and Violent Behavior* journal.
- “Troll factories: The internet research agency and state-sponsored agenda building,” by co-author Darren Linvill, a professor in the Department of Communication, published in *Resource Centre on Media Freedom in Europe* journal.
- “The effects of bystander programs on the prevention of sexual assault across the college years: A systematic review and meta-analysis,” by co-author Heather Kettrey, an assistant professor in the Department of Sociology, Anthropology and Criminal Justice, published in the *Journal of Youth and Adolescence*.
- “Beyond the balance sheet: performance, participation, and regime support in Latin America,” by Matthew Rhodes-Purdy, an assistant professor in the Department of Political Science, published in the *Comparative Politics* journal.

Clemson researchers' breakthrough in solar cell materials has been featured in *Nature Communications*.

By using laser spectroscopy in a photophysics experiment, Clemson University researchers have broken new ground that could result in faster and cheaper energy to power electronics.

This novel approach, using solution-processed perovskite, is intended to revolutionize a variety of everyday objects such as solar cells, LEDs, photodetectors for smart phones and computer chips. Solution-processed perovskite are the next generation materials for solar cell panels on rooftops, X-ray detectors for medical diagnosis, and LEDs for daily-life lighting.

“Perovskite materials are designed for optical applications such as solar cells and LEDs,” said Kanishka Kobbekaduwa, graduate student and first author of the research article. “It is important because it is much easier to synthesize compared to current silicon-based solar cells. This can be done by solution processing – whereas in silicon, you have to have different methods that are more expensive and time-consuming.”



From left, Pan Adhikari, Lawrence Coleman and Kanishka Kobbekaduwa align the ultrafast laser in the Department of Physics and Astronomy's UPQD lab.

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Honors & Achievements

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The goal of the research is to make materials that are more efficient, cheaper and easier to produce.

The research team included a pair of graduate students and one undergraduate student who are mentored by Jianbo Gao, group leader of Ultrafast Photophysics of Quantum Devices (UPQD) group in the College of Science's Department of Physics and Astronomy. The collaborative research was published March 12 in the high-impact journal Nature Communications. The article is titled "In-situ Observation of Trapped Carriers in Organic Metal Halide Perovskite Films with Ultra-fast Temporal and Ultra-high Energetic Resolutions." [READ MORE](#)



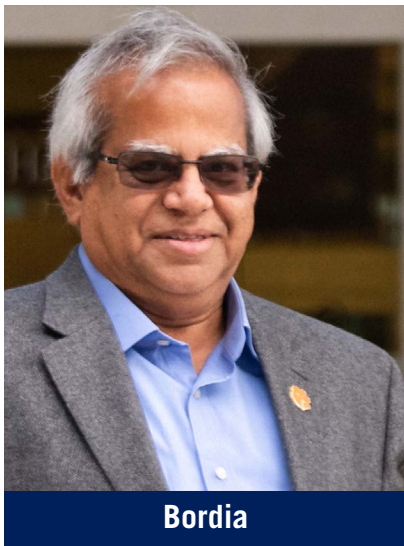
Gao

Rajendra Bordia has won a Distinguished Services Award from the Alumni Association of the Indian Institute of Technology Kanpur, where in 1979 he received his Bachelor of Technology in mechanical engineering.

Bordia now serves as the George J. Bishop, III Endowed Chair in Ceramic and Materials Engineering at Clemson and as scientific director of MADE In SC, a statewide program focused on growing research, education and workforce in advanced materials.

From 2013-19, he served as chair of Clemson's Department of Materials Science and Engineering.

The Distinguished Services Award "recognizes the hard work and dedication of alumni in doing exemplary service by becoming the goodwill ambassadors in various fields and augmenting and supporting the institute's effort in various ways," according to the association.



Bordia

Bordia said it is an honor to be recognized by his alma mater.

"IITK will always hold a special place in my heart," Bordia said. "This is where I laid the foundation for a career that took me to industry and academia and allowed me to expand knowledge and help prepare the next generation of engineering and science talent. I also made life-long friends who have always been there for me. I thank my teachers and mentors at IITK and colleagues and alumni of IITK who supported my nomination for this special award."

For the award, Bordia's most significant contribution was founding in 2008 the Kanpur IIT Research and Academic Alumni Network (KIRAAN). The network now has more than 100 members.

"The goal and activities of this network have been to more deeply engage the large number of IITK alumni, who are in research and academic positions around the world, in the research and academic activities of IITK," according to the Alumni Association. "The focal areas of this network are supporting the recruitment of faculty members at IITK, providing mentoring and research opportunities to IITK faculty and students, and engagement of the KIRAAN members in research and teaching at IITK."

Bordia has also mentored the institute's students and faculty, participated in joint research projects and served as a member of IITK Foundation Board. [READ MORE](#)

VIPR-GS: Virtual Prototyping of Ground Systems



Automotive autonomy technology is changing economies and global industries – and is also a driving force behind military modernization. Bringing these self-driving vehicles to life on- and off-road requires new concepts and algorithms to be tested expeditiously and cost-effectively – all of which happen through virtual prototyping. This key enabler for autonomy is the focus behind a new \$18 million center housed at the Clemson University International Center for Automotive Research (CU-ICAR) and a research partnership with the U.S. Army Ground Vehicle Systems Center (GVSC).

The Virtual Prototyping of Ground Systems (VIPR-GS) Center will serve as the impetus for the research project. As founding director of VIPR-GS, Zoran Filipi will lead more than 65 Clemson faculty across seven engineering departments on the multi-year research partnership with GVSC to develop virtual prototyping tools supporting the rapid transformation of U.S. Army fleets. The research will be focused on autonomy-enabled ground vehicles, including digital engineering, next-generation propulsion and energy systems, and manned and unmanned teaming in unknown off-road environments.

The Center will leverage a systems engineering approach to propel research breakthroughs in off-road vehicle autonomy and vehicle propulsion. Research activities will also take place on Clemson's main campus and will include learning opportunities for students at all levels.

Researchers will build and validate various virtual models and simulations for off-road vehicles with advanced electrified propulsion, situational intelligence, AI-enabled autonomy and team-routing algorithms. The Center will support one of the Army Big Six Modernization Priorities – developing next-generation combat vehicles – by providing tools for technology roadmaps and hardware demonstrations.

Three themes characterize the research efforts: Off-road autonomy for multi-scale vehicle fleets;

“ We have become a player internationally. We have a reputation and critical mass in key areas. VIPR-GS will help us realize the potential and reach new heights.

- **Zoran Filipi**
founding director, VIPR-GS



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VPR letter

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propulsion systems and smart energy; and virtual prototyping and digital engineering for autonomy-enabled off-road vehicles. Models, algorithms, analytical capabilities and decision-making tools resulting from the research will be evaluated by building a physical mock-up of an optionally manned, non-combat, off-road ground vehicle. As the project's final phase, discoveries and breakthrough innovations from the Center will be fabricated and validated via Deep Orange, the University's long-running educational prototyping program.

The Deep Orange program takes automotive engineering students through a two-year product development process that culminates in a fully functional concept. Deep Orange has been sponsored by industry leaders such as AVX, BMW, ExxonMobil, EY, Ford, GM, Honda R&D Americas, Mazda, MINI and Toyota.

VIPR leadership will involve industry to amplify breakthrough innovation and translation. By aligning strategic partners with Clemson's research strengths in artificial intelligence, simulation and advanced computing, the Center will fuel the next wave of mobility to be smarter, safer and more robust.

65**faculty members
participating****7****engineering
departments
involved****\$18M****in funding from
U.S. Department
of Defense**

Meet the Director: Zoran Filipi

In today's new reality of smarter, more connected vehicles, there is no better place to witness rapid transformative innovation than in the mobility sector. With global expertise in autonomy, prototyping and propulsion, Clemson's automotive engineering department is driving this innovation with Zoran Filipi at the helm.

Located at the Clemson University International Center for Automotive Research (CU-ICAR), Filipi oversees the department's 200 graduate students, 17 full-time faculty members and \$4M annual research expenditures. The research enterprise is on the path to double over the next several years. As the Timken Endowed Chair in Vehicle System Design, Filipi's research focuses on alternative and hybrid powertrain systems, advanced internal combustion engine concepts and energy for transportation.

Filipi is the founding director of the Virtual Prototyping of Ground Systems (VIPR-GS) Center, which he said is a result of CU-ICAR's 12 years of strategic growth and global recognition.

Filipi previously served as director of the Center for Engineering Excellence through Hybrid Technology at the University of Michigan, as well as the deputy director of the Automotive Research Center, a U.S. Army Center of Excellence for modeling and simulation of ground vehicles.

"Part of what makes me very confident is the culture of collaboration we have already established," he said. "Now with our VIPR-GS center we are going to spread our wings and truly take it to the next level. In addition, we can leverage CU-ICAR's proven model for building research partnerships and involving industry to accelerate breakthrough innovation. Our existing partners include major OEMs, suppliers and emerging players in the mobility industry. Discussions are already underway for new opportunities in software and automation. Rapid translation from fundamental research to viable technology will make new capabilities available to the army and our partners sooner."

**Filipi**

Researchers of the Year

Each year, Clemson recognizes two Researchers of the Year: a junior faculty member who earned their degree within the past 10 years and a senior faculty member. Finalists are nominated by their colleges and winners are chosen by an interdisciplinary committee. In the fall, Clemson named Hai Xiao, the Samuel Lewis Bell distinguished professor of electrical and computer engineering, senior faculty researcher of the year, and Vincent Richards, associate professor of biological sciences, was named junior faculty Researcher of the Year. Xiao and Richards are scheduled to discuss their research at the upcoming Research and Economic Development Committee meeting. The 2021 Researchers of the Year will be announced at the Research Symposium on May 4. The event will be held virtually and in person. [Details are online.](#)



Vincent Richards

Assistant Professor, Biological Sciences
College of Science



Vincent Richards is working to develop novel therapeutics and strategies to treat and prevent tooth decay. His recent work examines the diverse microbial communities in the mouth that affect human health. Richards has received more than \$4.8 million in funding from the National Institutes of Health and has published 39 papers, including seven in the past two years. Additionally, he is mentoring two PhD students, a master's student and two undergraduates.

Hai Xiao

Professor, Electrical & Computer Engineering
College of Engineering, Computing & Applied Sciences



Hai Xiao is supporting the development of new devices and materials with applications in energy generation, biomedical imaging, national security, and more. Xiao has organized and led several large multidisciplinary research projects at Clemson and currently serves as the principal investigator of seven projects with nearly \$8.5 million in external funding. He has published 88 peer-reviewed articles, earned 6 patents and graduated 10 PhD students since 2013. Xiao is currently mentoring eight PhD students and two master's students.

FOCUS ON FACULTY



This section highlights the achievements of faculty members.

Executive Summary

- Faculty members are highlighted from each college. Entries were submitted by the colleges.
 - » [College of Agriculture, Forestry and Life Sciences](#)
 - » [College of Architecture, Art and Humanities](#)
 - » [College of Behavioral, Social and Health Sciences](#)
 - » [College of Business](#)
 - » [College of Education](#)
 - » [College of Engineering, Computing and Applied Sciences](#)
 - » [College of Science](#)



Jessica Ann Hartshorn, PhD

Assistant Professor

Forestry and Environmental Conservation



Hartshorn is an ecologist whose research interests include the management of forest insects and diseases. She also studies pollinator health and effects of invasive plants on the environment. Prior to her appointment at Clemson University, Hartshorn worked for the Minnesota Department of Natural Resources as a forest health specialist, bringing government perspective to her current position.

Hartshorn teaches four undergraduate and graduate courses regarding forest health, forest protection, and invasion ecology. In addition to her teaching responsibilities at Clemson University, Hartshorn holds an adjunct position at the University of Florida and participates in the Women Owning Woodlands CU Extension program. She is developing an interdisciplinary certificate program in Invasive Species Management, created an online and in-person course in Invasion Ecology, revised a Forest Protection course, and designed and implemented a new online master's degree course "Issues in Forest Health and Management."

Selected Accomplishments

Professional Service:

- Working Party Deputy, International Union of Forest Research Organizations (1/20 – present)
- Committee Chair, North American Forest Insect Work Conference (4/18 – 6/21)
- President, South Carolina Entomological Society (10/19 – 10/20)

Presentations:

- "Ips implications: effects of drought on bark beetle in response to prescribed fire," Southern Appalachian Forest Entomology and Pathology Seminar (2020)
- "Forest health research in a changing climate," The Jones Center, Newton, GA (2019)

Sponsored Research:

- USDA Forest Service, "Distribution and spread of the invasive Callery pear into forests of the Eastern United States" (5/26/20 – 5/25/21)
- USDA Forest Service, "Biology of the Redbay Beetle in Sassafras at the Leading Edge of Laurel Wilt" (5/15/19 – 5/14/22)
- USDA Forest Service, "Response of Ips Bark Beetles to Prescribed Fire" (10/7/19 – 10/6/22)
- Belle W. Baruch Foundation, "Ips Populations Following the Use of Prescribed Fire to Manage Pine Stands Following Hurricane Damage" (two annual awards, 7/10/19 – 8/1/21)



Sruthi Narayanan, PhD

Assistant Professor

Plant and Environmental Sciences



Narayanan is an agronomist specializing in crop physiology. She joined Clemson University in 2015. Growing up in an agricultural family, Narayanan brings passion and experience that informs her motivation to study climate change and food security. Her vision is to develop the future generation of scientists and undertake cutting edge multi-disciplinary research to ensure a more sustainable, food secure future.

To achieve this vision, Narayanan combines instruction (undergraduate and graduate courses), research, training, and mentorship. She teaches several graduate and undergraduate courses, trains undergraduates with internships in her laboratory, and advises and mentors both master's and PhD students. Her two broad research themes are crop response and adaptation to climate change and improving field crop production through sustainable agronomic practices. Dr. Narayanan's research program focuses on understanding how different crops develop responses to abiotic stress, such as drought or excessive heat, at various levels – field, plant, cellular, and molecular. Her nationally recognized research program finds its roots in stakeholder needs as she spearheads the mandate of the Land Grant system's mission.

Selected Accomplishments

Instruction:

- Provost's Junior Teacher Award in 2021 and CAFLS Teaching Award for Excellence (<6 years' experience) in 2021
- Developed 6 courses at Clemson University and mentored 6 graduate students as major advisor (3 graduated) and 9 as a research committee member (3 graduated).

Sponsored Research:

- Pursued over \$2.2M in research funding
- Sponsored research includes two USDA NIFA grants, an NSF grant, and multiple research grants from the national and state commodity boards (peanut, soybean, cotton, and tobacco)
- Nominated for the Crop Science Society of America Early Career Award, 2021 (pending)

Publications:

- 17 peer-reviewed papers in high quality journals and two book chapters and 520 citations

Professional Service:

- Journal Associate Editor of Crop Science and The Crop Journal, Guest Editor of Agronomy, and Journal Review Editor of Frontiers in Plant Abiotic Stress



Alexis D. Stamatikos, PhD

Assistant Professor

Food, Nutrition and Packaging Sciences



Stamatikos, with a PhD in Nutritional Sciences, joined Clemson University in January 2019 after completing a postdoctoral fellowship appointment at the University of Washington, where he received training in vascular biology and gene therapy within the Department of Medicine, Division of Cardiology. His research involves atherosclerosis, including identifying aberrations in gene expression within vascular wall cells, and using cutting-edge techniques to correct these issues.

With these research interests, Stamatikos spans disciplines at Clemson University. He became a Faculty Scholar with the Clemson University School of Health Research initiative. He has received several internal grants at Clemson, is a panel reviewer for USDA and AHA grants, and an ad hoc reviewer for numerous journals. In addition, his dedication to mentoring undergraduate researchers resulted in two of his mentees being awarded funding from the first annual CAFLS Undergraduate Research Initiative.

Selected Accomplishments

- Selected by a university panel as the nominee for the prestigious Foundation for Food and Agricultural Research “New Innovator” award (2021)
- Received funding from the competitive Oak Ridge Associated Universities Event Sponsorship Program (2021)

Sponsored Research:

- American Heart Association, “Atheroprotection from ABC-transporter Expression in Vascular Smooth Cell Muscles” (January 2020 – December 2021)
- Prisma Health, “Changes in Exosomal Urinary MicroRNA Expression in Obese Children as an Early Biomarker for Chronic Kidney Disease” (April 2020 – March 2021)

Publications and Presentations:

- 13 PubMed articles (five as first author) and numerous poster and oral presentations

Professional Memberships:

- Academy of Nutrition and Dietetics (2010 – present)
- American Heart Association/American Stroke Association (2013 – present)
- American Society for Biochemistry and Molecular Biology (2014 – present)
- American Physiological Society Cardiovascular Section Transition Committee Member, 2020-Present



Joshua Catalano, PhD

Professor

History and Geography



Catalano is a historian of the United States and a practitioner of both digital and public history. Before coming to Clemson, he worked as a research assistant at the Roy Rosenzweig Center for History and New Media where he served as managing editor of Digital Humanities Now.

Catalano's research focuses on the role of symbolism and language in the process of settler colonialism. His current manuscript project analyzes the production, dissemination, and continual reinterpretation of the memory of the Gnadenhutten Massacre and the burning of Colonel William Crawford. His research projects provide new perspectives on the applicability of digital and computational methodologies for conducting historical research.

Selected Accomplishments

- Published article in *Ohio History* 126, no. 1 (2019), "Blue Jacket, Anthony Wayne, and the Psychological and Symbolic War for Ohio, 1790-1795."
- Published in *Current Research in Digital History* 1 (2018), "Digitally Analyzing the Uneven Ground: Language Borrowing Among Indian Treaties."
- Published in *Ohio History* 123, no. 1 (2016), "President William T. Jerome III: Why Bowling Green State University Remained Open after the Kent State Shootings."
- Recent digital work, "Digitally Analyzing the Uneven Ground: Language Borrowing Among Indian Treaties," *Current Research in Digital History* 1 (2018).
- "Mining the Eleanor Roosevelt My Day Columns," co-authored with Amanda Regan, 2017.
- Published software in "The 1960s and Youth Culture," BGSU University Libraries Digital Archive, 2014, (co-creator).



Clare Mullaney, PhD

Assistant Professor
English



Mullaney came to Clemson from Bryn Mawr and Hamilton Colleges. Her area of expertise includes disability studies, 19th and 20th Century U.S. literature, material text studies, and reading methods. Her research and teaching work at the intersection between 19th and 20th Century U.S. literature, disability studies, and material text studies. Her book project, *American Imprints: Disability and the Material Text*, brings into focus how turn-of-the-century authors grapple with physical and mental impairments in texts. Her work has received awards from the American Antiquarian Society, the Emily Dickinson International Society, the Library Company of Philadelphia, the New York Public Library, and the Society for Disability Studies. Currently, she is a junior member of the Andrew W. Mellon Society of Fellows in Critical Bibliography.

Selected Accomplishments

- Published article, “Not to Discover Weakness is the Artifice of Strength’: Emily Dickinson, Constraint, and a Disability Poetics.” *J19: The Journal of Nineteenth-Century Americanists*. 7.1 (2019): 49-81.
- Published chapter, “Emily Dickinson, Disability, and Crip Editorial Theory,” *The New Emily Dickinson Studies*, ed. Michelle Kohler, Cambridge University Press. May 2019, pp. 280-298.
- In the news: “The Social Advantage of Pockets.” *Object Lessons Series*, *The Atlantic*. December 21, 2016.



Vivek Sharma, PhD

Assistant Professor

Construction Science and Management



Sharma holds a Ph.D. in Civil Engineering (Construction Engineering and Project Management) from The University of Texas at Austin, a Master's in Science at Arizona State University (Del. E. Webb School of Construction), and a bachelor's degree in Architecture from NIT Raipur, India. Sharma is an assistant professor at Clemson University and an accounts manager for National Health Care Facility Benchmarking Program. Vivek Sharma is focused on benchmarking and project analytics-based healthcare research that advances capital project performance assessment. He is also interested in conducting healthcare research in a more holistic way to explore the impact of early programmatic and design decisions on facilities and patient outcomes.

Selected Accomplishments

- Helped develop and implement an external Healthcare Benchmarking Program for the healthcare construction industry and Construction Industry Institute (CII) funded by the U.S. Department of Veteran Affairs (VA) and the U.S. Department of Defense (DoD) / Military Health System (MHS).
- Is the account manager at Clemson University for a project funded by CII that includes working with healthcare industry partners such as Kaiser Permanente, HCA, Adventist, AECOM, to build a robust healthcare database.
- He chairs Deployment (Healthcare Benchmarking and Professional Development) sub-committee under the Facilities and Healthcare Sector Committee for the Construction Industry Institute (CII) at the University of Texas, Austin.



Kaileigh Byrne, PhD

Assistant Professor
Psychology



Byrne is a cognitive psychologist who studies individual differences in decision-making, reward motivation, and habit-forming behavior. She applies this research to contexts that involve optimizing decision-making across the lifespan and understanding cognitive correlates of mental health conditions.

Current ongoing research involves characterizing peer recovery coaching interventions for substance use disorder, examining how stress and performance pressure influence decision-making, and identifying how social technology use may affect cognitive functioning in older adults.

Byrne teaches courses in cognitive psychology, advanced experimental psychology, and judgment and decision-making. Through three Creative Inquiry programs, Byrne has also mentored 28 undergraduate students and three graduate students over the past two years.

Selected Accomplishments

- Director of the Clemson Cognition and Decision Science Lab and Co-Director of the Addiction Research Center Neuro Lab at Greenville Memorial Hospital
- Published 9 peer-reviewed journal articles between 2019-2020
- Presented scientific research at 4 international conferences, 6 local conferences between 2019-2020, and a webinar for the American Hospital Association
- Recipient of the Mather Lifeways Institute on Aging Silver Innovative Research on Aging Award
- Currently funded by the Health Sciences Center at Prisma Health Transformative Seed Grant and Carolina Center for Alzheimer's Disease and Minority Research Grant



Ryan Gagnon, PhD

Assistant Professor

Parks, Recreation and Tourism Management



Gagnon teaches undergraduate courses in recreation program administration, program design and evaluation, and graduate courses in both applied and advanced statistical analyses. His research focuses on the factors that inhibit or promote out-of-school-time program success; methodological innovation in sport, recreation, and youth program assessment; the development of evaluation capacity in programs that serve marginalized and/or underrepresented youth; and youth thriving.

In these areas, Gagnon has published 36 articles in peer-reviewed journals and produced several technical reports, book chapters, and conference papers. He focuses on the implementation of innovative statistical and methodological approaches (e.g., planned missing data designs, confirmatory factor analyses, structural equation modelling, geospatial data analyses) to tell the often complex story of the programs and people served by out-of-school-time programs.

While Gagnon has a heavy focus on the use of modern statistical techniques, his parallel focus is on the translation of findings to ensure they are useful to practitioners and the communities they serve. Prior to joining the faculty at Clemson, he worked in outdoor education programs at Washington State University serving youth and young adults, and with the U.S. Air Force Youth and Teen programs division.

Selected Accomplishments

- Published 16 peer-reviewed journal articles between 2019-2021
- Serving on the National 4-H Council Advancing the Youth Thriving Model Research Program as Lead Methodologist Fall 2019
- Received the 2020 Academy of Leisure Sciences New Researcher Award
- Joined the REYSE (Race, Ethnicity, Youth and Social Equity) Collaboratory as the Assistant Director of Research and Evaluation Fall 2020
- Selected to participate in Trailblazers, the Provost's Mentoring Initiative for Faculty (2020-2021 cohort)



James Gilmore, PhD

Assistant Professor
Communication



Gilmore is a critical scholar of media and technology studies who studies the mutually enforcing relationships between technology and culture. More specifically, his research examines how institutions, companies, and political entities implement computational technology and technical infrastructures to produce knowledge about the people under their care. He analyzes the consequences concerning how different communication and media technologies — in particular, digital platforms and wearable technologies — are imagined and implemented. As a researcher, he is concerned with the ways we are asked to bring communication and media technologies into our daily lives — into our habits and our routines — and how such technologies may be part of larger reconfigurations of the operations of daily life.

Gilmore teaches courses in the Communication B.A. and the Communication, Technology, and Society M.A., where he also advises graduate student research in the area of media and technology studies. His courses include Media Representations of Science and Technology, Critical-Cultural Communication Theory, and Survey of Communication Technology Studies. He also directs a Creative Inquiry course called the Collaborative on Communication and Culture, where undergraduate researchers work with him to develop, execute, and write research publications on issues in media, technology, and culture.

Selected Accomplishments

- Published 8 journal articles in reputable academic outlets with national and international readerships
- Co-edited a special double issue on research into infrastructural politics
- Founded a research collaborative on communication and culture through the university's Creative Inquiry program
- Contributed to the *SAGE International Encyclopedia of Mass Media and Society*
- Presented 6 competitively selected research papers at national conferences
- Invited to participate in 10 panels covering a variety of areas of expertise at multiple universities and conferences
- Invited to give 2 research talks and 8 classroom lectures on areas of expertise at multiple universities



Andrew Hanssen, PhD

Associate Professor
Economics



Andrew Hanssen is a professor in the John E. Walker Department of Economics at Clemson University. Hanssen joined the department in 2010. Prior to joining Clemson, Hanssen served on the faculty of Colby College and Montana State University. Hanssen's research interests include the economics of institutions, law and economics, political economy, the economics of sports, and industrial organization. Hanssen has published articles in a number of top economics journals, including the *American Economic Review*; the *Journal of Law and Economics*; the *Journal of Law, Economics, and Organization*; and the *Journal of Legal Studies*. Hanssen received his Ph.D. (1995) in economics from the University of Chicago, where he also received an MBA. Hanssen received bachelor's and master's degrees from Johns Hopkins University. Prior to receiving his Ph.D., Hanssen was a management consultant working in Latin America, Europe and the Far East.

Selected Accomplishments

- Published nearly 30 papers in highly regarded economics journals
- Authored 14 papers that have been included as chapters in books or have been circulated as policy briefs
- Visiting Fellow at the Ostrom Workshop at Indiana University
- Visiting Economist at the Antitrust Division at the U.S. Department of Justice (2007-2008)
- Lone Mountain Fellow at the Property and Environment Research Center (PERC) in Bozeman, Montana (2016)
- Senior Economist for Lexecon Inc. (2003-2004)
- Visiting Fellow at the Hoover Institute at Stanford (2001)



Kathryn Kisska-Schulze, JD

Assistant Professor
Accountancy



Kisska-Schulze is a business law faculty whose research efforts focus on the impact of taxation on U.S. industries, with particular emphasis paid to amateur sports, e-commerce, aviation, robotics, and artificial intelligence. Her publications have been listed as required reading at the University of Pennsylvania Wharton Business School and the University of Southern California. One of her articles was recently cited in the 2019 textbook, *Harmonizing Regulatory and Antitrust Regimes For International Air Transport*. Kisska-Schulze has been invited to present working papers at the Indiana University Kelley School of Business, Washington and Lee University College of Law, University of Georgia Terry College of Business, University of Pennsylvania Law School, and Georgia Institute of Technology Scheller College of Business.

Since joining Clemson in 2015, she has published or has forthcoming 14 articles in peer-reviewed journals. She has been interviewed by global news organizations, including Bloomberg Law, MLex US Tax Watch, and USA Today. Kisska-Schulze teaches the Legal Environment of Business course at the undergraduate level, and International Taxation and Special Topics at the Masters of Professional Accountancy (MPAcc) program.

Selected Accomplishments

- Awarded the Distinguished Proceedings Paper by the Academy of Legal Studies in Business in 2019
- Awarded Best Article by the Journal of Legal Aspects of Sport in 2016
- Awarded 1st Runner Up for the Holmes-Cardozo Award by the Academy of Legal Studies in Business in 2016
- Published 2 peer-reviewed articles in 2018-2019, and has 3 additional publications forthcoming
- Served as an invited panelist at the Academy of Legal Studies in Business conference in Montreal, Canada in 2019
- Serves as the Chairperson of the Sports and Entertainment Law Section of the Academy of Legal Studies in Business
- Serves on the Editorial Board of the *Rocky Mountain Law Journal*
- Serves in editorial capacities for the *Journal of Business Ethics*, *American Business Law Journal*, and *Journal of Legal Aspects of Sport*
- Recently invited to serve on the Advisory Council for the Anderson Institute of Technology (AIT)



Ryan Mullins, PhD

Associate Professor
Marketing



Mullins is an award-winning author, professor, and consultant focused on helping organizational leaders improve sales force performance. In his 7 years at Clemson, he has contributed 16 academic articles, with 7 of those appearing in the Financial Times Top 50 business journals in the world. In the classroom, Mullins teaches courses focused on personal selling, sales management, and sales leadership. He also serves as the director for the Sales Innovation Program (SIP) with the goal of becoming internationally recognized in sales research, education, and leadership. In line with this mission, Mullins has also been awarded a Provost's Innovation Fellowship at Clemson to help deliver a new sales course in collaboration with industry partners. Mullins greatly enjoys industry collaborations and has conducted multiple research projects with Fortune 500 companies, providing data analysis, insight, and training interventions when needed. This real-world engagement has helped Mullins be recognized as an insightful speaker to sales organizations and also enabled the delivery of innovative teaching in the classroom.

Selected Accomplishments

- 2019 Watt Faculty Fellowship to integrate Artificial Intelligence into Sales at Clemson
- Developed \$72,500 in annual industry partnerships in SIP's first year
- 2019 Provost's Innovation Fellowship for development of Selling in Healthcare Course
- 2018 Neil Rackham/Sales Education Foundation Research Grant Award
- 2017 James M. Comer Award for Best Contribution to Sales Management Theory
- 2015 Sales Excellence in Research Award
- Developed a \$2.5 million gift for the founding of the Sales Innovation Program
- Published 7 journal articles appearing in the Financial Times Top 50 Business Journals
- Highlighted for research contributions in 7 academic or industry press publications
- Recognized for 4 academic conference awards
- Published 2 invited journal articles
- Delivered 3 invited academic presentations at Clemson and peer universities
- Delivered 5 invited training workshops with sales organizations
- Founding faculty advisor for the Clemson Professional Selling Club



Nicole Bannister, PhD

Associate Professor
Teaching and Learning



Bannister is a mathematics educator who studies how teachers develop an asset-orientation to the profession, focusing on communities of practice as robust settings for teacher learning of strengths-based teaching practices. Recent contributions include empirical, theoretical, and practical tools for analyzing teacher learning of strengths-based practices, thereby addressing critical gaps in research on what teachers learn within teacher community contexts and how that learning takes place. Current projects are supported by the National Science Foundation (NSF) and National Security Agency (NSA).

Bannister — jointly appointed in the colleges of Education and Science — teaches both education and mathematics courses that prepare teachers for meeting the needs of every learner they encounter. While the rhetoric of a strengths-based approach is relatively easy to endorse, the intentional practice of interpreting and leveraging student actions as mathematical strengths is far more difficult to enact. An enduring challenge for mathematics teacher educators is to develop professional development and course experiences that support meaningful entry points into this change-work for prospective and practicing teachers. In response to this urgent issue, Bannister launched the Making to Learn Geometry Creative Inquiry (CI) course this year in order to support the reimagining of middle grades geometry through the lenses of “making.”

Selected Accomplishments

- Selected to participate in the inaugural Dean’s Leadership Institute (DLI) in the College of Education (2019-2020)
- Selected for participation in the ICMI Study 25 conference, a highly prestigious study conference
- Published 6 impactful peer-reviewed journal articles over the past 3 years
- Awarded multiple collaborative grants (NSF and NSA) to support the Mathematics: Opportunities in Research and Education (MORE) project, a cross-university research and outreach project that supports a diversity of students to pursue doctoral degrees in mathematics
- Selected as a 2019 candidate for Secretary of the Association of Mathematics Teacher Educators (AMTE) (election results pending)
- Selected as a 2019-2020 candidate for Co-Chair of the American Educational Research Association’s (AERA) Special Interest Group for Research in Mathematics Education (SIG-RME)



Pamela Stecker, PhD

Professor

Education and Human Development



Stecker joined the Clemson faculty in 1996. Her research, teaching, and service all focus on improving the academic outcomes of students with disabilities in pre-kindergarten through 12th grade. Her primary research efforts center on the development, validation, and utility of progress monitoring assessments for determining the adequacy of student progress and the effectiveness of students' instructional programs. For example, Stecker instructs pre-service and in-service teachers in how to use progress monitoring data to judge when instruction needs to be altered to better meet individual student needs. She also instructs educators in how academic interventions can be intensified for learners who are responding poorly to instruction. Stecker teaches this method of data-based individualization in coursework at both the undergraduate and graduate levels and has submitted several doctoral leadership grant applications for developing this expertise among young scholars (unfunded). Her peer-reviewed publications follow this same line of inquiry. Considering the impact of her work, Stecker has over 1,000 citations of her work during the past 5-year period and 3,200 citations across her academic career. However, she also writes for practitioner audiences to help current educators better use progress monitoring practices for instructional decision making and recently has provided teacher workshops on this topic for several school districts across the state. She also actively mentors new faculty in her department.

Selected Accomplishments

- Surpassed 550 citations for a peer-reviewed publication that synthesized research about academic progress monitoring and reached 500 citations for a second article
- Published two articles describing a collaborative research project with Iowa State University that had been funded by the Institute of Education Sciences (\$1.5 million)
- Co-authored textbook chapter on using student response to intervention as a framework for schools to monitor and address academic achievement
- Presented 16 sessions at national/international conferences over the past 3 years
- Received state-level grants to provide online instruction for current teachers seeking to add certification in learning disabilities
- Received two College of Education internal grant awards with junior faculty to design and test a technology application for helping young students practice reading sight words
- Evaluated progress monitoring tools in reading and mathematics as an expert reviewer for the federally funded National Center on Intensive Intervention
- Appointed by the SC Department of Education's Director of the Office of Special Education Services to serve on Data-Based Individualization Core Team



Rachel Wagner, EdD

Assistant Professor

**Educational and Organizational Leadership
Development**



Wagner joined the College of Education and the Department of Educational & Organizational Leadership Development as a scholar in student affairs and higher education leadership. As with many faculty of higher education and school leadership, she brings considerable professional experience. Wagner's professional practice includes more than 15 years in residence housing administration and leadership. She describes two primary areas of inquiry: (1) gender aware and expansive practice in higher education, and (2) social justice approaches to student affairs practice. Her grant activity includes funding from two of the professional and academic societies in her field. For her work on Building Capacities to Engage in Community Based Participatory Action Research, Wagner and her team received support from NASPA (formerly the National Association for Student Personnel Administrators). Wagner also received funding for A Critical Narrative Inquiry: Gender Inclusive Housing as a Best Practice, from the Association of College and University Housing Officers -International (ACUHO-I) Foundation.

Wagner is an active member of the Association for the Study of Higher Education (ASHE), ACPA – College Student Educators International (formerly American College Personnel Association), and NASPA (formerly National Association of Student Personnel Administrators) as well as several regional affiliates. Her work has been published in journals, including the following: *Equity & Excellence in Education*, *Journal of Diversity in Higher Education*, and *Journal of Student Affairs Research and Practice*, among others.

Selected Accomplishments

- College Student Educators International (ACPA) 2020 Emerging Scholar Award
- Invited Chair - *Centering Critical Interdisciplinary Campus Sexual Violence Research*, ASHE Presidential Summit Symposium
- Manuscript of the Year 2019: Better than most: Trans* perspectives on gender-inclusive housing. *Journal of College and University Student Housing*, (ACUHO-I)
- College Student Educators International (ACPA) Coalition Advocate Award



Angela Alexander-Bryant, PhD

Assistant Professor
Bioengineering



Alexander-Bryant is director of the Nanobiotechnology Laboratory. She obtained the Ph.D. in bioengineering from Clemson in 2015 and pursued a post-doctoral fellowship at Clemson through the Tigertalent program. Alexander-Bryant's current research interests include combined drug and gene therapies for the treatment of heterogeneous and drug-resistant cancers; the design of polymeric and lipid-based delivery systems and self-assembling peptide delivery systems; and targeted delivery and extended-release drug and gene therapies. Alexander-Bryant serves as the chair of the Bioengineering Diversity and Inclusion Committee, member of the Call-Me-Doctor Advisory Board, and a founder of the Clemson-Claflin BS-MS Program. Nationally, she serves as an officer of ABCRMS (Annual Biomedical Research Conference for Minority Students).

Selected Accomplishments

- Author of 12 recent scholarly publications and presentations
- Recipient of a National Science Foundation Early CAREER Grant
- Panelist, 4th Annual Biomedical Engineering Education Summit – Diversity and Inclusion in Biomedical Engineering, Cleveland, OH
- Guest speaker, University of Kentucky, Lexington, KY.
- Guest speaker, Hollings Cancer Center, Medical University of South Carolina, Charleston, SC.
- In 2020, her undergraduate research mentees secured fellowships from the NSF Graduate Research Fellowship Program (3), Call-Me-Doctor™, and the inaugural Hollings Cancer Center LOWVELO Graduate Fellowship.



Eric Davis, PhD

Assistant Professor

Chemical and Biomolecular Engineering



Davis is an assistant professor of Chemical and Biomolecular Engineering at Clemson University. He earned the Ph.D. in Chemical Engineering from Drexel University in 2013. Davis' research interests include revealing the fundamental relationship between polymer structure, transport phenomena, and polymer physics. His research group's current research focuses on the development of structure-processing-property relationships of polymer membranes for energy storage and delivery applications including fuel cells and redox flow batteries, as well as membranes for water desalination, aqueous separations, and moisture barrier applications. Davis' research utilizes a variety of spectroscopic and scattering techniques, as well as poromechanics for characterizing both structure and transport of advanced functional polymers. These powerful characterization techniques and analyses are used to shed light on polymer physics phenomena, as well as aid in the development of next-generation polymer membranes for a number of real-world applications.

Selected Accomplishments

- Author of 21 journal publications and numerous professional presentations
- Invited author of 2020 contribution to ACS Applied Polymer Materials, Special Issue on Young Investigators in Applied Polymers Research
- Invited author of 2020 contribution to Journal of Applied Physics, Special Issue on Polymer-Grafted Nanoparticles
- Supervised two Ph.D. students who graduated in 2020
- Recipient of a National Science Foundation Early CAREER Grant, 2019
- Director, ChBE GAANN Program on Molecular Engineering for Sustainability and Health



Laura Redmond, PhD

Assistant Professor
Mechanical Engineering



Redmond is an assistant professor of Civil and Mechanical Engineering at Clemson University and the head of the Clemson Advanced Structures Laboratory. She earned the Ph.D. in Civil Engineering from Georgia Tech in 2015. Prior to joining Clemson in 2018, she was a structural engineer with the NASA Jet Propulsion Laboratory, focusing on advanced finite element simulations, rigid body dynamics models, and the development of test programs for model validation and requirements verification. Redmond's research interests include advanced simulations for civil, mechanical, and aerospace applications, model verification, and model validation by test. Examples of her current research applications include seismic behavior of concrete and masonry structures, drive-by-health monitoring of bridges, modeling and design of rigid-flex PCB robotics, and calibration/validation techniques for vehicle subsystem models. Research sponsors include NASA, NSF, Army GVSC, and industry partners. Redmond is an active contributor to technical committees for The Masonry Society and SAE. She also serves as a member of the NASA Engineering and Safety Center's Loads and Dynamics Technical Discipline Team.

Selected Accomplishments

- Her PhD student, Rob Locke, received Best Student Paper in the Dynamics of Civil Structures Technical Division (2021), "*Experimental Evaluation of Drive-by Health Monitoring on a Short Span Bridge Using OMA Techniques*," Proceedings of IMAC XXXIX, Feb. 8-11, 2021.
- Author of seven scholarly publications and presentations in 2020
- Recipient of 2019 Award for the Outstanding Paper in *The Masonry Society Journal*



Zhicheng Dou, PhD

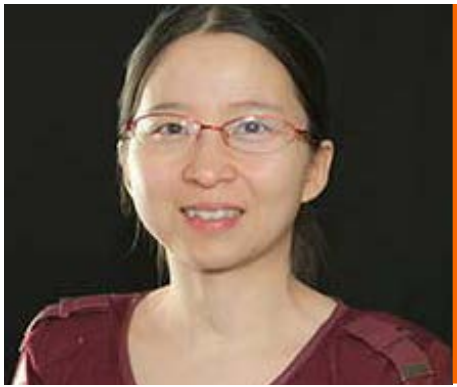
Assistant Professor
Biological Sciences



Dou leads a molecular parasitology lab in the Department of Biological Sciences, studying the pathogenesis of a human protozoan parasite called *Toxoplasma gondii*. According to the latest CDC report, approximately 40 million people in the US carry *Toxoplasma* infections, which imposes a significant health and economic burden on the human population. The Dou lab uses state-of-the-art molecular biology and genetic strategies to understand how *Toxoplasma* parasites disseminate their infections. There are two ongoing research projects in the Dou lab: 1) The lab investigates how the parasites interact with host cells during infection, such as ingestion and digestion of host nutrients by the parasites to support their growth and virulence. Blocking the unique nutrient scavenging pathway in the parasites will help identify novel therapeutics against infection. And 2) The lab studies heme metabolism in the parasites. Heme, an essential nutrient in virtually all eukaryotic cells, plays a crucial role in the function of mitochondrion, a power plant within eukaryotic cells. Their recent findings have revealed that *Toxoplasma* parasites encode a plant-like heme biosynthesis pathway and require it for infections. Currently, the Dou lab is collaborating with Dan Whitehead's organic chemistry lab to develop novel antibiotics against the parasite's heme production. Also, the heme-deficient mutant parasites serve as a potential microbial vehicle for delivering immunotherapeutic genes into human tissues for treatment of diseases such as cancer and Parkinson's. By collaborating with Yanzhang Wei's lab that specializes in immunology, the Dou lab is testing the concept of delivering immunotherapeutic proteins for breast cancer treatment via a virulent *Toxoplasma* parasites. Additionally, the nature of heme-deficient parasites makes them suitable as vaccine candidates for toxoplasmosis prevention. Current research in the Dou lab is supported by an NIH R01 grant.

Selected Accomplishments

- Published 5 peer-reviewed research articles in top journals since joining Clemson University, including *Nature Microbiology*, *PLOS Pathogens*, *mSphere*
- Received a 5-year NIH R01 grant (\$1.85 million)
- Reviewed grant proposals for NIH, Wellcome Trust Foundation, and American Heart Association. Serves as an academic editor for *PLOS One* and as a guest editor for a special section in *Frontiers in Cellular and Infection Microbiology* and a special issue for *MDPI Pathogens*
- Presented invited talks at national and international conferences, such as the International *Toxoplasma* Congress and GRC–Chemistry and Biology of Tetrapyrroles
- Currently advises 1 postdoctoral fellow, 2 Ph.D. students, and 2 undergraduate students in the lab



Xian Lu, PhD

Assistant Professor
Physics and Astronomy



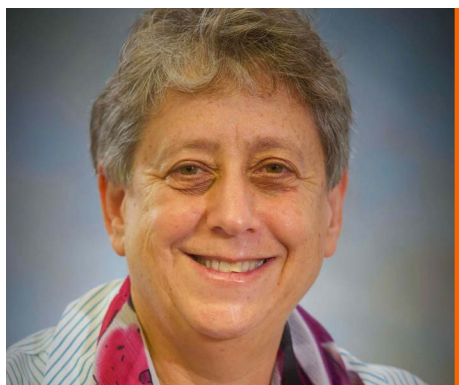
Lu is a leading computational atmospheric and space scientist. She is the leader of the Space Weather Modeling Group (SWMG) at Clemson University, including 4 faculties, 2 postdocs and 4 graduate students from the Department of Physics and Astronomy, School of Mathematical and Statistical Sciences, and School of Computing. Lu is leading the group to develop a next-generation space weather modeling framework and consolidate interdisciplinary techniques (e.g., data mining & machine learning) to space science.

Space weather refers to dramatic disturbances happening in the upper atmosphere of Earth that originate from the Sun. Severe space weather has historically damaged power grids, leaving people in darkness for hours, interrupted radio communication, blocked GPS signals, and destroyed space assets. Lu's group is developing a sophisticated physics-and statistics-based modeling framework to better understand and forecast space weather, for an ultimate goal of enhancing the preparation levels of human society to prevent the hazardous impacts. Multiple creative and frontier research efforts have been made: 1) the drivers of space weather models are upgraded to be data-driven which facilitates realistic modeling and forecasting; 2) new capability of physics models has been developed by adding nested grids and multi-level nudging modules; 3) statistical surrogate and machine learning techniques are under exploration. The career goal of Lu's is to establish a competitive research and education center for space weather modeling.

Lu has submitted 18 grant applications, 10 of which were funded, including her NSF CAREER award. Lu won the National Center for Atmospheric Research (NCAR) Faculty Award in 2018, was nominated as the Clemson Junior Researcher of the Year in 2019, and selected as Rising Star in Discovery by the College of Science in 2020. Lu has published 17 papers (4 more in revision) in prestigious journals of her field.

Selected Accomplishments

- Received NSF CAREER award, NCAR Faculty award, and Rising Star in Discovery award
- Graduate student received NCAR Newkirk fellowship
- Leading and co-leading 10 research grants (~\$2M) funded by NSF, NASA, AFOSR and NCAR.
- Published 17 peer-reviewed papers in prestigious journals and presented 13 invited talks at international conferences after joining Clemson.
- Advising 5 graduate students (2 visiting). Advised 4 postdocs. Advised 10 undergraduate students. Advised one high-school American African student.



Dvora Perahia, PhD

Professor
Chemistry



Perahia carries out an interdisciplinary research with the ultimate goal of resolving fundamental physics principles that control complex fluids and polymers and lead to their immense technological impacts from clean energy to bio-technology. To do so her group combines large scale computational studies with neutron experiments. Her computational studies are carried out on the Palmetto Cluster and DOE computers and her neutron experiments are carried out in Oak Ridge National Laboratory in Tennessee and the National Institute Standard and Technology in Maryland.

Over the last year, Perahia's efforts have focused on computational studies. Together with her experimental efforts, these studies provide unparalleled fundamental knowledge that offer guidelines to the design of charged polymers for clean energy and and biotechnology. In her recent work published in *The Journal of Chemical Physics* (February 2021), Perahia's group was able to resolve the effects of charge distribution on polymer chains on their structure and dynamics. The paper was just posted as "Editor's Selection" of the Journal. In another recent publication in *Macromolecules* (March 2021), using computational tools, Perahia attained for the first time direct atomistic insight into the interfacial response and adaptation of structure ionizable co-polymers. This fundamental knowledge is paramount to the design of materials with controlled adaptation characteristics for a broad range of applications. In parallel to her material based efforts, Perahia has been involved in computational developments through long term collaborations with Sandia National Laboratories. These efforts enable the connections between chemical structure of materials and their properties. Her research has been funded by the NSF, DOE and industry.

In addition to traditional monetary grants, Perahia has secured significant external resources including neutron instrumentation beam times whose value ranges between a quarter to half a million dollars annually, as well as significant amounts of computational time on the most advanced computer clusters in the nation.

As a result of her research achievements, Perahia has been elected to serve in several leadership roles at Clemson and in the physics community. At Clemson, she co-chairs the Clemson University Computational Advisory Team (CU-CAT) and has been a co-PI on the two recently awarded NSF instrumentation grants for computational nodes for Palmetto, leading the material research efforts. She was elected as the secretary/treasurer of the group of statistical and non-linear physics of the American Physical Society and a member of the Program Committee. She was a recent program chair of DPOLY (Division of Polymer Physics) of the APS. Also, she has been elected to serve on several advisory committees. Among notable recent activities, she has been serving on the Louisiana Consortium for Neutron Scattering, a DOE center, where she guided an emerging soft matter materials group. Other activities include Review Advisory Committee on Theory and Simulation of Nanoscale Phenomena (TSNP), Center of Integrated Nanotechnology (CINT), Sandia National Laboratories, Review Advisory Committee for NIST, Center of Neutron Scattering, and ORNL Center for Neutron Scattering.



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