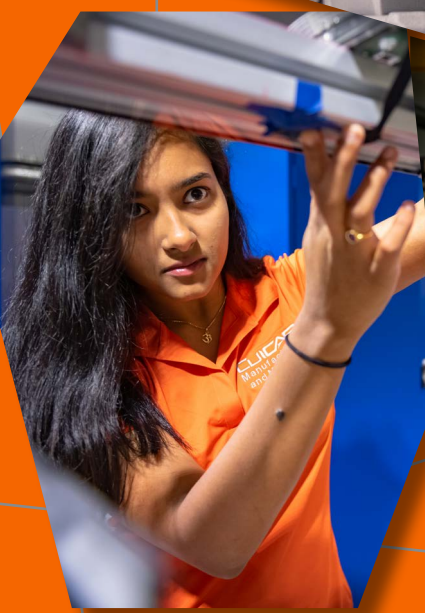




RESEARCH

A Carnegie R1 Institution



*Research Report
Board of Trustees
September 2021*

Click the tabs at the top of each page to navigate to the executive summaries at the beginning of each section, as well as to the letter from the vice president for research.

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4. [Focus on Faculty](#)

Underlined text in Clemson orange links directly to pages within this document or to additional information online.

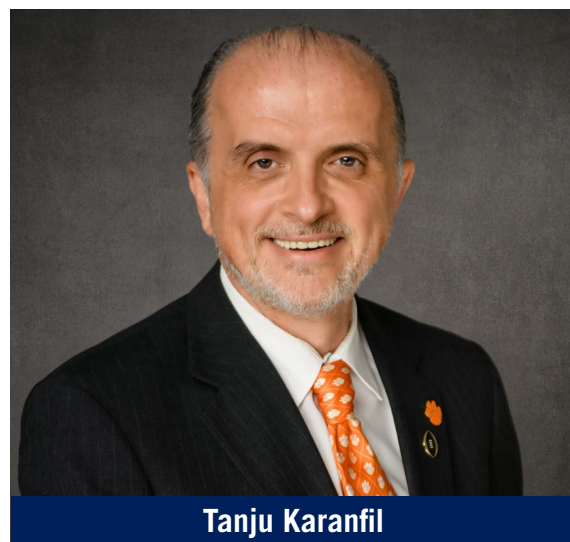
▶ From the Vice President for Research

Dear Board of Trustees Members,

I hope you and your loved ones are healthy, and I look forward to seeing you all in person at the upcoming Board of Trustees meeting. Seeing so many colleagues and the students back on campus has really been inspiring.

Though I must say, our faculty members, students, staff and everyone involved in research at Clemson have remained inspired throughout the pandemic. Consider the momentum we have maintained in fiscal year 2021, one of the most challenging years I can remember:

- Competitive research expenditures increased 9 percent to \$114 million, surpassing the ClemsonForward goal for the third consecutive year ([page 11](#)).
- Competitive research awards were up 37 percent from the prior year at \$162 million ([page 12](#)). That is the highest amount for decades. Incredible.
- Faculty have remained committed, submitting \$762 million in proposals, an increase of 4 percent from FY2020, which was a banner year. In fact, faculty are thinking even bigger and submitting higher value proposals ([page 13](#)).



I am proud of these accomplishments and the high-quality work of our faculty and students. Junior faculty earned 10 early-career awards in FY2021 ([page 8](#)). These are the most prestigious awards junior faculty can receive. They are highly competitive. Only the highest quality proposals are funded, and Clemson's junior faculty have been increasingly competitive the past five years ([page 9](#)). Research awards are a testament to the quality of our research ideas and our proposals. We are competing with the best research institutions around the country to earn these grant awards, and Clemson faculty continue to succeed. However, I must also include that we are operating at the limits of our research capacity with the number of faculty, researchers and research space we currently have ([page 14](#)).

Of course, once the awards come in, it is time to do the work, conduct the studies, compile the data, write the papers and books, complete the project, and so on. Clemson faculty have been productive and the scholarly community is recognizing the quality of the work. The number of peer-reviewed journal articles authored by Clemson faculty, for example, have increased nearly 30 percent since 2014 ([page 7](#)). When journals publish Clemson articles, they are affirming the quality of the work. Similarly, citations of Clemson research have increased 44 percent since 2014 ([page 7](#)). When other scholars cite work from Clemson, they are using it to advance their own research to advance discovery, increasing our reputation across the world.

One of the most substantial affirmations of the quality of our research enterprise comes with our designation as a Carnegie R1 research institution. This designation lists Clemson among the most active, prestigious research institutions in the country. Carnegie is expected to release its next classification in early 2022. Given Clemson's performance in Carnegie's metrics, as well as our comparison to peers, I believe we will retain our R1 designation as one of the nation's top-quality research institutions ([page 6](#)).

[continued on next page ▶](#)

From the Vice President for Research

► [continued from previous page](#)

Behind all of these achievements, of course, are passionate scholars who are having a great impact and earning the recognition of their peers. A Clemson professor, for example, developed proteins that could be used in cancer therapies ([page 24](#)). Another professor wrote the book on maintaining the finest golf course fairways and sports fields in the world ([page 25](#)). A Ph.D. student was named among the world's top young innovators in his field ([page 26](#)). Another Ph.D student identified genetic markers to breed improved lentils, a vital food crop in many parts of the world ([page 27](#)). Clemson faculty earned 15 patents in the past year for a variety of technologies: better crops; medical tools; environmentally friendly materials; and more ([pages 34-35](#)). Clemson is full of exciting research stories. I have provided some examples on [pages 20-35](#). I hope you enjoy reading them as I have.

At the upcoming meeting, time permitting, I have invited Meredyth Crichton to speak to you about Clemson's work at the Dominion Energy Innovation Center (EIC) in Charleston. EIC boasts a world-class wind turbine drivetrain testing bed and a smart grid that can emulate any electrical grid in the world. The center is doing important research and working closely with the energy sector to develop safe, secure, powerful new energy technologies to fuel the growing demand for electricity ([pages 20-23](#)). Meredyth joined Clemson from General Electric in February to lead the EIC into the future. I am excited for you to meet her and learn more about the center.

This report concludes with introductions to three faculty members from each college ([pages 37-58](#)). These are some of the people behind the extraordinary growth in Clemson's research enterprise. They are passionately pursuing scholarship and discovery to improve their communities and the larger world. I am proud of the work they do. I hope you enjoy learning more about the work they do.

Respectfully submitted,



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



A Carnegie R1 Institution

RESEARCH METRICS

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

Executive Summary

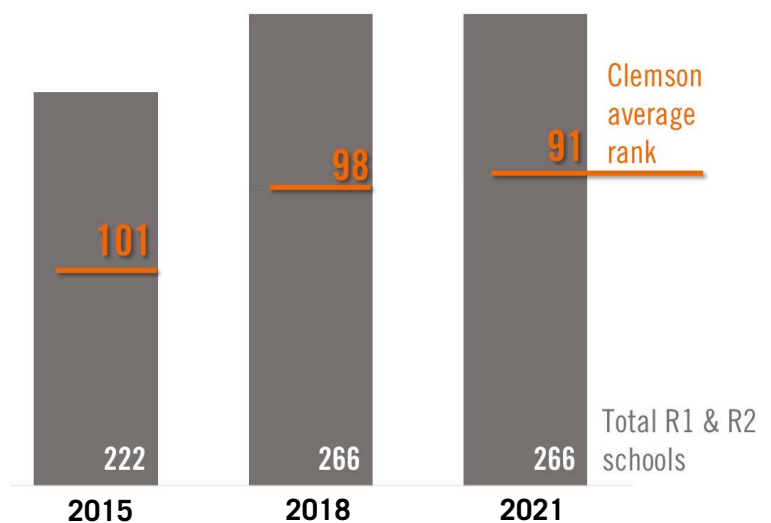
- Carnegie is expected to release its next classification in early 2022, and based on internal analysis, Clemson should remain a Carnegie R1 institution, solidifying its place among the nation's highest quality, most active research universities ([page 6](#)).
- The scholarly community is increasingly recognizing the quality of Clemson's research, with both the number of peer-reviewed journal publications and citations of Clemson authors on the rise ([page 7](#)).
- More Clemson junior faculty are winning the most prestigious awards early-career faculty can receive ([pages 8-9](#)).
- Total R&D expenditures have steadily increased since 2013 ([page 10](#)). *When comparing Clemson's size and research activity to R1 peers, our research enterprise is at capacity* ([page 14](#)).
- Expenditures from competitive awards increased 9 percent in FY2021 and have exceeded the ClemsonForward goal of \$100 million for the third consecutive year ([page 11](#)).
- Research awards increased 37 percent in FY2021 as funding agencies reward the high-quality proposals of Clemson faculty ([page 12](#)).
- Even as awards have increased, Clemson faculty continue to submit more proposals, particularly proposals for high-value projects of \$1 million or more ([page 13](#)).

Carnegie R1 status confirms research quality

Carnegie releases its next classification in early 2022, and Clemson is in strong position to remain an R1 institution. The R1 designation confirms the quality of the university's research enterprise, and places Clemson among the most active research institutions in the country. Carnegie tracks 10 metrics (listed in the chart below) to compile its university classifications. Clemson has improved in all but two metrics since 2018, when the last Carnegie Classification was released.

Metrics	Clemson 2015	Clemson 2018	Clemson 2020	Δ Metric 2018-2020
Science & Engineering Expenditures	\$117M	\$145M	\$165M	↑ \$20M
Non-Science & Engineering Expenditures	\$44M	\$49M	\$54M	↑ \$5M
Postdoc & Non-Faculty Researchers	65	111	162	↑ 51
PhD Humanities	2	8	7	-1
PhD Social Sciences	9	20	25	↑ 5
PhD STEM	143	170	156	-14
PhD Other	62	33	55	↑ 22
Per Capita Science & Engineering Expenditures	\$180K	\$159K	\$174K	↑ \$15K
Per Capita Non-Science & Engineering Expenditures	\$52K	\$53K	\$56K	↑ \$3K
Per Capita Postdoc & Non-Faculty Researchers	0.08	0.122	0.170	↑ 0.048

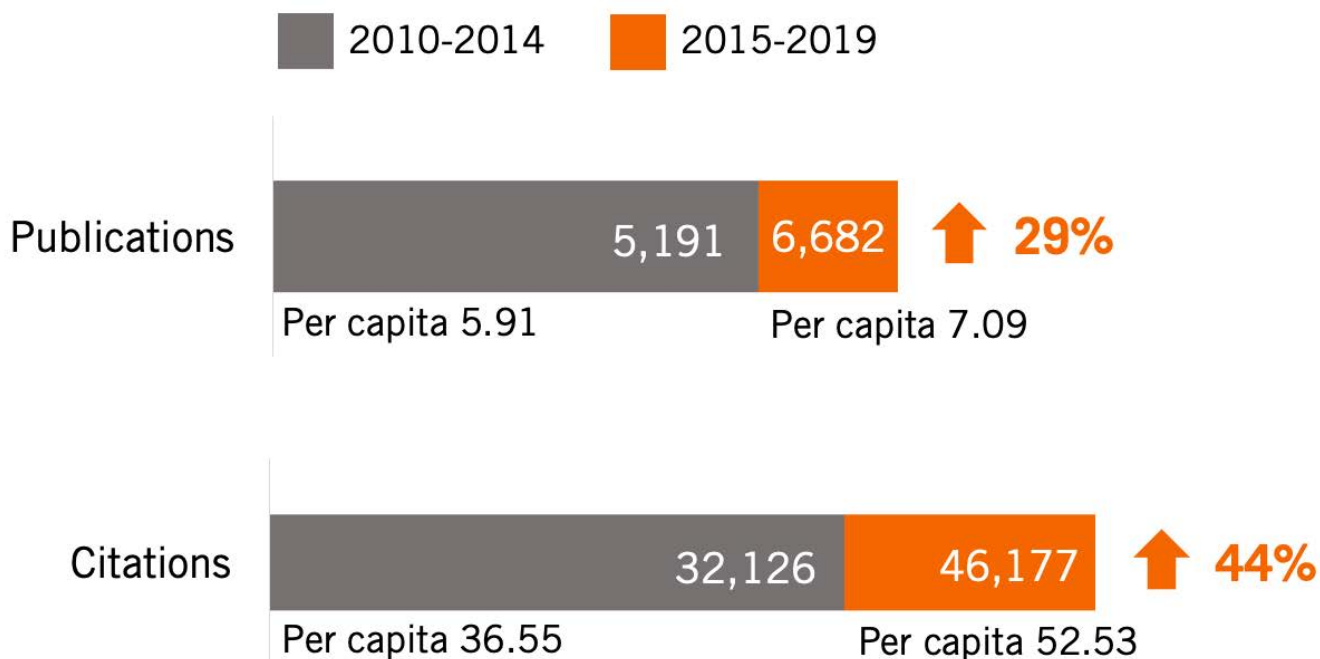
Carnegie collects the data above every three years to compile its university classifications. While Carnegie does not rank schools, the Division of Research has been analyzing Clemson's performance in Carnegie metrics to estimate its position among Carnegie R1 and R2 institutions. As seen in the chart at the right, Clemson has improved its position since 2015 from No. 101 to No. 91. This is a sign that Clemson has solidified its place among Carnegie R1 institutions. Given Clemson's progress in Carnegie metrics and our position among peers, the R1 designation is likely to be reconfirmed.



Journals certify quality of 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 quality 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. At the same time, citations of Clemson work have also increased as other scholars around the world use Clemson findings to advance discovery.

The chart below compares the annual average number of publications by Clemson authors, as well the number of citations of Clemson authors, over two four-year periods: 2010 to 2014 and 2015 to 2019.



SOURCE: Web of Science

Junior faculty earn most prestigious 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. An increasing number of Clemson faculty are earning these awards each year ([see page 9](#)). Clemson faculty have earned 10 such awards this year. These programs confirm the quality of Clemson's young faculty and the relevance of their research pursuits. Clemson's future is bright.



Angela Alexander-Bryant

Bioengineering

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



Kai He

Materials Science & Engineering

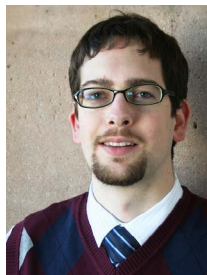
Kai is researching nanomaterials for use in sustainable energy and quantum information technologies.



Ioannis Karamouzas

School of Computing

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



Bart Knijnenburg

School of Computing

Bart is researching the principles of human-computer interaction.



Yingjie Lao

Electrical and Computer Engineering

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



Jessica Larsen

Chemical and Biomolecular Engineering

Jessica is working to develop materials for drug delivery applications in neurodegenerative disease.



Garrett Pataky

Mechanical Engineering

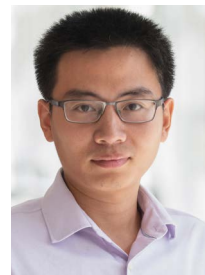
Garrett's research supports the development of stronger materials.



Judson Ryckman

Electrical and Computer Engineering

Judson is working on improved sensors for less expensive diagnostic tests.



Yongjia Song

Industrial Engineering

Yongjia is working to develop optimization technologies to support improved logistics for disaster relief.



Xin Zhao

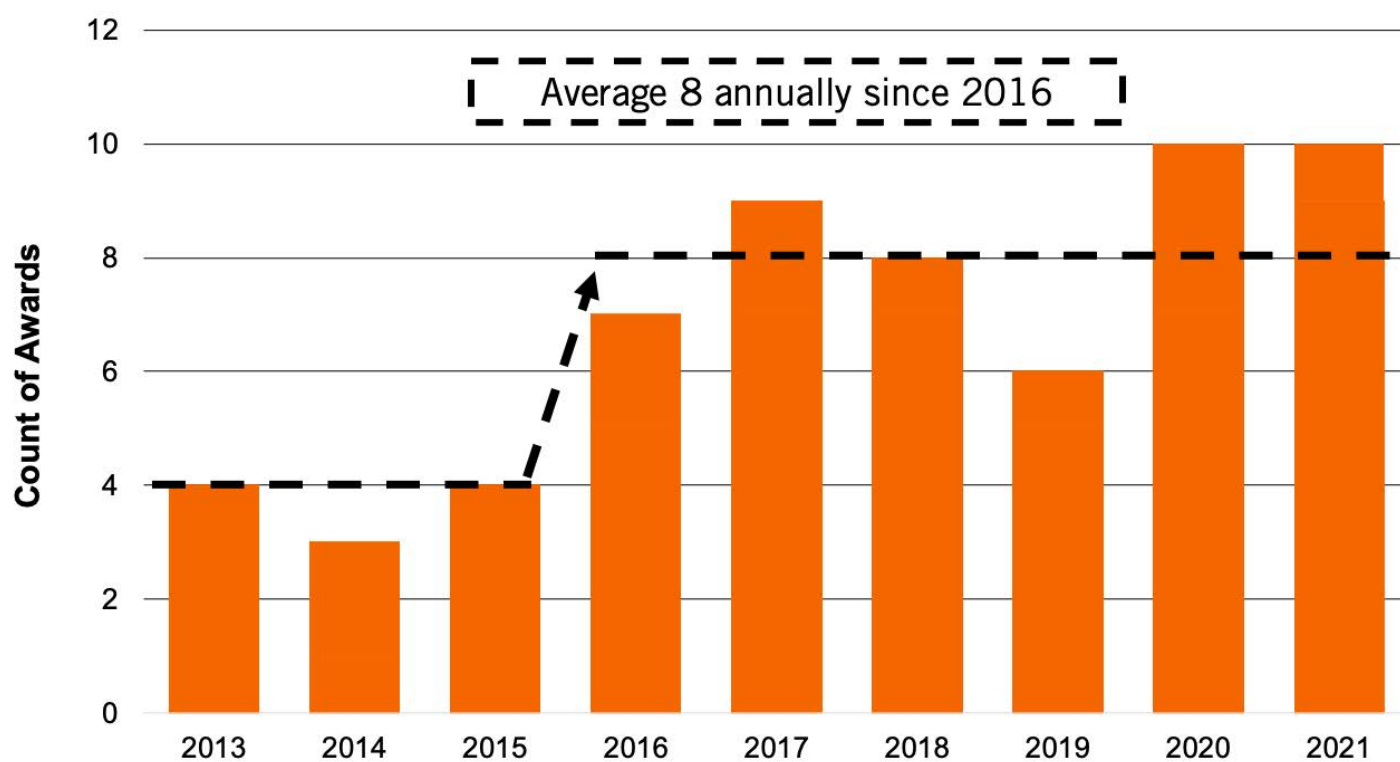
Mechanical Engineering

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

10 early-career awards earned past two years

Clemson's early-career faculty have become increasingly successful earning these awards. The Office of Research Development offers an annual CAREER Academy that helps faculty craft competitive proposals. The effort is paying dividends. The chart below shows the number of early career awards earned each year since 2013. From 2013-2015, Clemson averaged nearly 4 career awards a year. Since 2016, Clemson has averaged eight per year. These are important awards that provide around five years of research funding to help young investigators establish their research portfolios. Some of Clemson's most accomplished researchers once earned early career awards to jumpstart their work.

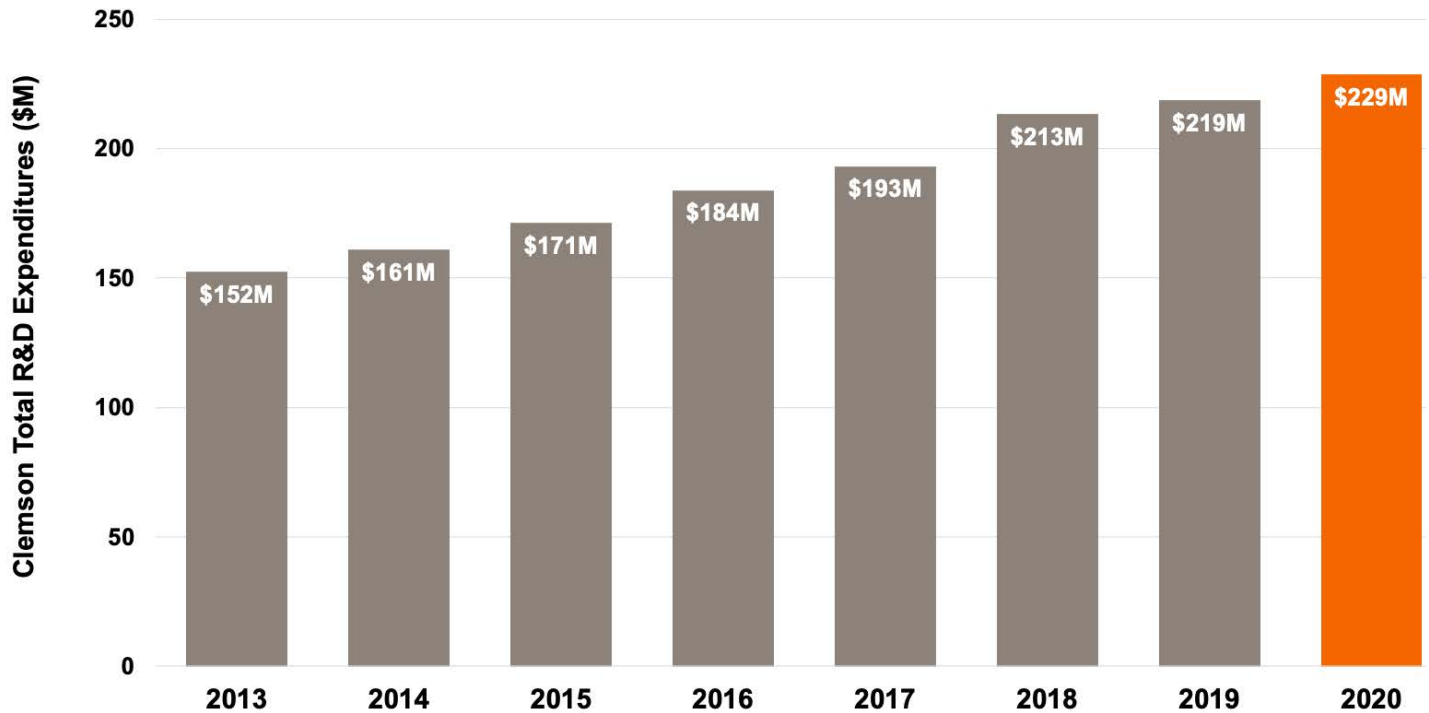
A list of Clemson faculty who have earned career awards is [posted online](#).



The Office of Research Development offers a 6-month CAREER Academy to help junior faculty craft competitive, successful proposals for these awards.

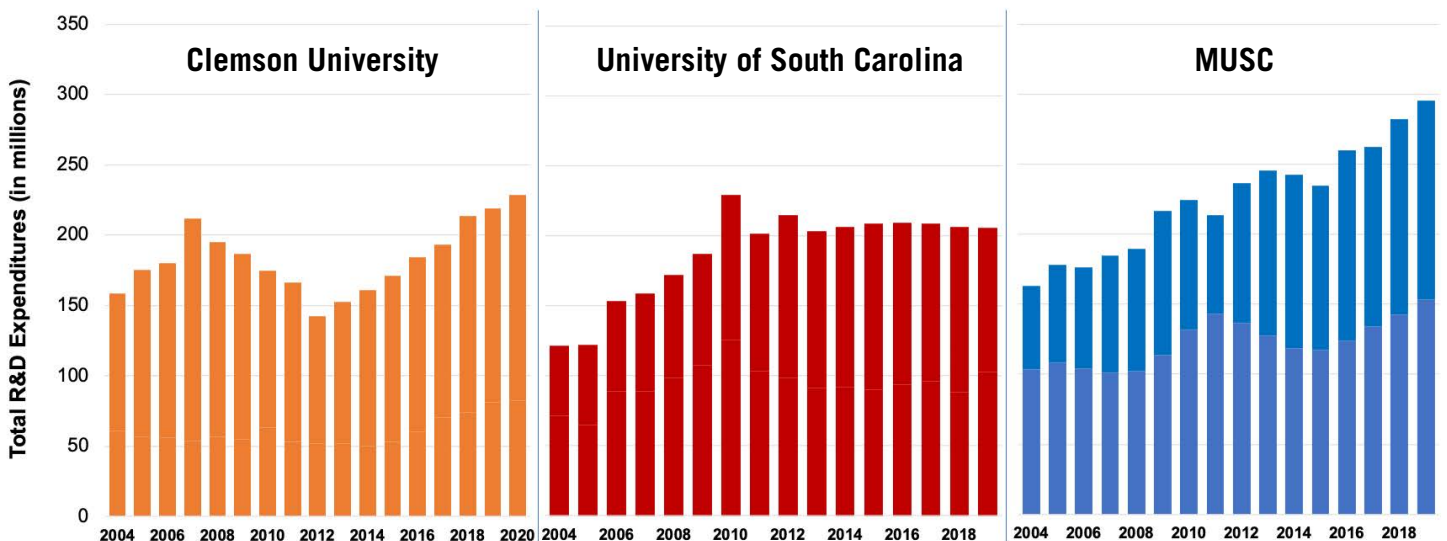
Total R&D expenditures increase ~5%

Since 2013, total research and development (R&D) expenditures have increased 50 percent. This data includes expenditures on all research revenue, including state support, gifts, external research services, competitive awards, and other sources. In 2020, total R&D expenditures increased nearly 5 percent from the previous year.



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

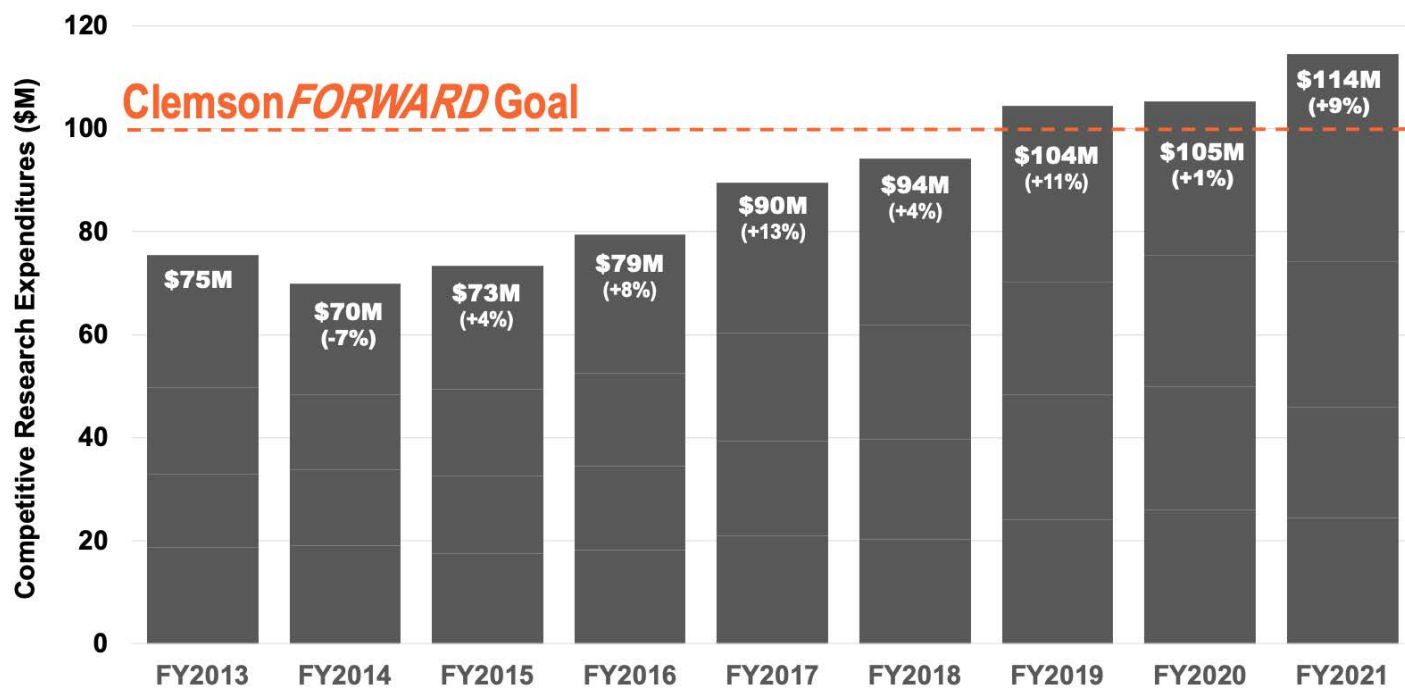
Used in the Carnegie Classification, this data is reported to the National Science Foundation, which allows for an apples-to-apples comparison to peer institutions. Total R&D at Clemson has surpassed University of South Carolina.



Competitive expenditures increase 9%

In the ClemsonForward strategic plan, Clemson University aimed to surpass \$100 million in annual competitive expenditures by 2026. Clemson achieved that goal (marked on the graph below with an orange line) seven years ahead of schedule in 2019. In FY2020, Clemson topped \$100 million for the second consecutive year and now we have done it again in FY2021, with an increase in competitive expenditures of 9 percent from the prior year.

Competitive expenditures include funds from competitively bid projects, such as federal grant awards. These are highly competitive awards that confirm the quality of Clemson's research enterprise.



These funds come from highly competitive awards. Continuous growth in this data confirms the quality of proposals submitted by Clemson faculty.

Research awards up 37% from prior year

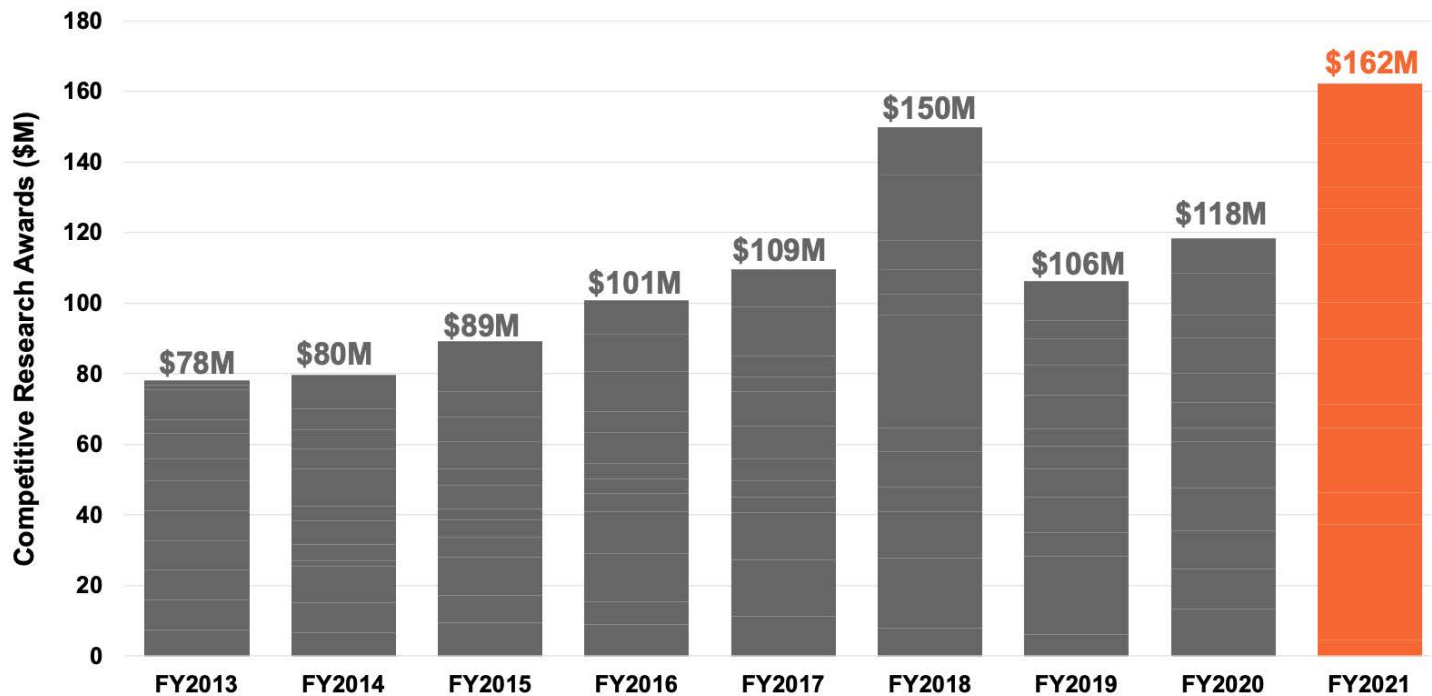
58

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

**THE TOTAL
VALUE OF THESE
PROJECTS IS**

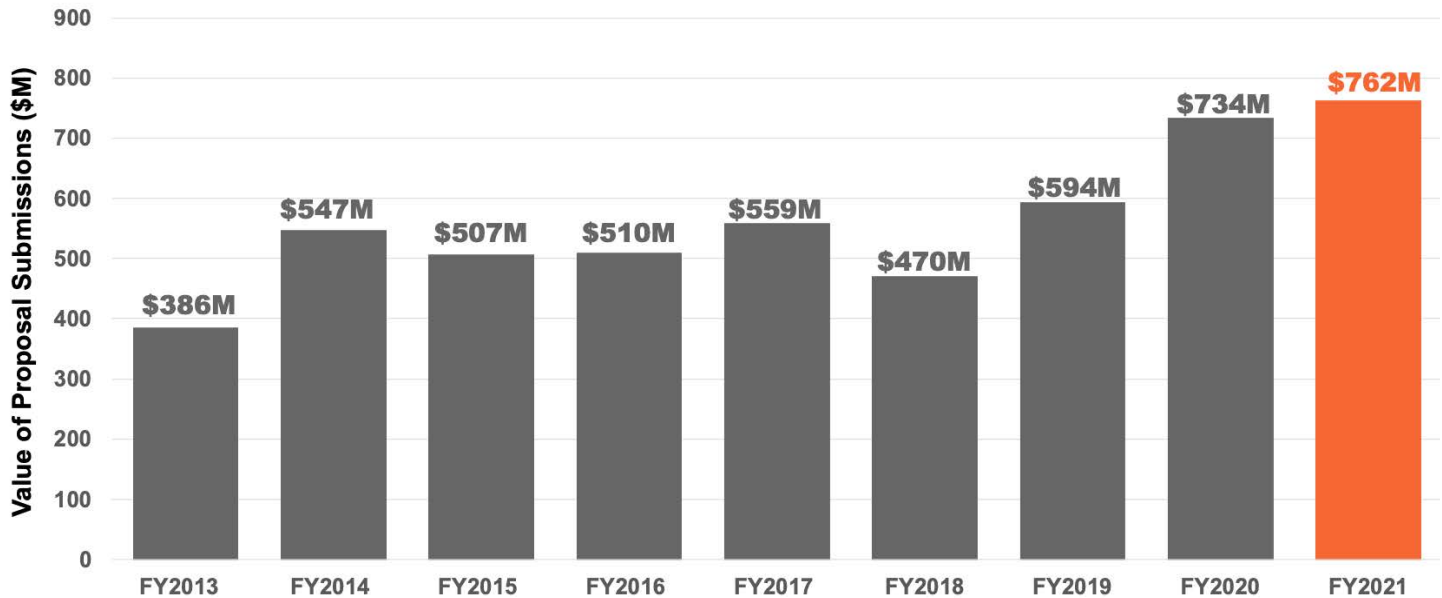
\$281 MILLION

Funding agencies continue to reward high-quality proposals and ideas from Clemson faculty. In particular, Clemson faculty are earning higher value awards of \$2 million and more, as shown in the graphic above. This is fueling an ongoing upward trajectory in research awards received, as shown in the chart below. In FY2021, awards increased 37 percent from the prior year.

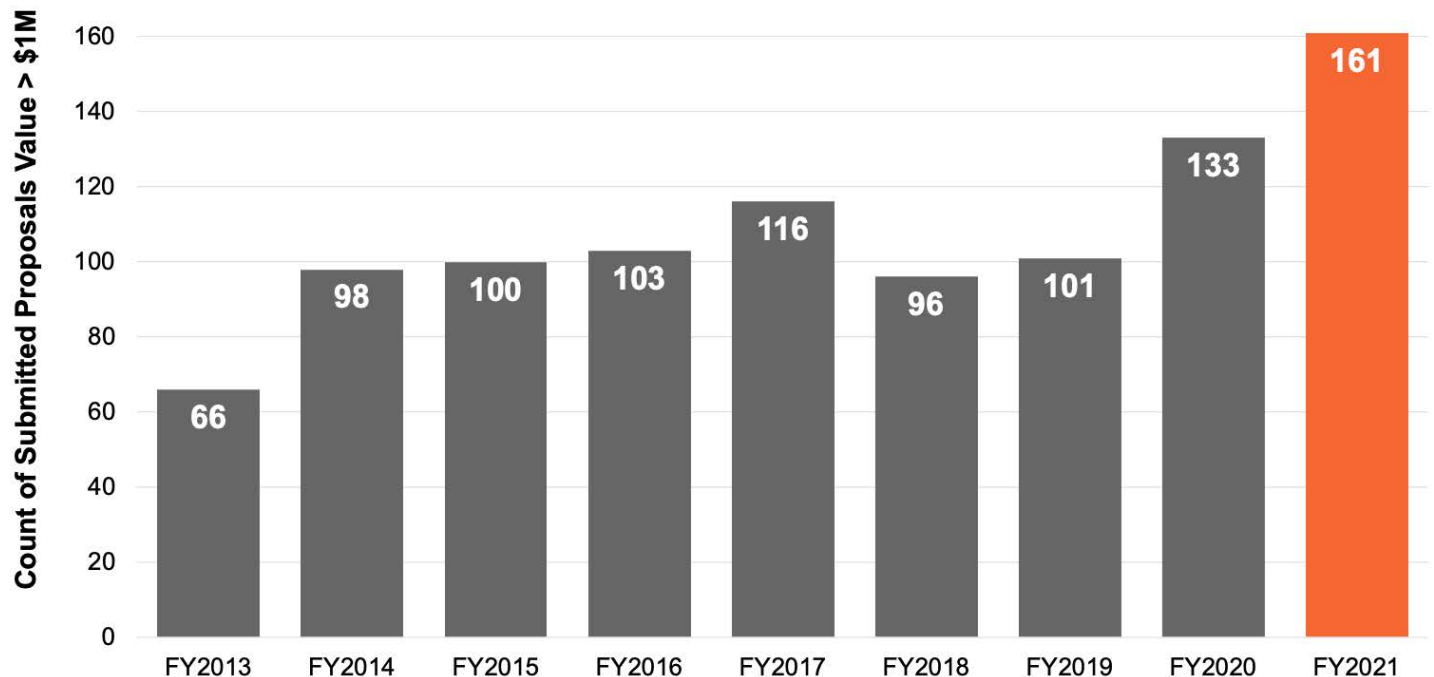


Proposal submissions increase 4%

Even as faculty have earned more awards, they continue to pursue more funding opportunities. In FY2021, proposals increased 4 percent from FY2020, which had been a high mark. Proposal submissions have nearly doubled since FY2013, as shown in the bar chart below.



Clemson faculty are increasingly going big, submitting proposals for grants valued \$1 million and above. The chart shows the number of proposals submitted annually for projects above \$1 million.



Productivity at available capacity

Growth in Clemson's research enterprise has been extraordinary and largely accomplished without an increase to the size of the faculty body or the number of researchers available to do the work. To estimate where Clemson can go from here, we can compare research activity (in this case signified by expenditures), the size of the research workforce and the space available to that of our peer institutions.

The chart below plots Clemson's peer R1 universities (similar public universities without medical schools) and Clemson (the orange bubble) based on number of researchers, amount of space available and total expenditures. The size of the bubble depicts research space available: the bigger the bubble, the more space.

When plotting universities this way, we see that universities with higher levels of expenditures also have larger faculty bodies and/or more available space. This suggests that Clemson is operating at its research capacity, so further research growth would require faculty hiring and investments in space.

Total Expenditures by Researchers Per Science and Engineering Space:

The size of the bubble depicts amount of space; Clemson is the orange bubble



Research Report Card (Year End FY2021)

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	
a. Proposal Submissions by Number		1,414	1,443	1,489	1,478	1,529	1,451	1,417	1,729	1,583	
1	CAAH	38	51	65	62	69	64	69	76	61	
2	CAFLS	235	230	224	222	241	229	377	473	401	
3	CBSHS	81	93	102	104	112	101	105	143	151	
4	CECAS	549	555	582	617	618	587	562	672	596	
5	COE	51	54	39	45	46	37	39	42	37	
6	COB	7	15	13	15	7	10	5	11	14	
7	COS	242	247	263	239	230	227	186	219	229	
8	CCIT	12	12	6	3	5	1	1	1	-	
9	PSA	88	90	118	97	170	163	33	37	26	
10	VP for Res & Interdisc Inst	31	17	7	17	14	12	25	29	29	
11	All Other	80	79	70	57	17	20	15	26	39	
b. Proposal Submissions by Dollar Value (in millions)		\$386M	\$547M	\$507M	\$510M	\$559M	\$470M	\$594M *	\$734M	\$762.4	FY2021 Targets
12	CAAH	N/A	N/A	\$9.4	\$8.6	\$3.1	\$5.7	\$4.4	\$5.9	\$5.6	\$6.6
13	CAFLS	N/A	N/A	\$42.6	\$23.8	\$43.4	\$37.1	\$68.4	\$92.9	\$84.1	\$68.6
14	CBSHS	N/A	N/A	\$28.4	\$40.1	\$41.4	\$25.9	\$87.5	\$41.1	\$64.3	\$51.3
15	CECAS	N/A	N/A	\$260.5	\$281.2	\$306.4	\$235.5	\$255.3	\$405.9	\$342.9	\$310.9
16	COE	N/A	N/A	\$13.8	\$14.7	\$18.1	\$19.1	\$10.1	\$18.9	\$22.4	\$14.3
17	COB	N/A	N/A	\$7.5	\$4.3	\$2.8	\$1.8	\$2.1	\$2.9	\$4.2	\$2.3
18	COS	N/A	N/A	\$100.2	\$111.3	\$95.9	\$100.4	\$73.8	\$129.3	\$175.4	\$95.6
19	CCIT	N/A	N/A	\$4.3	\$2.0	\$4.0	\$0.9	\$4.6	\$3.0	\$0.02	
20	PSA	N/A	N/A	\$23.3	\$10.4	\$31.3	\$25.8	\$11.4	\$6.4	\$5.6	\$15.3
21	VP for Res & Interdisc Inst	N/A	N/A	\$5.6	\$7.7	\$6.0	\$12.7	\$68.5	\$19.8	\$22.3	
22	All Other	N/A	N/A	\$11.4	\$5.6	\$6.0	\$5.0	\$7.4	\$7.7	\$35.7	

*This figure includes a large \$107M proposal

Research Report Card (Year End FY2021)

		2013	2014	2015	2016	2017	2018	2019	2020	2021
c. Research Awards (in millions)		\$78.0M	\$79.7M	\$89.3M	\$100.9M	\$109.5M	\$149.8M	\$106.3M	\$118.3M	\$162.2M
23	CAAH	\$0.2	\$0.6	\$0.7	\$1.4	\$0.5	\$1.9	\$2.0	\$1.4	\$1.4
24	CAFLS	\$7.3	\$6.7	\$14.1	\$8.6	\$10.9	\$13.9	\$14.2	\$22.3	\$24.2
25	CBSHS	\$2.7	\$3.4	\$4.8	\$5.1	\$4.6	\$8.1	\$5.9	\$7.7	\$17.4
26	CECAS	\$34.2	\$37.7	\$48.2	\$45.5	\$54.0	\$80.8	\$50.4	\$48.0	\$75.0
27	COE	\$2.6	\$4.1	\$3.2	\$2.9	\$2.8	\$4.5	\$3.3	\$2.3	\$5.1
28	COB	\$2.0	\$1.1	\$1.3	\$0.8	\$1.2	\$1.1	\$0.8	\$1.2	\$0.2
29	COS	\$10.3	\$7.8	\$9.9	\$15.6	\$19.9	\$14.7	\$18.7	\$14.2	\$25.4
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	\$5.8
32	VP for Res & Interdisc Inst	\$1.8	\$0.3	\$0.6	\$5.1	\$5.0	\$15.1	\$6.2	\$14.6	\$5.1
33	All Other	\$0.3	\$0.2	\$1.2	\$2.0	\$1.2	\$1.7	\$0.7	\$2.2	\$1.9
d. National Young Investigator Awards		4	3	4	7	9	8	6	10	10
34	NSF CAREER Awards (by start date)	4	1	3	5	7	7	4	6	9
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	-	-	-	-	-	-	-	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

Research Report Card (Year End FY2021)

		2013	2014	2015	2016	2017	2018	2019	2020	2021
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	\$114.4M
48	CAAH	\$0.5	\$0.4	\$0.4	\$1.1	\$1.3	\$1.4	\$1.7	\$1.6	\$1.1
49	CAFLS	\$8.8	\$7.7	\$6.8	\$8.6	\$11.1	\$11.0	\$14.1	\$16.4	\$15.0
50	COB	\$1.2	\$1.2	\$1.1	\$1.0	\$0.9	\$0.8	\$0.8	\$0.7	\$0.7
51	CECAS	\$35.0	\$35.0	\$35.0	\$37.5	\$42.9	\$45.1	\$50.3	\$46.4	\$54.4
52	CBSHS	\$3.1	\$2.8	\$3.7	\$4.1	\$4.4	\$4.9	\$5.3	\$6.7	\$9.0
53	COE	\$3.3	\$3.3	\$3.8	\$2.5	\$2.6	\$2.2	\$2.5	\$2.4	\$2.3
54	COS	\$13.2	\$10.5	\$9.3	\$11.3	\$14.8	\$16.7	\$17.2	\$17.3	\$15.9
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	\$5.5
57	VP for Res & Interdisc Inst	\$1.9	\$1.3	\$1.9	\$3.5	\$3.9	\$3.9	\$7.1	\$9.5	\$9.6
58	All Other	\$1.7	\$1.7	\$2.2	\$1.5	\$1.5	\$1.6	\$1.5	\$0.4	\$0.7
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	\$114.4M
59	Advanced Materials	\$14.3	\$11.3	\$10.7	\$10.4	\$10.7	\$12.1	\$15.4	\$13.5	\$14.3
60	Cyberinfrastructure & Big Data Science	\$10.3	\$10.5	\$10.1	\$8.9	\$8.1	\$9.6	\$6.9	\$4.4	\$5.5
61	Energy, Trans. & Advanced Manufacturing	\$4.7	\$5.7	\$7.2	\$7.6	\$17.8	\$16.8	\$17.1	\$14.5	\$19.9
62	Health Innovation	\$13.1	\$10.2	\$10.2	\$12.5	\$16.3	\$17.8	\$23.8	\$27.1	\$27.1
63	Human Resilience	\$8.2	\$7.7	\$9.7	\$9.8	\$7.8	\$8.6	\$9.0	\$9.7	\$12.7
64	Sustainable Environments	\$18.3	\$16.9	\$17.9	\$21.7	\$18.9	\$19.5	\$20.6	\$23.9	\$21.3
65	Other	\$6.5	\$7.6	\$7.4	\$8.6	\$9.9	\$9.6	\$11.7	\$12.1	\$13.6
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	\$114.4M
66	Federal Government	\$62.9	\$56.9	\$58.5	\$65.1	\$74.6	\$78.2	\$85.1	\$85.2	\$95.1
67	Foundations, Societies, and Associations	\$4.2	\$4.3	\$4.7	\$4.1	\$4.7	\$5.1	\$7.4	\$6.9	\$6.2
68	Industry/Other	\$4.9	\$5.6	\$6.1	\$6.9	\$6.8	\$6.3	\$5.3	\$5.5	\$4.8
69	International	\$0.8	\$0.6	\$0.8	\$0.8	\$0.5	\$0.4	\$0.3	\$0.3	\$0.4
70	Local Government	\$0.6	\$0.6	\$0.6	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.8
71	State Government	\$1.9	\$1.9	\$2.7	\$2.0	\$2.4	\$3.7	\$5.7	\$6.8	\$7.3

Research Report Card (Year End FY2021)

		2013	2014	2015	2016	2017	2018	2019	2020	2021
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	\$6,912
73	CAFLS	\$88,570	\$81,120	\$69,612	\$84,618	\$105,396	\$103,814	\$134,555	\$137,438	\$131,195
74	COB	\$14,415	\$13,047	\$11,510	\$9,683	\$8,855	\$8,269	\$8,200	\$6,991	\$7,132
75	CECAS	\$169,754	\$160,698	\$163,406	\$163,685	\$194,323	\$214,280	\$225,620	\$201,553	\$223,843
76	CBSHS	\$27,982	\$26,853	\$33,764	\$42,376	\$34,751	\$39,532	\$40,301	\$50,495	\$67,202
77	COE	\$54,779	\$51,688	\$62,195	\$38,037	\$44,483	\$40,197	\$47,371	\$47,742	\$48,805
78	COS	\$95,724	\$72,421	\$61,912	\$77,589	\$95,956	\$110,206	\$118,600	\$116,020	\$107,258
79	Clemson Average	\$83,858	\$75,089	\$78,826	\$85,753	\$84,297	\$103,706	\$99,125	\$96,497	\$103,187
j. Additional information										
80	NIH R01-Equivalent Awards (by start date)	-	-	2	2	2	3	6	1	3
81	Doctorates Awarded (Aug, Dec, May)	187	217	237	233	231	234	301	249	225
82	STEM Doctorates Awarded (Aug, Dec, May)	118	153	165	138	156	171	174	162	159
83	Disclosures	102	129	70	60	65	51	62	68	44
84	Patents	16	15	15	14	18	11	18	12	15
85	Licenses/Options	9	7	7	5	10	11	19	13	13
86	Licensing Revenue	\$1,134,289	\$762,811	\$360,131	\$354,827	\$539,490	\$461,755	\$398,136	\$315,578	\$239,074
87	Start-up Companies (based on licenses/options)	1	4	4	2	3	3	5	1	1

RESEARCH NEWS

This section highlights research news and accomplishments of Clemson faculty and students

Executive Summary

- Clemson's Dominion Energy Innovation Center looks to make a big impact on the energy sector ([pages 20-23](#)). The center's new Executive Director Meredyth Crichton is prepared to discuss research at the center at the upcoming Research and Economic Development Committee meeting, time permitting.
- Clemson faculty continue to have great impact through research and are earning accolades:
 - » A Clemson professor, for example, developed proteins that could be used in cancer therapies ([page 24](#)).
 - » A Clemson professor wrote the book on maintaining the finest golf course fairways and sports fields in the world ([page 25](#)).
 - » A Ph.D. student was named among the world's top young innovators in his field ([page 26](#)).
 - » Another Ph.D student identified genetic markers to breed improved lentils, a vital food crop in many parts of the world ([page 27](#)).
 - » Clemson faculty earned 15 patents in the past year ([pages 34-35](#)).
 - » Numerous stories showing the high-quality research, impact and honors of Clemson faculty and students are on [pages 20-35](#).
- Vice presidents for research from numerous ACC universities visited Clemson's Lowcountry facilities recently to discuss matters related to university research ([page 36](#)).



Dominion Energy Innovation Center

Big Equipment | Big Plans | Big Impact

When Dominion Energy noticed new equipment it planned to install to provide enough electricity for more than 3 million South Carolina homes was not working correctly, it called on the Dominion Energy Innovation Center at Clemson University to solve the problem. At Clemson, experts were able to duplicate the problem in the simulation lab and quickly identify a solution, test it and correct the issue.

The project provides just one example of the unique asset EIC has become for the state's energy sector. Not only is EIC identifying and solving potential problems, it is helping to design, test and refine technological innovations to fuel the growing demand for clean energy and smart, secure electric grids.

Rapid growth in population, urbanization and industrialization will spur a 50 percent increase in global energy usage by 2050, according to the U.S. Energy Information Administration. Currently, fossil fuels like coal, oil and natural gas supply nearly 80 percent of the world's energy, but wind and solar are becoming increasingly popular sources of more environmentally

“ Providing the energy industry testing capabilities helps us identify key areas for research to address the next set of needs.

- **Meredyth Crichton**
executive director,
Dominion Energy Innovation Center



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Dominion Energy Innovation Center



Wind Turbine Drivetrain Testing

The EIC currently houses two test rigs: a 15 megawatt (MW) rig and one for up to 7.5 megawatts. This is the world's most advanced wind-turbine drivetrain testing facility, capable of full-scale, highly accelerated mechanical and electrical testing. Tests on largescale turbines are multiple-year projects. Investments in such highly advanced testing facilities are cost-prohibitive for most companies, but at a shared facility such as EIC, industry can test product reliability without increasing the cost of electricity to consumers. In turn, industry contracts help EIC maintain world-class equipment, work on needed societal innovations, and provide unique opportunities to faculty and students.

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friendly energy. To meet the rising demand and support efforts to cut emissions from energy production, the Dominion Energy Innovation Center (EIC) at Clemson University is working closely with the private sector on cost-effective, efficient innovative energy technologies.

Housed at the Clemson University Restoration Institute campus in the Lowcountry, the Dominion Energy Innovation Center features both the Duke Energy eGRID – an electrical grid simulator that can replicate any grid in the world – and the world's most-advanced wind-turbine drivetrain testing facility capable of full-scale highly accelerated mechanical and electrical testing of advanced drivetrain systems for wind turbines.

At the EIC, Clemson researchers are testing grid capability, controls, connections and security from cyberattacks. They are testing equipment systems, such as wind turbine machine heads, solar inverters, and high-efficiency gas turbines for efficiency and

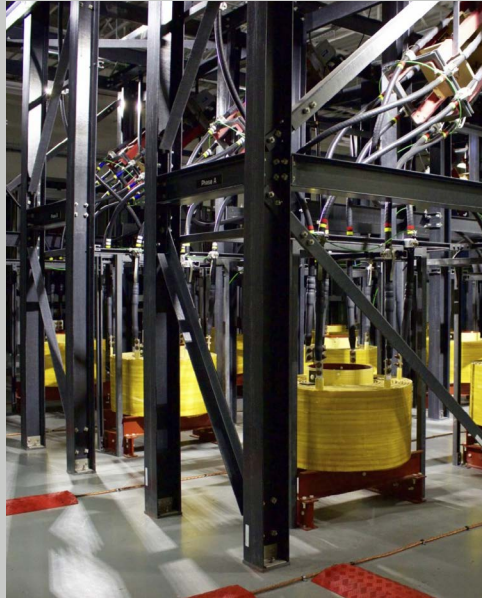


Powering the Economy

The energy sector posted 11% employment growth from 2015-2019, almost twice the rate of the overall economy, according to the 2020 U.S. Energy and Employment Report.

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Dominion Energy Innovation Center



Duke Energy eGRID

(Electrical Grid Research Innovation and Development)

The 15-megawatt hardware-in-the-loop grid simulator supports education, research and economic development to speed new electrical technologies to market. The eGRID can simulate the electrical grid of any country in the world. It allows wind turbine generator (WTG) manufacturers to test both mechanical and electrical characteristics of their machines in a well controlled and calibrated environment. By moving many electrical testing scenarios that were only previously available by field demonstrations into a controlled environment, the simulator gives manufacturers a platform to ensure new innovations meet even more stringent global electrical standards. This will increase reliability and lower the cost of energy delivered.

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durability. Research at EIC helps provide reliable and low-cost energy, prevent grid blackouts and helps companies maintain power during hurricanes and other critical situations. Additionally, students working in the state-of-the-art labs are learning the technical skills to work in the expanding energy industry.

EIC Research at a Glance

CURI receives \$5.2M contract from GE

This project is a collaborative agreement between General Electric and Clemson's Wind Turbine Test Bed to permit the testing of GE wind turbines. Curtiss Fox, the director of research operations at the Dominion Energy Innovation Center, will lead this project.

\$2.3M project to test power generation efficiency

The Department of Energy awarded Curtiss Fox, the director of research operations at the Dominion Energy Innovation Center, \$2.3 million to test and develop a medium-voltage, high-speed combined heat and power system (CHP) to improve power generation efficiency and reliability for manufacturing environments. Fox will partner with



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Dominion Energy Innovation Center



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TECO Westinghouse, a manufacturer of electric motors, generators and drives.

Energy Innovation Center decommissioned Vestas project

The Dominion Energy Innovation Center has decommissioned a project to test MHI Vestas' V164 9.5 megawatt (MW) turbine, the world's largest. The project, announced in 2018, used the university's state-of-the-art 15MW test bench to gain a better understanding of how the turbine's gearbox and bearings will react over the course of a 20-plus year lifecycle.

\$1.2M project to study offshore wind

Clemson researchers will provide advanced testing facilities, including capabilities for hardware-in-the-loop testing for wind turbine nacelles. These unique facilities support testing of wind turbine drive trains under a variety of conditions and can simulate how the turbines will interface with the power grid. Fox will lead the project, which is funded with \$1.2 million from the U.S. Department of Energy.

\$4M project to address sustainable energy generation

Funded with \$4 million from the U.S. Department of Energy, Clemson will lead a team investigating Organic Rankine Cycle (ORC) processes for flexible sustainable energy generation. ORC is a process developed to maximize energy output from alternate sources of electricity.

By The Numbers

\$14.5M

Current Research Contracts

15

Active Research Projects

21

Staff Members

5

PhD Students Participating

Impacts, Honors and Achievements

Study sets stage for new immunotherapy for cancer

Clemson University researchers have developed fusion proteins that could allow the human body to kill cancerous cells. The human immune system has natural killer cells deployed to attack disease.

“The idea is to use this bifunctional protein to bridge the natural killer cells and breast cancer tumor cells,” said Yanzhang “Charlie” Wei, a professor in the College of Science’s Department of Biological Sciences. “If the two cells are brought close enough together through this receptor ligand connection, the natural killer cells can release what I call killing machinery to have the tumor cells killed.”

It’s a novel approach to developing breast cancer-specific immunotherapy and could lead to new treatment options for the world’s most common cancer. Immunotherapy harnesses the power of the body’s immune system to kill cancer cells.

About one in eight women in the U.S. and one in 1,000 men will develop invasive breast cancer during their lives. Breast cancer is the second leading cause of cancer death in women in the U.S., trailing only lung cancer. The American Cancer Society estimates that about 43,600 U.S. women will die from the disease this year. [READ MORE](#)



Yanzhang “Charlie” Wei

Justice Deferred: Race and the Supreme Court

In the first comprehensive accounting of the U.S. Supreme Court’s race-related jurisprudence, distinguished historian Orville Vernon Burton of Clemson University and renowned civil rights lawyer Armand Derfner scrutinize a legacy too often blighted by racial injustice.



Burton

The Supreme Court is usually seen as protector of our liberties: it ended segregation, was a guarantor of fair trials, and safeguarded free speech and the vote. But this narrative derives mostly from a short period from the 1930s to the early 1970s. Before then, the Court spent a century largely ignoring or suppressing basic rights, while the 50 years since 1970 have witnessed a mostly accelerating retreat from racial justice.

From the Cherokee Trail of Tears to *Brown v. Board of Education* to the dismantling of the Voting Rights Act, Burton and Derfner shine a powerful light on the Court’s race record—a legacy at times uplifting, but more often distressing and sometimes disgraceful. For nearly a century, the Court ensured that the nineteenth-century Reconstruction Amendments would not truly free and enfranchise African Americans. And the twenty-first century has seen a

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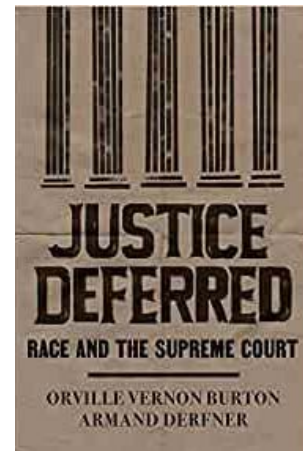
Impacts, Honors and Achievements

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steady erosion of commitments to enforcing hard-won rights.

Their book, *Justice Deferred*, is the first that comprehensively charts the Court's race jurisprudence. Addressing nearly 200 cases involving America's racial minorities, the authors probe the parties involved, the justices' reasoning, and the impact of individual rulings. We learn of heroes such as Thurgood Marshall; villains, including Roger Taney; and enigmas like Oliver Wendell Holmes and Hugo Black. Much of the fragility of civil rights in America is due to the Supreme Court, but as this sweeping history also reminds us, the justices still have the power to make good on the country's promise of equal rights for all.

"American citizens may not be aware of this history of race and the role the Supreme Court has played in race relations," said Burton, Judge Matthew J. Perry, Jr. distinguished professor of history. "We have studied the end of the first Reconstruction in which the Supreme Court played a heavy role. And we have seen the end of the second Reconstruction, in which the Supreme Court also played a heavy role. The future is here and we see a potential pattern of undoing the gains of racial reconciliation." [READ MORE](#)



Field

Town Hall Meetings and the Death of Deliberation

In his book, *Town Hall Meetings and the Death of Deliberation*, Clemson's Jonathan Beecher Field tracks the permutations of the town hall meeting from its original context as a form of democratic community governance in New England into a format for presidential debates and a staple of corporate governance. In its contemporary iteration, the town hall meeting models the aesthetic of the former but replaces actual democratic deliberation with a spectacle that involves no immediate electoral stakes or functions as a glorified press conference. Urgently, Field notes that though this evolution might be apparent, evidence suggests many U.S. citizens don't care to differentiate. Field is an associate professor of American literature whose research interests include 17th Century American literature, settler colonialism, puritanism, disability.

Best Management Practices for Carolina Sports Fields

Sports fields across the Carolinas are said to be some of the finest in the world, and information found in a book written by turfgrass experts from Clemson University and North Carolina State University can help keep these fields in excellent shape.

Best Management Practices for Carolina Sports Fields was written by Clemson professor and turfgrass master Bert McCarty and North Carolina State University professor Grady Miller.

In this book, McCarty and Miller provide information related to designing sports fields, construction and installation of sports fields, agronomic practices to maintain the fields, and integrated pest management strategies including safe and effective use of pest-control products. Although the name states "Carolina," the information is applicable worldwide.

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Impacts, Honors and Achievements

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This is the 15th book McCarty has authored or co-authored.

“There is a dire need for this information, especially for those not as familiar with the science of constructing, installing and maintaining sports fields,” McCarty said. “Writing books also forces authors to keep up-to-date with the latest agronomic and technological advances in this field. These types of publications indicate professors associated with Clemson and N.C. State universities are leaders in this field and are great resources for people interested in proper sports field design, installation and maintenance.”



Namara

Ph.D. student named among top young innovators

MIT Technology Review included Ph.D. student Moses Namara in its global list of 35 innovators under 35 years old for his work with the nonprofit Black in AI. Namara co-created programs that provide support to Black junior researchers as they apply for graduate school, navigate graduate school and then look for jobs after graduation. Namara holds a Master of Computer Science from Clemson and is now pursuing a doctorate in human-centered computing under the guidance of Associate Professor Bart Knijnenburg.

[READ MORE](#)

Alumnus Charles Dove wins Hertz Fellowship

Clemson University alumnus Charles Dove has won the Hertz Fellowship, one of the nation’s most competitive awards for graduate students. Out of more than 900 applicants from around the world, Dove was among 12 this year to receive the fellowship. It comes with five years of funding up to \$250,000 and the freedom to pursue innovative projects wherever they may lead, according to The Hertz Foundation website. Dove received a Bachelor of Science in electrical engineering from Clemson in May 2020 and is now pursuing a Ph.D. at the University of California, Berkeley. [READ MORE](#)



Dove

National competition honors Clemson students’ architectural innovation

A prestigious national competition focusing on architectural innovation has once again recognized Clemson Master of Architecture students for their work on sustainable design.

For the fifth year in a row, Clemson students have been honored by the American Institute of Architects Committee on the Environment (AIA COTE). Each year, the COTE Top Ten for Students competition honors sustainable design excellence.

The winning Clemson students are Thalia Jimenez Escobar and Daniel Mecca for their project “Growing Together Under One Roof.” Their winning design was a concept for a transitional housing project for domestic violence survivors in Alaska. The design combines public and private spaces to accommodate residents at different stages of the recovery process.

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Impacts, Honors and Achievements

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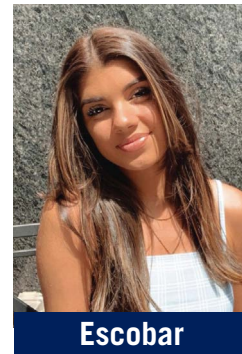
“Growing Together Under One Roof” is designed to be a 165,309-square-foot facility for domestic violence survivors who may not have the resources needed to escape difficult home lives. Jimenez Escobar and Mecca incorporated multiple renewable energy sources into the design to ensure sustainability.

Jurors commented that the successful project exhibited “a strong sense of integration between the buildings, sustainable responses and building performance. The design creates something unique in an already harsh climate by developing a community of support. The unique climate location in Alaska along with the project’s environmental solutions elevates the design.”

Projects created at Clemson have received seven of the 50 COTE student honors in the past five years, representing a full 14 percent of the awards presented nationwide. The annual successes reflect the School of Architecture’s commitment to sustainability and excellence in design. [READ MORE](#)



Growing Together Under One Roof



Escobar



Mecca

Ph.D. student IDs genetic markers for healthy, hearty lentils

A Clemson University doctoral student has determined genetic markers that can be used to breed new varieties of lentils, a nutritious crop grown worldwide.

Lentils are cool-season pulse crops that belong to the legume family. Known as “poor man’s meat,” lentils are inexpensive to grow, high in protein, low in fat, and an ideal crop for use in feeding low-income populations.



Johnson

They also contain significant amounts of prebiotic (low digestible) carbohydrates – specialized fibers that help plants better tolerate cold and drought and also support healthy guts in humans.

Nathan Johnson of Grand Rapids, Minn., and a team of researchers are studying how to enhance these prebiotics to develop new lentil lines that can be grown in South Carolina’s climate. Based on this information, new plant lines can be bred to include or not include certain gene variants. He is focusing his graduate studies on identifying DNA regions associated with prebiotic concentrations in lentils.

“We have identified several significant genetic variants associated with these prebiotic carbohydrates,” said Johnson, who plans to be a medical doctor. “In the future, plant breeders will be able to use these genetic markers based on these findings to develop

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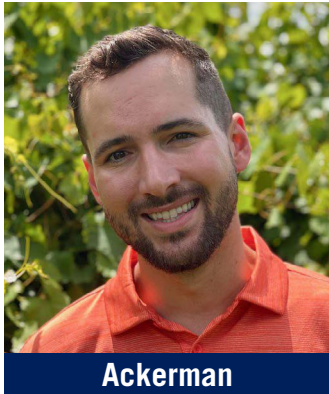
Impacts, Honors and Achievements

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improved lentil varieties ... Genome-wide mapping of prebiotic carbohydrates is important for creating new breeding lines that can withstand climate change and help provide global nutritional security.”

Johnson is working with Dil Thavarajah, Clemson associate professor; Lucas Boatwright, a Clemson Plant and Environmental Science Department research assistant professor; Stephen Kresovich, Clemson Robert and Lois Coker Trustees Endowed Chair of Genetics, and lentil breeder Shiv Kumar Agrawal, who leads the Food Legumes Program for ICARDA (International Centre for Agricultural Research in the Dry Areas) in Rabat, Morocco. Their research is supported by a grant from the United States Department of Agriculture’s Institutes of Food and Agriculture (USDA-NIFA).

Researchers use modern technology in this study. Boatwright is performing bioinformatics to sequence lentil varieties and develop computer programs and genetic resources for research. He is using Clemson’s Palmetto Cluster to process the lentil genetic data. [READ MORE](#)



Ackerman

Clemson Ph.D. student named national scholar

A Clemson University doctoral student has been named a National Association of Plant Breeders Borlaug Scholar.

The Borlaug Scholars Program is named after Norman Borlaug, who was a renowned plant breeder largely credited with igniting the Green Revolution and fighting worldwide hunger. A.J. Ackerman of Prophetstown, Ill., is majoring in Plant and Environmental Sciences. He studies under the direction of Rick Boyles, an assistant of plant breeding and genetics at the Clemson Pee Dee Research and Education Center.

Ackerman plans to continue working in plant breeding and “develop cultivars that are impactful on farms in private industry,” he said, adding that he will “greatly benefit” from what he has learned during his time at Clemson.

Borlaug Scholars receive financial support to attend the National Association of Plant Breeders Annual Meeting. [READ MORE](#)

Retired Clemson LPH director earns Order of the Palmetto

Recently retired state veterinarian and director of Clemson Livestock Poultry Health, Boyd Parr was awarded the Order of Palmetto at the South Carolina Farm Bureau Executive Committee meeting. Parr still serves as an adjunct professor in the College of Agriculture, Forestry and Life Sciences at Clemson University.

The Order of the Palmetto is South Carolina’s highest civilian honor, recognizing individuals for their extraordinary achievements, service and contributions to the state. A once in a lifetime achievement, the award is presented only to natives or residents of the State.

Growing up on a dairy farm in Newberry, S.C., Parr has spent his life actively involved in the agriculture community. He served two terms on the Secretary’s Advisory Committee on Animal Health for USDA and is the past president of the U.S. Animal Health Association and the Southern Animal Health Association. [READ MORE](#)



Parr

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Impacts, Honors and Achievements

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One-of-a-kind interpreting center renewed to serve S.C. educators

The South Carolina Educational Interpreting Center at Clemson University is reopening for a new five-year cycle thanks to \$1.4 million in funding from the South Carolina Department of Education. The center, which trains interpreters working in K-12 schools with specific skills for educational interpreting, is the only one of its kind in the nation.

This ensures that all students who are deaf or hard of hearing have equitable access to the school setting, including instruction as well as extracurricular services, through highly qualified educational interpreters.”

The SCEIC first launched in 2016 after Clemson ASL faculty and the SC Department of Education saw that not all interpreters working in K-12 public schools had the competencies needed for the classroom environment, and that local school districts were not equipped to evaluate the quality of interpretation.

“The general population doesn’t know when interpreting is happening, when it’s effective, or when it’s not,” said Stephen Fitzmaurice, associate professor of Interpreting: ASL, who oversees the Center. He says the challenges of effective interpreting only increase when working with children.

“The general education for any student, hearing or deaf, is to learn language as you’re going through the educational program. And so, how do you interpret for someone who doesn’t have even the foundations of language?” he said. “It’s akin to asking you to read ancient Chinese characters without knowing any Chinese.” [READ MORE](#)



Fitzmaurice

Clemson faculty earn distinguished Roy Professorship

Three Clemson University professors will receive support for research on health care provider well-being, genetics contributing to opioid addiction, and the improvement of microbial infection treatments – thanks to support from the Dr. Wallace R. Roy Distinguished Professorship program.

Emil Alexov and Dev Arya, both professors in the Clemson University College of Science, and Marissa Shuffler, an associate professor in the Clemson University College of Behavioral, Social and Health Sciences, have been named as Roy Professors for the next three years.



Alexov

The professorship is named for Wallace R. Roy, one of the nation’s leading food technologists and a 1926 Clemson alumnus who established a charitable trust for the benefit of the University. The endowed professorship provides supplemental support for outstanding faculty members for research with Prisma Health or other health system partners.

Emil Alexov, a professor in the Department of Physics and Astronomy, is working with William Hand at Prisma Health to reveal the genetic signature and molecular mechanisms of opioid addiction. The goal is to identify genetic differences common for opioid-addicted individuals that are not present in non-addicted individuals and

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Impacts, Honors and Achievements

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Arya

create a list of genes and variants linked to opioid addiction. He is also working with Roger Stevenson, MD, and Steven Skinner, MD, at Greenwood Genetic Center. Their research goal is to reveal the effects of human genetic variants and their link with human diseases, specifically mental disorders. They hope this research will help provide early diagnostics and treatment. In addition to his research, Alexov is leading the effort of 35 Clemson faculty to establish a new master's and Ph.D. program in medical biophysics.

Dev Arya is a professor in the Department of Chemistry. He has been working with MUSC (Medical University of South Carolina) and the UofSC (University of South Carolina) School of Medicine Greenville on several projects, including SARC-COV2 inhibitors, setting up a central repository for clinical fungal and bacterial isolates, and building a network of local researchers and clinicians interested in studying and treating microbial infections. During his professorship, he plans to continue these collaborative projects and further build this network of researchers and clinicians.



Shuffler

Marissa Shuffler is an associate professor of industrial/organizational psychology in the Department of Psychology and director of Clemson's DIGITAL (Deriving Innovative & riGorous science for Teaming And Leading) Research Lab, supervising a team of graduate and undergraduate students. During her professorship, she plans to continue to expand her health care research on team well-being in the emergency medicine department and coordinate interventions for complex patient care multiteam systems.

[READ MORE](#)

A 'Silver Lining' to COVID?

In the midst of a global pandemic that negatively affected nearly everyone in some way, people were still able to identify some positive outcomes—a “silver lining”—in the situation.

These are the findings of Clemson University researchers who studied the reactions of individuals to COVID-19 in the early stages of the pandemic. The researchers also reported that the majority of respondents felt that even when things were arguably at their worst, people tended to reflect on and value similar aspects of their “new normal.”

The research was conducted by Robin Kowalski, professor in Clemson University Department of Psychology, and undergraduate students as part of Creative Inquiry, a University-wide program that engages students in research activities. Kowalski and students Hailey Carroll and Jordan Britt answered a call for COVID-related research put out by Creative Inquiry as part of the program's COVID Challenge.

The researchers collected data in June and July of 2020, with respondents only three months into the

“ For everyone who experienced loss during the pandemic, large or small, it was still a time to reflect or reframe, and there's real benefit in that.

Robin Kowalski,
professor of psychology



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Impacts, Honors and Achievements

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pandemic. The researchers asked participants to report their level of satisfaction in work, leisure, fitness, mental health, finances and other areas during three points: currently, six months prior to the study and their projected satisfaction six months later. An overwhelming majority of participants listed “more time with family and friends” as a primary benefit of COVID-19. They also reported more satisfaction with family. [READ MORE](#)



Foulger

Clemson's Foulger receives Fulbright award

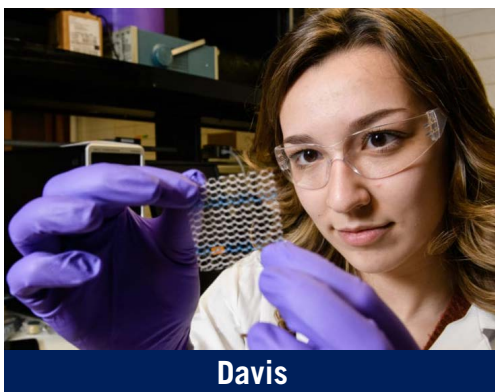
Stephen Foulger of Clemson University is headed to the Czech Republic to conduct artificial-intelligence research and help strengthen U.S. ties to the Central European nation, an opportunity made possible by a grant he is receiving from the Fulbright Foreign Scholarship Board.

Foulger serves as the Gregg-Graniteville Endowed Chair and Professor in Clemson's departments of Materials Science and Engineering and Bioengineering as well as the director of the University's Center for Optical Materials Science and Engineering

Technologies (COMSET).

As part of the Fulbright award, he will be researching memristors at the Institute of Macromolecular Chemistry, Czech Academy of Sciences in Prague and at Tomas Bata University in Zlín. Memristors are polymeric optoelectronic devices that can mimic biological synapses, raising the hope that they could be used in developing an “artificial brain” in the future, Foulger said.

Foulger has been collaborating with researchers at both universities for several years, and the Fulbright award will give them an opportunity to advance their work. [READ MORE](#)



Davis

Clemson's Davis earns prestigious astronaut scholarship

Lauren Davis, a senior bioengineering major, was recently selected for the Astronaut Scholarship, her third major award in less than two years. She previously was named a Beckman Scholar in 2020 and a Goldwater Scholar earlier this year.

Astronaut Scholarships go to college juniors and seniors who are studying STEM topics and intend to “pursue research or advance their field upon completion of their final degree,” according to the Astronaut Scholarship Foundation. Davis said the scholarship will help pay for her senior year tuition. She is among 60 students

from 44 universities to receive the scholarship, according to the Astronaut Scholarship Foundation.

The honor comes as Davis wraps up the research she has been conducting as part of the Beckman Scholars Program. The award opened new opportunities for her to extend her research into mesh implants used in hernia repair and pelvic floor surgery. She has been conducting the research under the guidance of Melinda Harman, an associate professor of bioengineering. [READ MORE](#)

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Impacts, Honors and Achievements

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Research introduces a regenerative food chain process that's safe, yet profitable



Roth

A regenerative and socially responsible approach to food production and distribution is crucial to long-term food security and fundamental to our ecological and human well-being, according to a study by an acclaimed researcher at Clemson University.

Recently published research by Burlington Industries Distinguished Professor of Supply Chain Management Aleda Roth introduces and compares two types of food chains – Conventional Food Supply Chains (CFSC) and Regenerative, Organic Food Value Chains (ROFVC). Moving from conventional to regenerative food chains is vital to our ecological, human, and socioeconomic well-being, according to Roth's research.

"A Tale of Two Food Chains: The Duality of Practices on Well-being," published in *Production and Operations Management*, delves into the entire food production and distribution system, from "dirt to table" by contrasting underlying problems of conventional supply chains and the benefits of organic, regenerative practices. [READ MORE](#)

Clemson marketing study named best paper

Integrating analytics into college-level business curriculum – across-the-board – is no simple task. Such was the topic of a study by two Department of Marketing researchers who won an award for their work on integrating analytics into higher-education curricula in a way that will enable students to develop the analytical competencies necessary to succeed in today's business world.

"Integrating Analytics into Marketing Curricula: Challenges and Effective Practices for Developing Six Critical Competencies" won the Best Paper Award from the Society for Marketing Advances, which publishes *Marketing Education Review*.

Marketing's Danny Weathers, professor, and Oriana Aragon, assistant professor, authored the paper that identified best practices in teaching marketing metrics and analytics.

"Whether it's marketing, finance or economics, instructors have unique challenges in teaching analytics because many students have little experience with statistics," Weathers said. "Twenty-first century business is requiring that analytics be integrated throughout the business disciplines and is something Dean (Wendy) York has deemed a competency that Clemson business students should have upon graduating."

Dean of the Wilbur O. and Ann Powers College of Business, York has identified Business Analytics as one of the College's Signature Programs, or business-critical competencies, necessary for 21st century business success.

"Business today is data-driven, so it's important our students are equipped with relevant and functional business analytics competencies no matter their area of study," she said. "Businesses are grasping analytics in making strategic decisions and our graduates must be proficient in understanding and utilizing analytics in order to achieve business success." [READ MORE](#)



Weathers



Aragon

[continued on next page](#) ►

Impacts, Honors and Achievements

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Clemson working to improve ocean health

Ocean health is a growing concern — and for good reason. The ocean covers over 70 percent of the Earth's surface and produces more than half the world's oxygen. It is home to more than 238,000 identified marine species and potentially hundreds of thousands yet undiscovered.



At Clemson University, research, teaching and outreach efforts are playing a critical role in understanding and communicating the importance of healthy oceans.

Microbiologist Barbara Campbell's collaborative research revealed the significance of bacteriophages — viruses infecting bacteria — and the crucial role they play in creating a healthy marine ecosystem, something scientists are just now beginning to understand.

Phages are known for their ability to modulate host cells, take over cellular metabolic processes and proliferate through a bacterial population. As many as 40 percent of bacteria are infected at any one time.



Campbell

“Viral infection of bacteria in certain environments is crucial to the ecosystem,” said Campbell, an associate professor in the College of Science's Department of Biological Sciences. “If there's a limited amount of nutrients available and some bacteria are lysed, those nutrients are released and taken up by other bacteria. It creates a viral-mediated microbial loop, a cycle where nutrients are being recycled between viruses, bacteria and other microbes.”

One mechanism phages use to alter the metabolic state of their host is through auxiliary metabolic genes. Sulfur is an essential nutrient to all forms of life, including bacteria. In normal marine ecosystems, the bacterial proteins transform sulfate to sulfide or vice versa and produce energy. When a virus has copies of that gene, it will make additional energy when it replicates.

Campbell and her collaborators discovered auxiliary metabolic genes associated with sulfur cycling in many viruses that infect bacterial host cells. They identified 191 phages in 12 environments that encoded auxiliary metabolic genes for the oxidation of sulfur and thiosulfate.

“Until now, we didn't know why these phages picked up these extra genes. We didn't know the purpose of the genes,” Campbell said. “Now we know they create more energy in the ocean ecosystem.”

The findings, published in the journal *Nature Communications*, could shift scientists' views of the importance of viruses in aquatic ecosystems. The article is titled “Ecology of inorganic sulfur auxiliary metabolism in widespread bacteriophages.” [READ MORE](#)

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Impacts, Honors and Achievements

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CLEMSON
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RESEARCH
FOUNDATION

curf.clemson.edu

Clemson faculty secure 15 patents

The Clemson University Research Foundation (CURF) is working to move the results of Clemson research from the lab to the marketplace where they can provide real-world benefit. Last year, CURF was able to assist faculty with securing 15 patents for technologies in areas ranging from agriculture to materials science, in an effort to advance innovation through protecting and developing university intellectual property. Below is a complete list of inventors who received a patent.



Roberts

Mark Roberts (chemical and biomolecular engineering) received a patent for his research on thermally responsive electrolytes for lithium-ion batteries. His technology utilizes a polymer electrolyte with temperature responsive properties that can be used to inhibit thermal hazards associated with high-power lithium-ion batteries.

Jeremy Mercuri (bioengineering) secured a patent for his positioning bracket technology that allows surgeons to manipulate multiple bone tunnel drill guides independently during arthroscopic orthopedic surgery.

Naren Vyavahare (bioengineering) received a patent for his targeted drug delivery technology that uses micro-sized drug carriers with elastin antibodies to deliver compounds that prevent the degradation of elastin in diseased tissue.

Valery Bliznyuk (environmental engineering and earth sciences) and Timothy Devol (environmental engineering and earth sciences) obtained a patent for their technology that utilizes a new class of organic pyroazoline-based fluorophores that offer higher efficiency of plastic scintillators and a reduced cost of fluorophore loading.

Hai Xiao (electrical and computer engineering) received a patent for his research on fiber-optic micro-probes that can measure the acidity level, temperature, and antigens in cells.



DesJardins

John DesJardins (bioengineering) and Jeffrey Anker (chemistry) received a patent for an orthopedic plate strain indicator that utilizes a simple and robust readout that can be easily adapted into current surgical workflow for the evaluation of fracture healing and bone fusion.

Laine Mears (automotive engineering) secured a patent for his innovative assisted flow drilling technique that allows for the joining of stackups that cannot be currently joined by flow drill screws and can do so in a faster manner than current methods.

Jeremy Mercuri (bioengineering) obtained a patent for his development of a biomaterial that mimics the structure and function of human nucleus pulposus to halt the progression of intervertebral disc degeneration.

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Impacts, Honors and Achievements

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Jeremy Mercuri (bioengineering) received a patent for a collagen-based, cell friendly patch for repair of the annulus fibrosus within the intervertebral disc using a simple and scalable process.

Agneta Simionescu (bioengineering), Leslie Sierad (bioengineering), and Dan Simionescu (bioengineering) have secured a patent for their self-adjusting tissue holder technology with flow placement that can be utilized for universal integration into the tissue preparation process.



Kendall Kirk (agriculture, forestry, and life sciences) obtained a patent for his innovative approach to creating crop yield maps. This technique utilizes inexpensive sensors to monitor the mass flow intake of hay balers.

Stephen Kresovich (agriculture, forestry and life sciences) and Richard Boyles (agriculture, forestry and life sciences) have secured a patent for their development of an inbred sorghum restorer line that can serve as a male parent in standard seed production systems.



Daniel Whitehead (chemistry) has secured a patent for an innovative method to create environmentally friendly disposable poly(lactic) particles that can degrade a variety of pollutants.

Mary Beth Johnstone (Okeanos Research Laboratory) and Andrew Mount (Okeanos Research Laboratory) obtained a patent for their highly effective and safe antifouling peptide innovation that can potentially be incorporated into epoxy-based paints to deter fouling marine invertebrates from settling.

Daniel Whitehead (chemistry) and James Morris (Eukaryotic Pathogens Innovation Center) have received a patent for their novel compounds that are active against parasitic infections, offering an avenue for dramatically improved treatments of parasitic infections.

CURF and the Division of Research work together to support Clemson-affiliated inventors and entrepreneurs through patent protection, marketing, education, material transfer and license negotiation services.

By The Numbers

Numbers below include data from FY2017-2021

290

Invention Disclosures

74

Patents Issued

66

Licenses/Options

\$2M

Licensing Revenue

ACC Vice Presidents for Research meeting

The top research administrators at Atlantic Coast Conference universities joined Clemson University vice president for research Tanju Karanfil at Clemson's Lowcountry campus Aug. 13 to brainstorm ideas to enhance university research.

The group also toured the Clemson University Restoration Institute.

“Sharing ideas and experiences with administrators of some of the nation’s top institutions has been very rewarding and I believe will be helpful to our ongoing efforts to advance research at Clemson,” Karanfil said. “This is a very fruitful endeavor that I look forward to continuing in the future.”

The following individuals participated in the annual meeting, which has twice been held at Clemson:

- Thomas Chiles, vice provost for research and academic planning, Boston College (attended virtually)
- Laurel Fulkerson, interim vice president for research, Florida State University
- Chaouki Abdallah, executive vice president for research, Georgia Tech
- Mladen Vouk, vice chancellor for research and innovation, North Carolina State University
- Ramesh Raina, interim vice president for research, Syracuse University
- Bob Bernhard, vice president for research, University of Notre Dame
- Melur “Ram” Ramasubramanian, vice president for research, University of Virginia
- Keith Bonin, associate provost for research and scholarly inquiry, Wake Forest University



FOCUS ON FACULTY

This section highlights achievements of three faculty members from each college. Entries were submitted by the colleges.

Executive Summary

- Click the links below to read about faculty from the respective college.
 - » [College of Agriculture, Forestry and Life Sciences \(pages 38-40\)](#)
 - » [College of Architecture, Art and Humanities \(pages 41-43\)](#)
 - » [College of Behavioral, Social and Health Sciences \(pages 44-46\)](#)
 - » [College of Business \(pages 47-49\)](#)
 - » [College of Education \(pages 50-52\)](#)
 - » [College of Engineering, Computing and Applied Sciences \(pages 53-55\)](#)
 - » [College of Science \(pages 56-58\)](#)



College of
**AGRICULTURE, FORESTRY
AND LIFE SCIENCES**

Sandra E. Branham, PhD

Assistant Professor

Plant and Environmental Sciences



The primary goal of Branham's research program is the improvement of vegetable crops for production in the Southeastern U.S. Her focus is on genomics-assisted breeding through 1) development of genomic resources, 2) exploring the genetic and phenotypic diversity of the USDA germplasm repositories, 3) identifying QTL associated with resistance to heat and disease, 4) developing and testing molecular markers associated with phenotypes of interest, and 5) population development for marker validation, trait introgression and gene pyramiding.

Branham has made substantial progress in initiating a breeding program at Clemson's Coastal Research and Education Center (CREC) through a new position that has required building resources and infrastructure. She is using start-up funds and a S.C. Department of Agriculture-ACRE grant to build resources that will increase the research productivity of her laboratory and CREC, including a 95' x 30' hoop house, dew chamber (for pathology projects), vernalization chamber, and growth chamber. There was no molecular breeding laboratory located at CREC so Branham has started the process of converting a lab space for this purpose. She has received two USDA grants that will fund the first four years of her research. Her research lab consists of two Ph.D. students, one master's student, and two fulltime technicians. Although her appointment is 100% research, she has built strong relationships with some of the most important vegetable stakeholders in South Carolina. The growers and processors will have direct interaction throughout the breeding process to ensure the germplasm released from Branham's program will increase the productivity and profits of South Carolina Agribusiness.

Select Accomplishments

- Published 25 peer-reviewed journal articles.
- Received \$426,761 from a \$500,000 research grant from the USDA.
- Received \$134,835 from a \$7,050,000 research grant from the USDA.
- Received a \$40,000 research grant from the SCDA.
- Gave a keynote presentation at Cucurbitaceae 2018.
- Gave a podcast interview for Seed World Magazine (topic: marker-assisted selection of disease resistance in watermelon).
- Serves on the CAFLS Variety Release Recommendation Committee.
- Serves as an editorial board member for three international journals, *Theoretical and Applied Genetics*, *Vegetable Research* and *Frontiers in Plant Science*.



College of
**AGRICULTURE, FORESTRY
AND LIFE SCIENCES**

Mani Rouhi Rad, PhD

Assistant Professor

Agricultural Sciences



Rouhi Rad is a natural resource and environmental economist who studies the management of natural resources and environmental externalities. In his research, he explores the effect of biophysical characteristics of natural resources and the institutional settings for their management on the resource use decisions of individuals and firms. He has also explored the role those biophysical characteristics play on the effectiveness of different resource management and environmental policies. He is an economist who has extensive experience working with researchers from different disciplines including hydrology, crop science and engineering.

Rouhi Rad's current research projects are funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA), U.S. Department of Interior, and U.S. Forest Service. In these projects, he studies the management of salinity in irrigated agricultural regions, scope for a soil carbon offset market for agricultural producers, river basin planning in South Carolina, and the ecosystem service effects of forest fires. In Rouhi Rad's previous projects, he has studied the management of water resources in the High Plains Aquifer, led the development of a hydro-economic model called MOD\$AT that integrates models from economics, hydrology, crop simulation, and climate simulation. Currently, his research lab consists of one postdoctoral fellow, and two master's students.

Select Accomplishments

- Organized and co-convended a session on the American Geophysical Union.
- Published 11 peer-reviewed journal articles, including three papers in two top environmental and resource economics journals, and four papers in interdisciplinary journals.
- Received a \$499,786 research grant from the USDA NIFA.
- Received a \$86,849 research grant from the USDA NIFA.
- Received a \$38,521 research grant from the USDA NIFA.
- Received a \$26,051 cooperative grant from the U.S. Forest Service.
- Received a \$124,999 research grant from the U.S. Department of Interior.
- Served as a reviewer for Southern SARE Graduate Student Grants.
- Served as abstract reviewer for four conferences.
- Serves on the Faculty Advisory Council.



College of
**AGRICULTURE, FORESTRY
AND LIFE SCIENCES**

Jose Payero, PhD

Assistant Professor

Agricultural Sciences



Payero is an irrigation engineer located at Clemson's Edisto Research and Education Center (EREC) where he conducts his research and provides Extension programming. With a focus of on-farm agricultural water management, especially related to situations where water is limited, Payero employs modeling and direct measurement of crop water use, crop response to water stress, water use efficiency, plant-water-atmosphere interactions, adaptation strategies for climate change and climate variability, irrigation scheduling, and the development of online decision support tools for irrigation planning and irrigation scheduling. Payero has more than 120 research and extension publications, covering a variety of subjects related to irrigated agriculture, including irrigation water management, crop nutrition, crop evapotranspiration, climate change, canopy energy balance, irrigation decision support systems, crop modeling, and remote sensing, among others.

Payero is the lead principal investigator on more than \$1 million in current grant-funded projects in the past two years. His work as lead investigator at Clemson University has been supported by the USDA Agricultural and Food Research Institute, the S.C. Cotton Board, the S.C. Peanut Board, the S.C. Peach Council, and Cotton Incorporated, as well as Monsanto. As a co-investigator, Payero has recently collaborated on multidisciplinary projects with faculty at EREC and the Baruch Institute of Coastal Ecology and Forestry. Over the past two years, these five multidisciplinary projects have received nearly \$2.5 million in federal funding.

Select Accomplishments

- Received a \$497,189 USDA award: "On-Farm Demonstration and Evaluation of Cloud-based Soil Moisture Monitoring Technologies for Irrigation Scheduling to Enhance Farm Profitability and Environmental Quality."
- Received a second USDA award for \$453,405: "Development of Site-Specific Water and Nutrient Management."
- Received the "NIFA Partnership Award for Multistate Efforts."
- Earned the American Society of Civil Engineers (ASCE) Journal of Irrigation and Drainage Engineering Honorable Mention Paper Award.
- Awarded the American Society of Agricultural and Biological Engineers (ASABE) blue ribbon award for an outstanding entry in the Educational Aids Competition.
- Received the Bureau of Reclamation Commissioner's Water Conservation Award.



College of
**ARCHITECTURE, ARTS
AND HUMANITIES**

Anjali Joseph, PhD

Endowed Chair

Architecture + Health Design and Research



Joseph is the endowed chair in Architecture + Health Design and Research at Clemson University and also is a professor of architecture. A trained architect, Joseph has spoken at events worldwide. At Clemson, she served as a principal investigator on several grants from different foundations such as the Robert Wood Johnson Foundation, the Agency for Healthcare Research and Quality, the U.S. Green Building Council and the Kresge Foundation. Her work has been published in many academic journals and magazines. She frequently peer reviews articles for journals. Joseph obtained her Ph.D. with a focus on architecture, culture and behavior from the Georgia Institute of Technology, a master's degree in architecture from Kansas State University and a bachelor's degree in architecture from the School of Planning and Architecture in New Delhi, India.

Select Accomplishments

- Earned the Clemson University Research, Scholarship and Artistic Achievement Award (URSAAA) for having a publication exceed 1,000 citations.
- Serves on an independent review panel on military medical construction standards for the Defense Health Agency.
- Serves as principal investigator on a multi-year patient safety learning lab funded by AHRQ focused on designing safer and more ergonomic operating rooms.
- Recognized as Researcher of the Year in 2018 by the Healthcare Design Magazine.



College of
**ARCHITECTURE, ARTS
AND HUMANITIES**

Mark J. Spede, PhD

Director of Bands, Professor

Performing Arts



Spede is professor, director of bands, director of Tiger Band, and conductor of the Symphonic Band at Clemson University, where he administrates the band program (symphonic, athletic, and jazz bands). Spede is the recipient of the Clemson University 2009 Dean's Award for Excellence in Teaching (College of Architecture, Arts and Humanities), and three Clemson University Board of Trustees Awards for Faculty Excellence (2008, 2009, and 2012). He teaches a number of courses, including two for the Calhoun Honors College: aesthetics of music and science of music. He served as assistant conductor of the Dallas Wind Symphony, where he also helped produce two of their recordings. His professional performing experience includes orchestra (principal percussion in the Gainesville Chamber Orchestra, Muncie Symphony Orchestra, Ann Arbor Symphony Orchestra, Flint Symphony Orchestra), jazz (performing with such artists as Randy Brecker, Ray Brown, Pete Christlieb, Dennis DiBlasio, Duffy Jackson, Dave Pell, Bobby Shew, Marvin Stamm, Bill Watrous, Ernie Watts and Phil Wilson), as well as at Walt Disney World.

Select Accomplishments

- He is co-chair of the International Performing Arts Aerosol Study in response to COVID-19 that has allowed thousands of music students to continue to play this school year.
- He served the College Band Directors National Association (CBDNA) in a number of capacities. From 2003 to 2005, Spede served as state chair for South Carolina. He also served on the CBDNA "New Era Think Tank" from 2005 to 2007 and served as chair of the "Athletic Band Task Force" from 2005 to 2009. He served as president of the Southern Division of CBDNA (encompassing 11 southern states) and currently serves as national president. He published in *Current Research in Digital History* 1 (2018), "Digitally Analyzing the Uneven Ground: Language Borrowing Among Indian Treaties."
- His wind band arrangements and transcriptions are published by Peer Music, Schirmer, Boosey and Hawkes, and Carl Fischer, including "D.C. Fanfare" by John Corigliano, "Red Cape Tango" by Michael Daugherty, "Wedding Dances from Bandanna" by Daron Hagen, "Acrostic Song" by David Del Tredici, and "Millennium Canons" by Kevin Puts.
- He is on the team to produce the first ever virtual college marching band involving 1,600 performers from 200 college bands.



College of
**ARCHITECTURE, ARTS
AND HUMANITIES**

Valerie A. Zimany, PhD

Chair, Professor

Art



Zimany is chair of the Department of Art and joined Clemson's faculty in 2010. Prior to Clemson, she taught ceramics and foundations at Lawrence University in Appleton, Wisc., as well as ceramics at Hope College in Hope, Mich., and the Urban Institute of Contemporary Art, Grand Rapids, Mich. After completing her MFA studies at Kanazawa College of Art as a Fulbright Fellow and Japanese Government (Monbusho) Scholar, Zimany spent three years in residency at the Utatsuyama Craft Workshop in Kanazawa, Japan, during which she researched contemporary craft and Kutani overglaze enamels. She was recently honored with a second Fulbright grant by the U.S. Department of Education and returned to Kanazawa's Institute of Art & Design as a guest researcher. Zimany exhibits both nationally and internationally, and her work is held in multiple public and private collections, including the Taipei Yingge Ceramic Museum, Taiwan; the American Museum of Ceramic Art, Pomona, Calif.; the World Ceramic Museum at Icheon, Korea; and the Slovenia National Museum in Metelkova, Slovenia.

Select Accomplishments

- Featured in the Lark Books 500 Ceramic Sculptures and 500 Prints on Clay, Ceramics Art and Perception magazine, and is the subject of a full feature article, "Valerie Zimany: Recasting the Japanese Tradition" in Ceramics Monthly magazine.
- She was named an American Craft Council Searchlight Artist, a Ceramics Monthly Emerging Artist
- She was a finalist for the Society for Contemporary Craft's Raphael Founder's Prize
- She has received two international prizes - the Award of Excellence at the Cluj International Ceramics Biennale in Cluj-Napoca, Romania, and the Grand Prize of Medalta International Artist in Residence's annual juried exhibition
- Her major residencies include the Archie Bray Foundation for the Ceramic Arts, at Medalta International Artists in Residence, STARworks Ceramics, and as the Antinori Distinguished Fellow at Hambidge Center for Creative Arts and Sciences.



College of
**BEHAVIORAL, SOCIAL
AND HEALTH SCIENCES**

John M. Coggeshall, PhD

Professor

Sociology, Anthropology and Criminal Justice



Coggeshall is a cultural anthropologist who studies American regional and ethnic groups in the United States, focusing on South Carolina. Coggeshall teaches Introduction to Anthropology, Cultural Anthropology, North American Indian Cultures, Anthropological Theories, and Ethnographic Methods (both undergrad and graduate students). He has been with Clemson University since January 1988

Several years ago, Coggeshall published *Liberia, South Carolina: An African American Appalachian Community* (University of North Carolina Press, 2018), an oral history about a small community of African Americans in upper Pickens County. The residents are the descendants of freed slaves still living on land acquired by their ancestors after 1865, despite the challenges of surviving during Reconstruction, Jim Crow, and the Civil Rights movement. Along with the matriarch of the community, Mable Owens Clarke, Coggeshall has given many talks on the history of the community, including one for the School of Arts and Sciences Speaker's Series for Greenville Technical College (February 2021). Clarke and Coggeshall were also interviewed for an article in *Eating Well* magazine (July 2020).

Currently under contract is another book, *Something in These Hills: Interpreting the Southern Appalachians* (University of North Carolina Press, forthcoming). This book consists of interviews with residents in the area about their views of family land – how and why land is critically and symbolically important to long-term residents.

Initial writing has begun on a third book, “A Slow Life But a Good Life: Stories From the Mountains,” incorporating interesting cultural material that was not included in the other two books.

For Fall Semester 2019, Coggeshall spent the semester as an Erasmus Scholar in the Dept. of Ethnology, Charles University, Prague, Czech Republic.

Select Accomplishments

- Co-principal investigator (with Aby Sene-Harper, PRTM) “Driving Tour of African American Heritage Sites in Upper Pickens and Oconee Counties,” with the Appalachian Regional Commission, \$49,000. To be re-submitted this fall.
- Currently serves on the University General Education Committee and University Undergraduate Curriculum Committee
- Currently chairs the Curriculum Committee for CBSHS and the Department Curriculum Committee.



College of
**BEHAVIORAL, SOCIAL
AND HEALTH SCIENCES**

Laura Olson, PhD

Thurmond Professor

Political Science



Olson is a political scientist who studies contemporary religion and politics with emphases on public opinion and civic engagement. She has published articles in a variety of leading scholarly journals as well as nine books, most recently *Religion and Politics in America: Faith, Culture, and Strategic Choices* (Routledge, 2018). Her work has been supported by the John Templeton Foundation, the Louisville Institute, the American Academy of Religion, and the Society for the Scientific Study of Religion.

Olson was a U.S. Fulbright Scholar to Italy last spring. She had to return to the U.S. four months early due to the Covid-19 pandemic. She has also served as president of the Society for the Scientific Study of Religion, editor-in-chief of the *Journal for the Scientific Study of Religion*, and an affiliated scholar with the Public Religion Research Institute. A native of Wisconsin, she teaches undergraduate and graduate courses on American politics, religion and politics, and collective action.

Select Accomplishments

- Fulbright U.S. Scholar-Italy, Università degli Studi di Bari “Aldo Moro,” 2020.
- Guest Scholar, Fulbright Finland, Åbo Akademi University and the University of Turku, 2020.
- Published 5 peer-reviewed journal articles and 2 book chapters since 2019.
- Received Clemson University Research, Scholarship, and Artistic Achievement Award, 2020
- Received Award of Excellence in Student Engagement, College of Behavioral, Social, and Health Sciences, 2020.
- Currently serving as past president of the Society for the Scientific Study of Religion.
- Currently serving as co-editor of a University Press of Kansas book series on American religion, politics, and law.



College of
**BEHAVIORAL, SOCIAL
AND HEALTH SCIENCES**

Veronica G. Parker, PhD

Professor

School of Nursing



Parker is an alumni distinguished professor at Clemson University, and the director of the Center for Research on Health Disparities. She earned a Ph.D. in biostatistics from the Medical University of South Carolina, a BS in engineering analysis (concentration in bioengineering) from Clemson University, and a BS in physics-engineering from the College of Charleston. Parker teaches in the undergraduate and graduate programs at Clemson, in the areas of nursing research, clinical epidemiology, and research analysis (biostatistics). Parker has expertise in the areas of categorical data analysis, statistical analysis of chronic disease registry data, predictive modeling/analytics, path analyses, big data analytics, and program evaluation (to name a few). She has secured more than \$10 million in collaborative internal and external research funding thus far at Clemson. Parker's current research interests are in the areas of health disparities/health equity, quality of life and well-being, resilience, spirituality, and health risk behaviors in vulnerable and underserved populations.

Select Accomplishments

- Appointed member of the Advisory Committee on Minority Health, Office of Minority Health (OMH), U.S. Department of Health and Human Services (HHS), (Fall 2018-2022).
- Invited work group member for the U.S. Department of Health and Human Services (HHS) Office of Minority Health's (OMH's) Think Cultural Health team advising the development of an online continuing education program for nurses regarding culturally and linguistically appropriate services (CLAS), (November 2020 - 2021).
- Invited/selected reviewer for the Office of the Assistant Secretary for Health (OASH), Office of Minority Health's Sickle Cell Disease Data Collection Platform grant, (August/September 2020).
- Selected for the fourth class of the President's Leadership Institute (PLI) at Clemson University, (May 2019 – April 2020).
- Appointed as faculty scholar of the Clemson University School of Health Research (CUSHR), at the rank of professor, by the executive VP for academic affairs and provost, April 1, 2015-2021. Reappointed: May 15, 2021-June 30, 2024.
- Currently serving as co-investigator/evaluator on several externally funded (e.g., HRSA, SAMHSA, HSC/PRISMA) collaborative research projects totaling more than \$4.1 million.



Bill Kettinger, PhD

William S. Lee Distinguished Professor

Management



Kettinger is a management professor who studies the strategic impacts of Information Technology (IT) on businesses, industries and communities. His research addresses vexing problems facing managers challenged in exploiting IT. Current research projects are supported by such companies as FedEx, IMC, and Freight Waves. Kettinger currently teaches information systems courses in the Clemson MBA program and Ph.D. research seminars. He has chaired, or co-chaired, 14 Ph.D. dissertations. He also serves as the co-faculty advisor for the undergraduate student chapter of the Association of Information Systems. Prior to joining Clemson, he served as professor and FedEx chair of excellence in MIS at the Fogelman College of Business and Economics at The University of Memphis. Kettinger has regularly taught in the MBA programs at IMD in Lausanne Switzerland, Wirtschaftsuniversität Wien, Vienna Austria and at the Tecnologico de Monterrey in Mexico. Kettinger has over 100 publications, including four books and 80 refereed journal articles. He is a senior editor of MISQ Executive, MIS Quarterly (emeritus) and serves, or has served, as an associate editor of Information Systems Research, MISQ and JAIS and has served as a special editor for JMIS on three occasions.

Select Accomplishments

- Clemson University Research, Scholarship and Artistic Achievement Award, May 8, 2019.
- Ranked as 28th among the most productive researcher in the world publishing in the Association of Information Systems six top journals (AIS-6) between 1990-2017. Ranked as 60th among the most productive researcher in the world publishing in the Financial Times-50 (FT-50) top MIS journals (MISQ, ISR, JMIS) between 1990-2017.
- Co-Chair, Doctoral Consortium, Association of Information System (AIS), Annual Meeting – New Orleans, 2018; Faculty Mentor, AIS Doctoral Consortium: 2013, 2016, 2017.
- Members of the Finance and Compliance Technical Steering Committee, Blockchain in Transportation Alliance (BITA), 2018-ongoing.
- Member, Clemson Academic Technology Council, 2019-2022; Clemson MBA Council, and the Council's Curriculum Review Subcommittee, 2018-2020; Graduate Program Committee, Department of Management 2018-2019; Senior Associate Dean Selection Committee (2019-2020); Co-Chair, selection committee for two Tenure Track Professor positions, 2019-2020.
- Best Paper Award, Organization Systems & Technology Track, HICSS Conference, 2015.
- Fulbright Scholar at the Vienna University of Business and Economics, Vienna Austria, 2013.



Brandon Lockhart, PhD

Associate Professor

Finance



Lockhart is a former corporate banker who conducts research on corporate investment and financing topics. He has published research on corporate capital structure, corporate lobbying, and corporate tax avoidance. His recent published work focuses on links between financing constraints and corporate investment, labor market incentives for executives and corporate disclosure policies, and executive compensation and corporate tax avoidance. His current work investigates the impact of executive compensation and labor market incentives on corporate debt contracts.

Lockhart teaches the first of two introductory corporate finance courses and an upper-level financial statement analysis and valuation course that draws on his previous work in corporate banking. He uses the opportunity of financial statement analysis to introduce his students to statistical and analytical software programming using large financial statement databases, preparing his students for corporate analyst roles. Lockhart also teaches the core corporate finance course in Clemson's MBA program, and the introductory finance course in Clemson's Business in Europe - Oxford summer study abroad program.

Lockhart received his undergraduate degree from Georgia Tech and his Ph.D. from the University of Florida. He was previously on the faculty at the University of Nebraska-Lincoln. While at Clemson, DLockhart has received departmental research productivity awards and two college-level graduate teaching awards.

Select Accomplishments

Recent Publications:

- "Internal capital and investment: Evidence from 2012 pension relief" with Thomas R. Kubick and John R. Robinson, forthcoming at Contemporary Accounting Research.
- "Industry tournament incentives and stock price crash risk" with Thomas R. Kubick, Financial Management, Volume 50, Issue 2 (Summer 2021), pp. 345-369.
- "Does inside debt moderate corporate tax avoidance?" with Thomas R. Kubick and John R. Robinson, National Tax Journal, Volume 73, Issue 1 (March 2020), pp. 47-76.
- "Does corporate lobbying activity provide useful information to credit markets?" with Emre Unlu, Journal of Corporate Finance, Volume 50 (June 2018), pp. 128-157.



College of

BUSINESS**Danny Weathers, PhD***Professor***Marketing**

Weathers, professor in the Department of Marketing, conducts research on consumer behavior and decision making. He has published articles in the top journals in marketing and his research has been cited over 1,300 times. One of his recent publications in the Journal of Advertising focused on how underdog brands and companies maintain authenticity after achieving success. (To illustrate, consider this recent headline: “Dabo Swinney Was an Underdog for Decades: That’s Done Now.”) Another project examines the appeal of behavioral streaks and how companies can utilize streaks to encourage behavior. (To illustrate, Clemson’s Office of Development seeks to encourage donations by providing special recognition to those who donate in consecutive years.) This research is currently under second review at the Journal of Consumer Research, a premier journal in marketing.

Weathers has also received two recent grants to support the agricultural industry in South Carolina. One grant involves research on consumer perceptions of poultry farming practices. Insight from this research will help the S.C. poultry industry better communicate and connect with consumers. Another grant from the S.C. Sea Grand Consortium (\$42,277) involves research that will support the S.C. shellfish industry, as it examines ways by which shellfish farmers can more effectively market directly to consumers. In addition to his research interests, Weathers was the immediate past Faculty Senate president and serves as the MS Marketing Graduate Program Director for the Department of Marketing.

Select Accomplishments

- Siemens, J. C., Weathers, D., Smith, S., & Fisher, D. (2020). Sizing Up Without Selling Out: The Role of Authenticity in Maintaining Long-Run Consumer Support for Successful Underdog Brands. *Journal of Advertising*, 49(1), 78-97.
- Faculty Senate President (2019-2020).



College of
EDUCATION

Jacquelynn A. Malloy, PhD

Associate Professor

Teaching and Learning



Malloy contributes to research that highlights the influence of instructional methods on the motivation and engagement of learners. Within this broad purpose, her research has led to the development of several literacy motivation profiles that have been used in research and promoted for classroom practice as well as research on engaging classroom practices that integrate the language arts with content area instruction. Her research is also used to support teachers in developing their visions as learner-centered practitioners, extending this knowledge to support Clemson teachers and teacher residents through the Perfecting Your Roar and Master Teacher Institute programs.

Malloy has developed several courses for the College of Education, including one on social justice for elementary education majors, a course on poverty for students in the Educational Doctorate in Improvement Science program, and design-based research for doctoral students across the departments. She contributed to the development of a proposed human capital degree program and will be developing a course for design-based practices for that sequence. She serves on doctoral committees in every department, currently advising three doctoral students and serving on the committees of 20 others.

Malloy is an active member the Literacy Research Association, the International Literacy Association and the Association of Literacy Educators and Researchers and serves on the editorial boards of Reading Research Quarterly, The Reading Teacher, and Literacy, Research, and Instruction. She has edited one volume on motivation through the ILA and has published 23 articles in scholarly journals and 18 invited book chapters. One co-authored piece received an award in 2018 for distinguished research by the Association of Teacher Educators.

Select Accomplishments

- Co-author of three literacy motivation profiles used for research and classroom practice.
- Over 1,100 citations of work (Google Scholar).
- Program coordinator, Elementary Education
- Member, General Education committee during the revision process.
- Area chair for the Literacy Research Association.
- Chair of Young Adult Literacy Award for the International Literacy Association.
- President of the Board of the Clemson Child Development Center.



College of

EDUCATION

Rachelle S. Savitz, PhD*Assistant Professor***Education and Human Development**

Savitz engages in scholarship and teaching to better understand equitable practices within classrooms and instruction. Her work explores how literacies can be utilized to promote student agency, while also investigating culturally sustaining practices that teachers can incorporate in their classrooms to focus on the culturally, linguistically, and economically diverse students' lived experiences. Her projects and research are influenced by critical sociocultural theory that identifies how education is not neutral and there is a need to better understand hidden messages and silenced voices within instruction and practices. She also has a co-authored book with Douglas Fisher and Nancy Frey entitled *Teaching Hope and Resilience for Students Experiencing Trauma: Creating Safe and Nurturing Classrooms for Learning* and has a co-edited journal special issue entitled *Teachers as researchers: A diversity of methods for a diversity of voices* in *The Clearing House: A Journal of Educational Strategies, Issues, and Ideas*. Her work has also been published in premier journals for her field, such as *Teaching and Teacher Education*, *Literacy Research and Instruction*, and *Journal of Adolescent & Adult Literacy*.

Savitz is the president of the South Carolina Literacy in the Disciplines, 6-12. She is also an active member of professional and academic societies critical to her field, such as LRA (Literacy Research Association), ALER (Association of Literacy Educators and Researchers), ARF (American Reading Forum), ILA (International Literacy Association), and American Educational Research Association (AERA).

Select Accomplishments

- Recipient of Clemson 2020 GSG Outstanding Graduate Student Advocate Award. (April 2020).
- Recipient of Jerry Johns Promising Research Award through the Association of Literacy and Education Researchers. This award is given to a junior ALER member to recognize research that addresses significant questions for reading/literacy and extends understanding of its development, assessment, and/or instruction. (September 2019)
- Recipient of Gary Moorman Early Career Literacy Scholar Award through the American Reading Forum. This award is given to a junior American Reading Forum member in the early stages of his/her career (generally defined as the first five years). (December 2018)



College of

EDUCATION**Misty B. Soles, PhD***Senior Lecturer***Educational and Organizational Leadership**

Soles is a student-oriented teacher who strives to engage students in both undergraduate and graduate courses in athletic leadership. Hired as the second faculty member for AL's new graduate program in 2016, Soles has worked with program coordinator Michael Godfrey to grow and expand Clemson's Athletic Leadership program into a nationally known and recognized program. The program has grown from a first cohort of 15 students to a current enrollment of more than 80 students.

Graduate courses led by Soles include Marketing and Communications Responsibilities in Intercollegiate Athletics, Intercollegiate Athletics Finance, Legal Issues in Intercollegiate Athletics and Intercollegiate Athletics Facility Planning and Management.

Select Accomplishments

- In the 2019-20 academic year, Soles was responsible for 930 credit hours, which included courses in summer, fall and spring terms.
- Soles has created two new undergraduate courses for the AL undergraduate minor, both of which are supportive of departmental, college and institutional missions: Athletics and Women: Current and Historical Issues and Social Issues in Athletic Leadership.
- Co-chaired the hiring committee for the first tenure track faculty member in AL.
- Nominated for the College of Education Excellence in Teaching Award, 2019.
- Promoted to Senior Lecturer in Athletic Leadership, 2021.



College of
**ENGINEERING, COMPUTING
AND APPLIED SCIENCES**

Rachel Getman, PhD

Associate Professor

Chemical and Biomolecular Engineering



Getman's research involves using quantum and classical chemical modeling to understand chemical reaction pathways on solid catalysts. Specific areas of interest include understanding catalyst function, deriving reaction mechanisms, and optimizing catalyst composition using high throughput screening. She is especially interested in catalysts that employ transition metal active sites, such as extended metal surfaces, metal nanoparticles, and biomimetic metal-containing systems.

Membrane separation is an important method for separating unlike materials in a wide range of important chemical processes. Traditional membrane separation mechanisms rely on differences in size and charge which are insufficient to purify the individual industrially significant rare earth elements. Through a new National Science Foundation research grant, Getman and her collaborators are developing a novel multistage separation process for rare earths utilizing chemical digestion, electrodialysis, and peptide-functionalized membranes. A key goal is to discover the mechanisms that underpin peptide-ion selectivity and leverage those mechanisms to design a new class of highly selective membranes. A techno-economic analysis and life-cycle assessment will be performed to quantify the environmental and financial impacts of the proposed design. Knowledge generated from this research will enable currently challenging selective separations across the fields of membranes and sorbent materials.

Select Accomplishments

- First recipient of the Murdoch Family Endowed Professorship in Chemical and Biomolecular Engineering.
- Recipient of NSF CAREER award.
- Recipient of the Clemson University Research, Scholarship and Artistic Achievement Award for publishing a paper that has received more than 1,000 citations.
- Mentoring two postdoctoral researchers, seven graduate students and undergraduates.



College of
**ENGINEERING, COMPUTING
AND APPLIED SCIENCES**

Srikanth Pilla, PhD

Professor

Automotive Engineering



Pilla joined CU-ICAR in August 2013 and prior to that was assistant scientist at the Wisconsin Institute for Discovery, University of Wisconsin-Madison. Pilla also has industrial experiences at SC Johnson and Son Inc. and SuGanit Biorenewables Inc.

Pilla's research focuses on the mechanics, processing and characterization of polymers, multifunctional composites, nanocomposites, sustainable materials and microcellular foams. His research thrust includes the development of structural foams, biobased and biorenewable materials, gas-assisted foam processing, composites for extreme environments including high-temperature, thermoset composites processing using OOA (UV based) methods, multi-functional materials including self-repairing structural composites, and the evaluation of these materials using experimental mechanics, rheology, thermal, spectroscopic and microscopic analysis. In addition, his work focuses on the chemistry and physics based understanding of joining methods for dissimilar and hybrid materials and structures while investigating the environmental impact through stochastic life-cycle assessment.

Select Accomplishments

- Currently leads an \$11 million cooperative agreement established with the U.S. Army Research Laboratory to develop technology that will accelerate the development of new 3D-printed components for future ground vehicles, aircraft and munitions. A Digital Lifecycle Model utilizing artificial intelligence will be created to allow rapid, low-cost virtual design and characterization of complex, multi-material components that provide advanced capabilities while minimizing size, weight, and power. The project is funded for \$6.3 million in its first phase.
- Serves as the associate editor of SAE International Journal of Materials and Manufacturing, and Series Editor of Polymer Science and Plastics Engineering at Wiley-Scrivener.
- Serves on the editorial board of Journal of Renewable Materials.
- Serves on the board of Injection Molding Division of the Society of Plastics Engineers.



College of
**ENGINEERING, COMPUTING
AND APPLIED SCIENCES**

Zheyu Zhang, PhD

Assistant Professor

Electrical and Computer Engineering



Zhang is the Warren H. Owen – Duke Energy assistant professor of engineering at Clemson University. He was a research assistant professor in the Department of Electrical Engineering and Computer Science at the University of Tennessee, Knoxville from 2015 to 2018. In 2018, he joined General Electric Research as a Lead Power Electronics Engineer at Niskayuna, NY.

Zhang has more than 10 years of professional experience with balanced industry and academic career in the area of power electronics for electric propulsion, electrified transportation, renewables, energy storage, and grid applications.

Zhang's research interests include wide band-gap based power electronics, modularity and scalability technology, medium voltage power electronics, advanced manufacturing and cooling technology (e.g. cryogenic cooling) applied in power electronics, and highly efficient, ultra-dense, cost-effective power conversion systems for electric propulsion, electrified transportation, renewables, energy storage, and grid applications.

Select Accomplishments

- Awarded \$1.2 million from the U.S. Department of Energy to develop, validate, and demonstrate the TRACE-PV, a general, objective, third-party tool, for lifetime prediction, physics-to-failure mechanism identification, and levelized cost of energy (LCOE) assessment of photovoltaic (PV) inverters.
- Published more than 80 papers in the most prestigious journals and conference proceedings, filed over 10 patent applications with one licensed, and authored one book and one book chapter.
- Was the recipient of two prize paper awards from the IEEE Industry Applications Society and IEEE Power Electronics Society, one first-author IEEE TPEL spotlight paper, and two IEEE APEC outstanding presentation awards.
- Currently serves as an associate editor for IEEE Transactions on Power Electronics and IEEE Transactions on Industry Applications. Zhang is a senior member of IEEE.



College of
SCIENCE

Timo Heister, PhD

Associate Professor

Mathematical and Stastical Sciences



Heister joined Clemson University as an assistant professor in 2013 in Mathematical and Statistical Sciences and became an associate professor in 2018. His work in computational science enables researchers from all over the world and across disciplines to use high performance computing for scientific simulations. He and his students and collaborators develop numerical algorithms that work efficiently on the largest supercomputers and implement them in open source software.

To date, Heister has won 6 National Science Foundation awards in collaboration with other universities totalling \$4.8 million. Through that, he brought in more than \$1.8 million in research funds to Clemson, which allowed him to support graduate students and postdocs, who went on to successful careers at Sandia National Lab, MIT, University of Florida, and companies like ANSYS. Since 2014, he has been organizing week-long training events (“hackathons”) every summer with international attendance to train students to become computational scientists. He has close ties and collaborations with colleagues across the US and Europe and organizes research visits for students between these institutions.

One major application of Timo’s research is the accurate simulation of convection in the Earth’s mantle. The software ASPECT (also open source) is used by the international geoscience community to make progress in understanding Earth’s deep interior. He recently was awarded a collaborative NSF award (\$2.5 million, \$393,000 at Clemson) in the division of Earth Sciences to develop a framework to compute a reference state describing the thermal, chemical, and mineral properties of the interior of the Earth by combining large-scale, parallel numerical methods with insight from mineral physics and seismology. These simulations have the potential to provide insight into a wide range of topics, including variations in the motion and deformation of tectonic plates, the flow of magma and the cycling of water through the Earth’s interior, and the structure of the deep Earth.

Select Accomplishments

- Maintains the widely used deal.II open source Finite Element library used in 1,600-plus peer reviewed articles.
- Wrote 35 peer reviewed publications, including two books.
- Mentoring two postdocs and seven graduate students.



R. Kenneth (Ken) Marcus, PhD

Robert Adger Bowen Professor

Chemistry



Marcus is an analytical chemist who joined the Clemson faculty in the fall of 1986. While the specific topicality of research projects have evolved since that time, there has been a consistent focus on the development of instrumentation and methodologies for chemical analysis. Those instruments have addressed unique challenges in materials science, energy science, metallomics, separation science, forensic science, and now clinical and biological chemistry. His students have built complex instruments from basic components, implemented commercial instruments, and developed new versions of instruments in collaboration with manufacturers. Instrumentation developed in his laboratory is used worldwide. His current research focuses on two completely divergent areas of measurement science; uranium isotope ratio measurements in support of the nation's nuclear nonproliferation/forensics needs and the development of novel methods of isolating and purifying proteins and unique biological nanoparticles known as exosomes. To those ends, his group is currently supported by major grants from the U.S. Department of Energy and the National Science Foundation. Smaller, recent awards have come from companies and research consortia in the area of biopharmaceutical production.

Marcus has taught the freshman-level Chemical Communications course for the last 10 years, as well as graduate-level courses in Separation Science and Mass Spectrometry. His current research group consists of five graduate students (4 having graduated in last 2 semesters). Marcus takes particular pride in the fact that he has graduated 41 Ph.D. and 13 MS students, 18 of whom are employed in federal research laboratories, including the Savannah River and Oak Ridge national laboratories, the Centers for Disease Control, the Food and Drug Administration, and the National Institute for Standards and Technology. Many others are employed in the pharmaceutical sector.

Select Accomplishments

- Fellow of the Royal Society of Chemistry (London); the American Association for the Advancement of Science; the Society for Applied Spectroscopy; and the National Academy of Inventors.
- Inaugural recipient of Clemson University Researcher of the Year.
- Recipient of the South Carolina Governor's Award for Scientific Research.
- Recipient of Clemson University Alumni Association Distinguished Researcher Award.
- Published over 220 peer reviewed research articles at Clemson University.
- Inventor/co-inventor on more than 15 U.S. and International patents.
- Received more than \$7.5 million in extramural research funding.



College of
SCIENCE

Christopher Parkinson, PhD

Professor

Biological Sciences (Science)

Forestry and Environmental Conservation (CAFLS)



Parkinson is an evolutionary biologist and conservation geneticist who leads a multidisciplinary research program that incorporates fieldwork, molecular biology and genomics, bioinformatics and high-performance computing to investigate the evolution, conservation and systematics of venomous snakes.

Parkinson has built several multidimensional collaborations with international and institutional researchers. He has trained several international students and currently mentors a Fulbright scholar from Mexico. Currently, he and his team are working with Brazilian, Costa Rican, Ecuadorian and Mexican collaborators trying to understand if the evolution of “venom” increases speciation rates in snakes. This international collaborative project is currently supported by a US-BIOTA-São Paulo Dimensions in Biodiversity award from the NSF and a Brazilian funding agency (FAPESP) with approximately \$2 million to U.S. investigators and approximately \$2 million to Brazilian researchers. Additionally, Parkinson is the CUGBF core lead for the \$10.7 million NIH COBRE in Eukaryotic Pathogens (EPIC) and is a joint core lead with Trudy Mackay for the enhanced CUGBF core for the \$11 million NIH COBRE in Human Genetics. Recently, he has partnered with Delphine Dean (Bioengineering) and others to submit grants to understand the SARS-CoV2 (COVID-19) variant landscape within the Upstate of S.C.

Lastly, Parkinson is interested and has expertise in assessing the strengths and barriers to interdisciplinary scholarship and education. While at the University of Central Florida, he led the task force to design and process changes to incentivize interdisciplinary scholarship and instruction. He and his team developed and implemented the interdisciplinary Faculty Cluster Initiative program to initiate discovery in critical areas of excellence and enhance their unique potential for impact.

Select Accomplishments

- Has mentored 26 graduate student researchers, nine postdoctoral research associates, and a multitude of undergraduate students over past 30 years.
- Mentors multiple junior and midcareer faculty members in both the College of Science and the College of Agriculture, Forestry and Life Sciences.
- Has published more than 75 scientific articles, has over 5,500 citations and nearly all of his articles have student authors.
- Published two papers in the prestigious journal *Proceedings of the National Academy of Sciences* in 2021; one documenting the simplest, most toxic venom of a rattlesnake and the second hypothesizing “why and how” we see venom variation across the rattlesnake tree of life.



Division of

RESEARCH

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