

Board of Trustees | Oct. 10, 2019



R1
Clemson
University

FY19
YEAR END

REPORT

A Note from the Vice President for Research

1

Dear Board of Trustees Members,

I am excited to report that in Fiscal Year 2019, we achieved a significant milestone and key goal of our ClemsonForward strategic plan: Competitive research expenditures topped \$100 million for the first time ([see page 5](#)). This is a significant accomplishment and a testament to the great ideas, determination, and hard work of our faculty members, as well as to our students and staff members who support research across Clemson's footprint. We have grown extraordinarily over the past five years. Our total R&D expenditures, which are used in the Carnegie R1 classification, increased 9% to \$213 million in fiscal year 2018, the most recent year for which this data is available ([see page 6](#)).

We notched several other notable achievements in the fiscal year ended June 30, as well. Of course, our Carnegie R1 status was reconfirmed amid an unexpected to change to Carnegie's data collection cycle, a sign of the strength and upward trajectory of our research enterprise. Awards topped \$100 million for the fourth consecutive year ([see page 8](#)). This fiscal year alone, we have received 10 grants valued above \$2 million, bringing a combined \$33 million to Clemson. We are earning more federal awards even as overall federal investments in higher education R&D have been flat ([see page 9](#)). Proposal submissions reached \$594 million ([see page 10](#)). While this figure is heightened by a \$107 million submission, FY2019 proposals surpassed prior-year levels when excluding that large submission. While securing more grants, our faculty members have also notched several significant honors and accolades at the national and international level ([see pages 31-51](#)).



We are working hard to continue this momentum. We are releasing several new R-Initiative funding programs to invest in faculty research. We are engaging with industry in new ways to increase private-sector collaboration ([see pages 24-26](#)). We continue to pursue high-level grant opportunities and have assembled another team to apply for a Center of Biomedical Research Excellence grant (COBRE) with the National Institutes of Health, which could bring approximately \$30 million to the university. Additionally, we are hiring an associate vice president for research development to lead efforts to aggressively pursue high-value funding opportunities and to develop and nurture large, interdisciplinary research projects.

For the Board of Trustees committee meeting, I have invited faculty members to discuss their research with you, time permitting, to give you an idea of the impact our work has ([see page 30](#)). Also, I invited two undergraduate students to share their Creative Inquiry research projects ([see pages 27-29](#)). The Creative Inquiry program showcases the educational power of research. These students get invaluable experiences, while contributing to cutting-edge research with real-world impact. They are proof that our future is bright.

I am excited to see what the future holds.

Respectfully submitted,

A handwritten signature in black ink that reads "Tanju Karanfil". The signature is written in a cursive, flowing style.


Tanju Karanfil, Ph.D., PE, BCEE, IWA Fellow

Vice President for Research, Clemson University



- 1. *FY2019 YEAR-END METRICS***
- 2. *TOP GRANTS***
- 3. *NEWS***
- 4. *FOCUS ON FACULTY***

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



Pictured: Sudeep Popat received a grant from NASA to continue his development of microbial fuel cells that may convert human waste to hydrogen peroxide or wastewater to electricity. [LEARN MORE](#)

EXECUTIVE SUMMARY

KEY MILESTONES ACHIEVED IN FY2019

- Our Carnegie R1 status was reconfirmed this fiscal year, placing Clemson among the top research universities in the country ([see page 4](#)).
- Competitive research expenditures topped \$100 million, a key goal of the ClemsonForward strategic plan ([see page 5](#)).
- Total Clemson research expenditures, which are used in the Carnegie R1 classification, reached \$213 million, an increase of 9 percent from the prior year ([see page 6](#)).
- Competitive grant awards topped \$100 million for the fourth consecutive year ([see page 8](#)).
- We have been successful securing large awards, receiving 10 awards valued above \$2 million in fiscal year 2019 for a total of \$33 million.
- We have added \$10 million in research equipment.



Working to become a perennial R1 Institution

The university's **Carnegie R1 status was confirmed** in FY2019 amid an unexpected change to Carnegie's data collection cycle.

Our strong growth over recent years has given us a solid footing in the R1 field among the nation's top research institutions. This distinction confirms Clemson's "very high research activity" and helps us recruit the best and brightest faculty members, students and administrators and puts us in a great position to compete for high-value research projects.

COMPARING GROWTH

Clemson is among the fastest growing institutions among our Carnegie R1 peers (Figure 1). This high level of growth in expenditures has been accomplished efficiently, without being inflated by institutional expenditures (Figure 2). Faculty productivity has grown greatly (Figure 3).

Federal Expenditures

Percent Growth: 2013 Compared to 2017, Peer 30 (R1, Public, No Medical School)

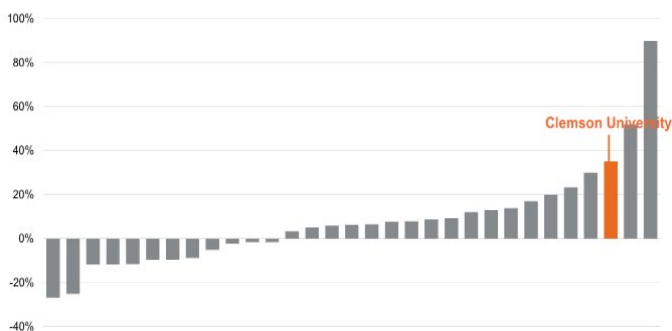


Figure 1

Institutional Expenditures

Percent Growth: 2013 Compared to 2017, Peer 30 (R1, Public, No Medical School)

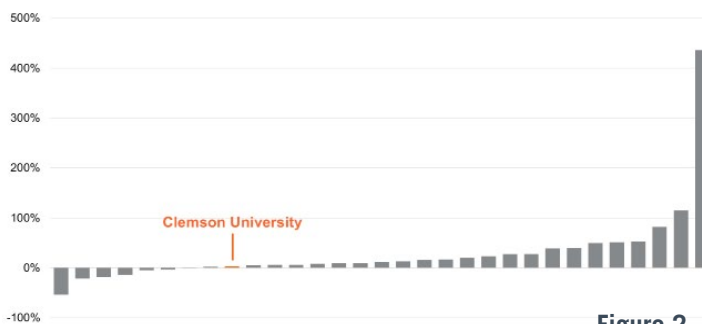


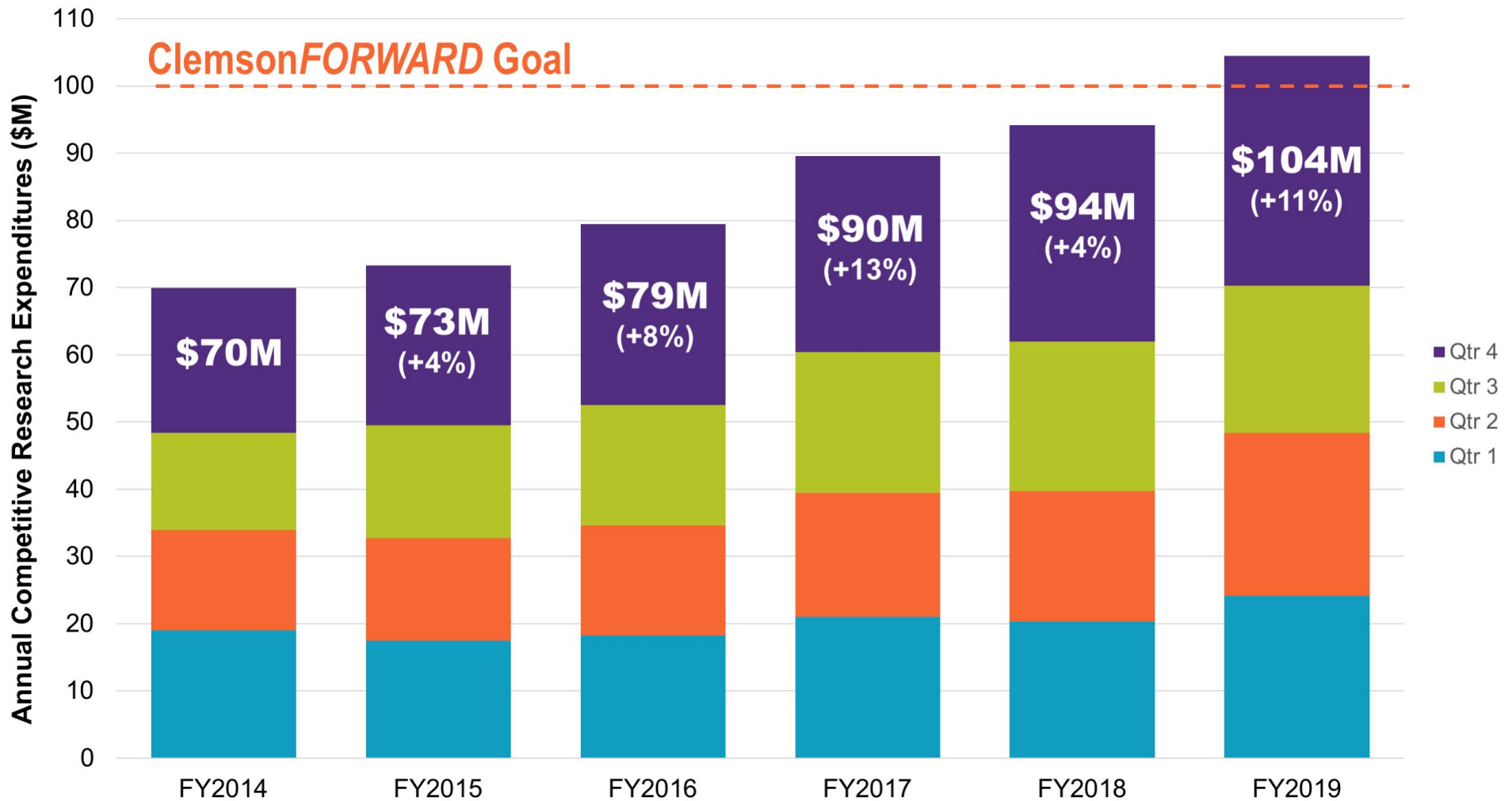
Figure 2

Research Awards Per Tenured, Tenure-Track Faculty	\$92K	\$162K
Research Expenditures Per Tenured, Tenure-Track Faculty	\$88K	\$102K
Research Awards Per Researchers*	\$84K	\$141K
Students Per Tenured, Tenure-Track Faculty	25	28
Research Awards Per S&E Sq. Ft.	\$123	\$219

The chart to the left compares per-capita and per-space outputs in 2013 (purple bar) to 2018 (orange bar).

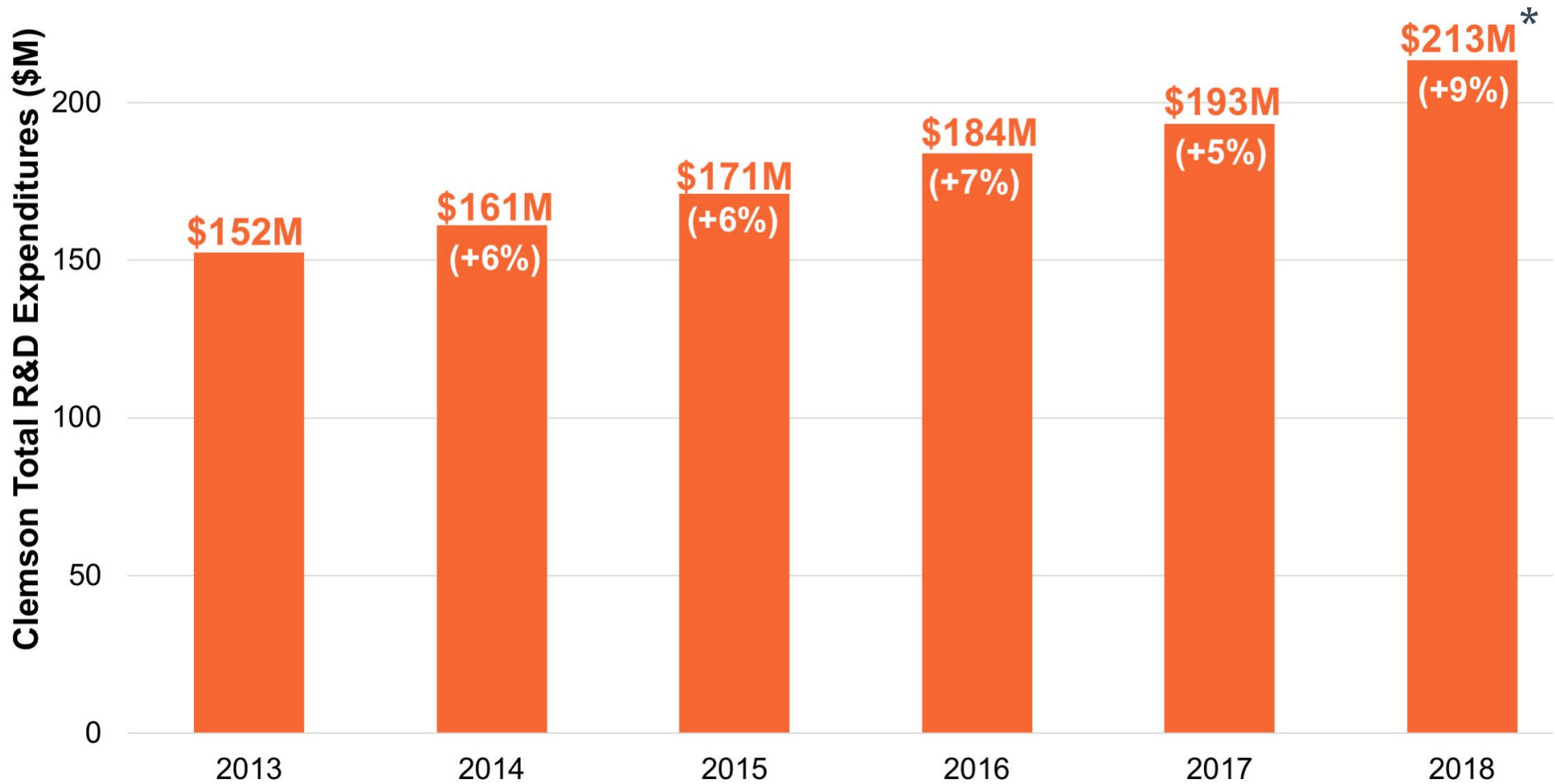
Figure 3

Competitive Research Expenditures FY2014-19



Total R&D Expenditures 2013-2018

Total expenditures include competitive research awards, external research services, research gifts, institutional research support, state research support, etc., reported to the NSF. These totals are used for the Carnegie R1 classification.



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

*Submitted total to NSF

Clemson Report Card vs NSF HERD Survey FY2018

This table compares competitive expenditures reported in the Clemson University Report Card ([pages 12-15](#)) to total R&D expenditures reported to the National Science Foundation Higher Education Research and Development Survey, which is used in Carnegie Classifications.

Expenditures	Report Card			NSF Survey		
	yes	no	FY2018	yes	no	FY2018
External:						
• Federal Expenditures	✓		\$ 78,178,742	✓		\$ 73,735,597 ¹
• State and Local Government	✓		\$ 4,198,807	✓		\$ 21,348,997 ²
• Business / Industry	✓		\$ 6,300,105	✓		\$ 19,475,058 ³
• Non-Profit	✓		\$ 5,095,719	✓		\$ 4,509,319
• Other	✓		\$ 391,922	✓		\$ 298,002
Institutional: ⁴		X		✓		
• Institutionally Funded Research		X		✓		\$ 81,630,388
• Cost Share		X		✓		\$ 6,597,612
• Unrecovered Indirect Costs		X		✓		\$ 5,863,000
Total			\$ 94,165,295			\$ 213,457,973

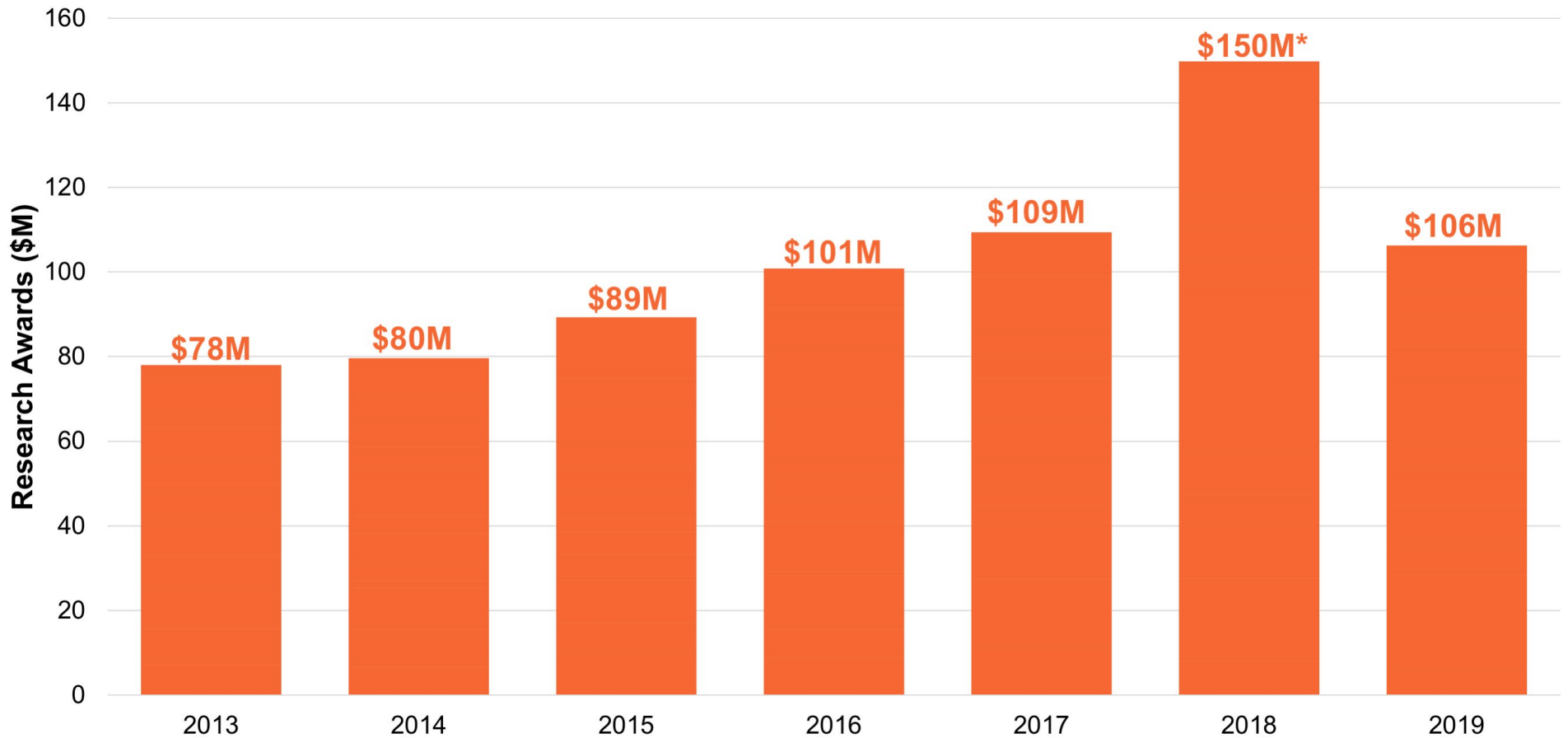
¹ The Report Card figure includes “Public Service” (e.g., After School Programs, 4-H programs, pesticide monitoring programs) and “Instructional” expenditures (e.g., College Ready Writers Program, Agricultural Education Professional Development, Noyce Scholarship), while only “Research” is included in NSF HERD.

² NSF HERD totals include \$16.6 million Public Service Activities funding from the state that is not included in competitive expenditures reported in the Clemson Report Card.

³ NSF HERD totals include \$5.7 million in endowments and \$6.8 million from student support and non-departmental research programs (e.g., Call Me Mister, SCE&G Energy Innovation Center, Deep Orange) that are not included in competitive expenditures reported in the Report Card.

⁴ This includes faculty start-up (e.g., lab renovations, equipment, grad student support, faculty time allocated for research), cash cost share, and unrecovered indirect costs.

Research Awards 2013-19



* Includes two major awards (MHI Vestas & PCORI) totaling \$33M

Total U.S. Higher Education R&D Expenditures

The federal government has been investing more in Clemson (see orange bar on Figure 1), even as overall federal investments in higher education R&D have been flat (see orange line on Figure 2).

Figure 1: A Breakdown of Clemson Competitive Awards by Funding Source

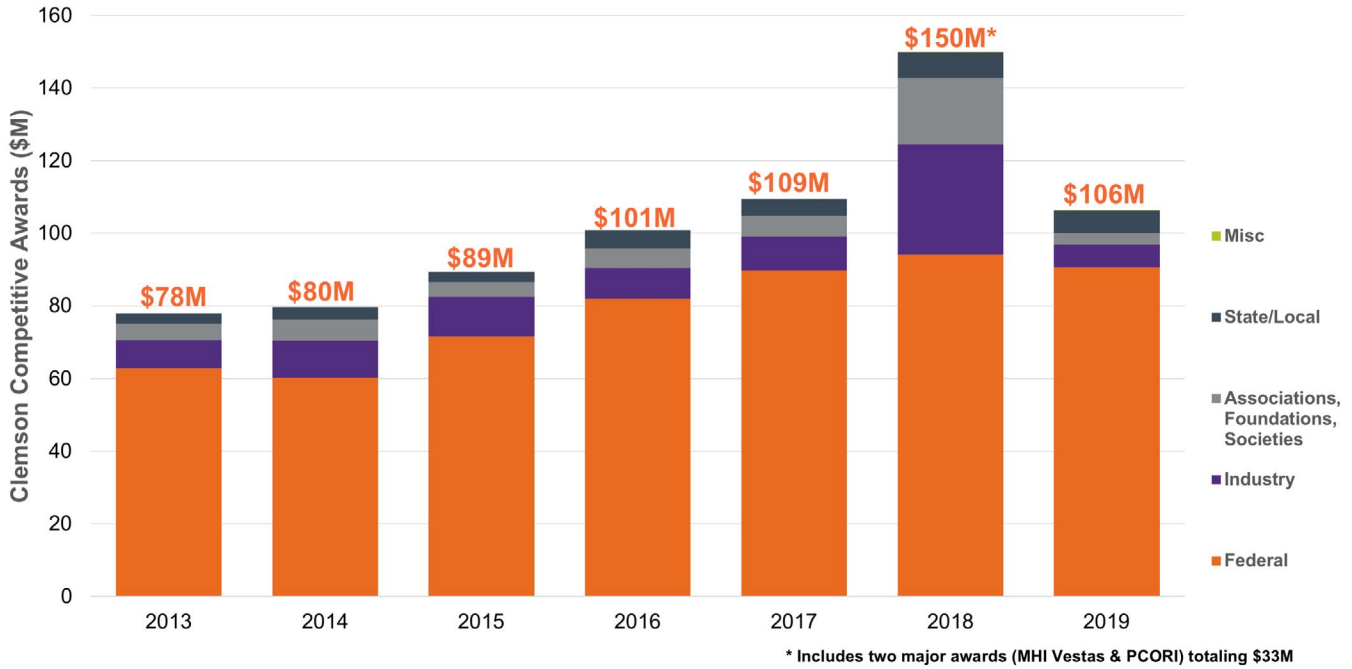
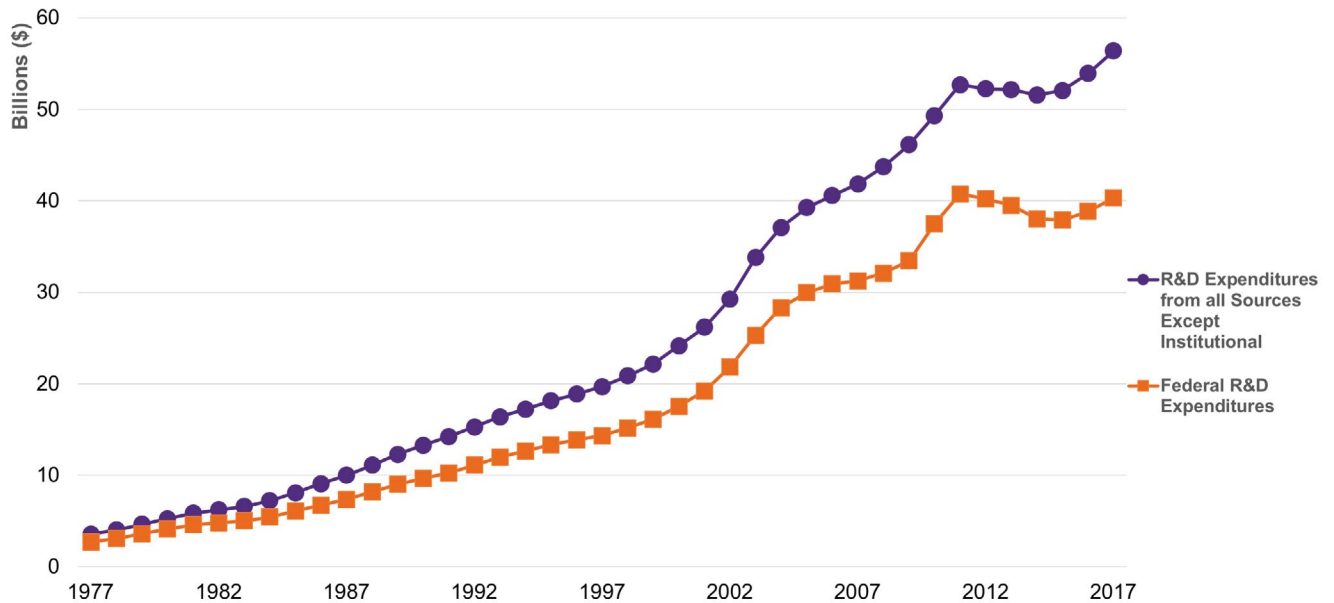
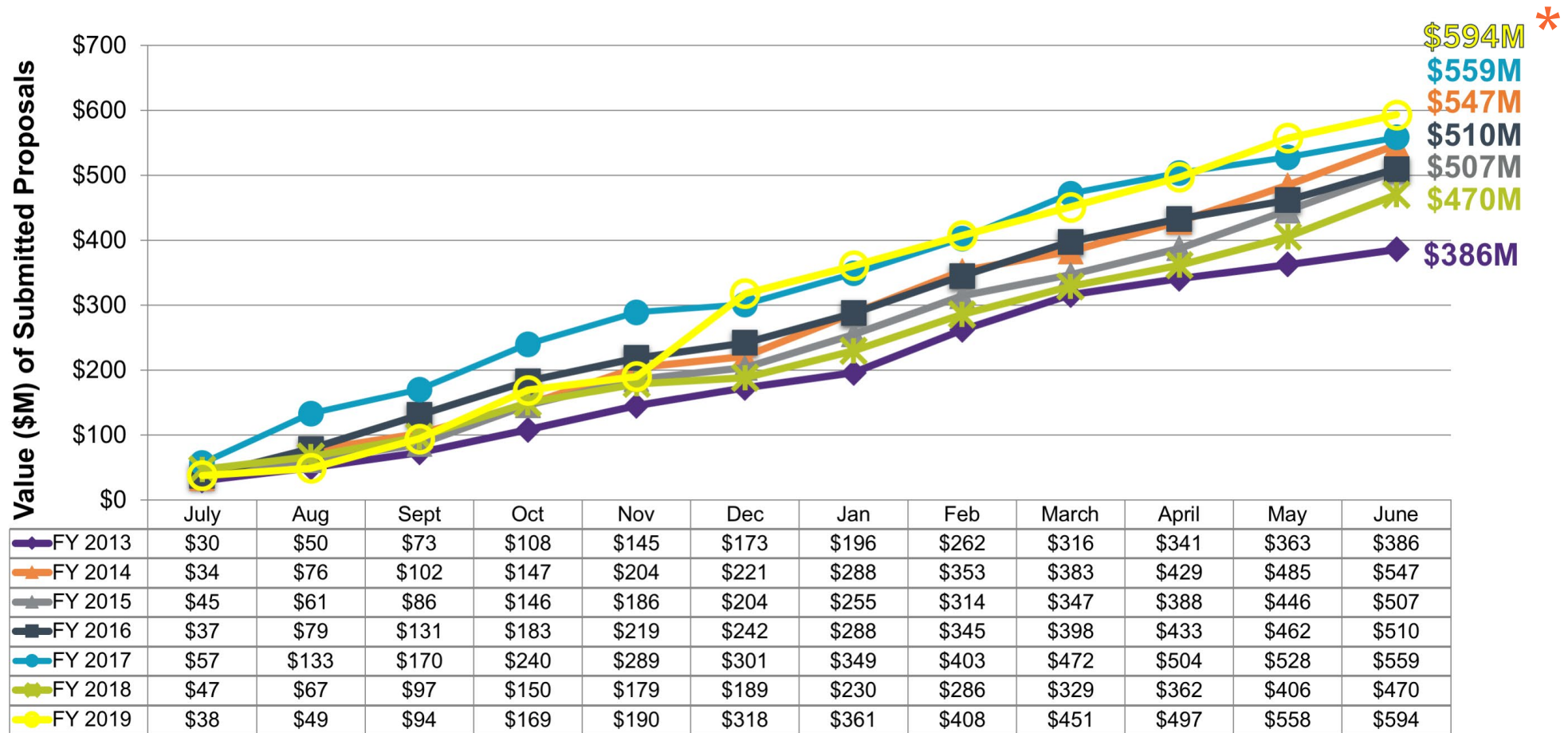


Figure 2: Total R&D Expenditures in Higher Education Across the United States



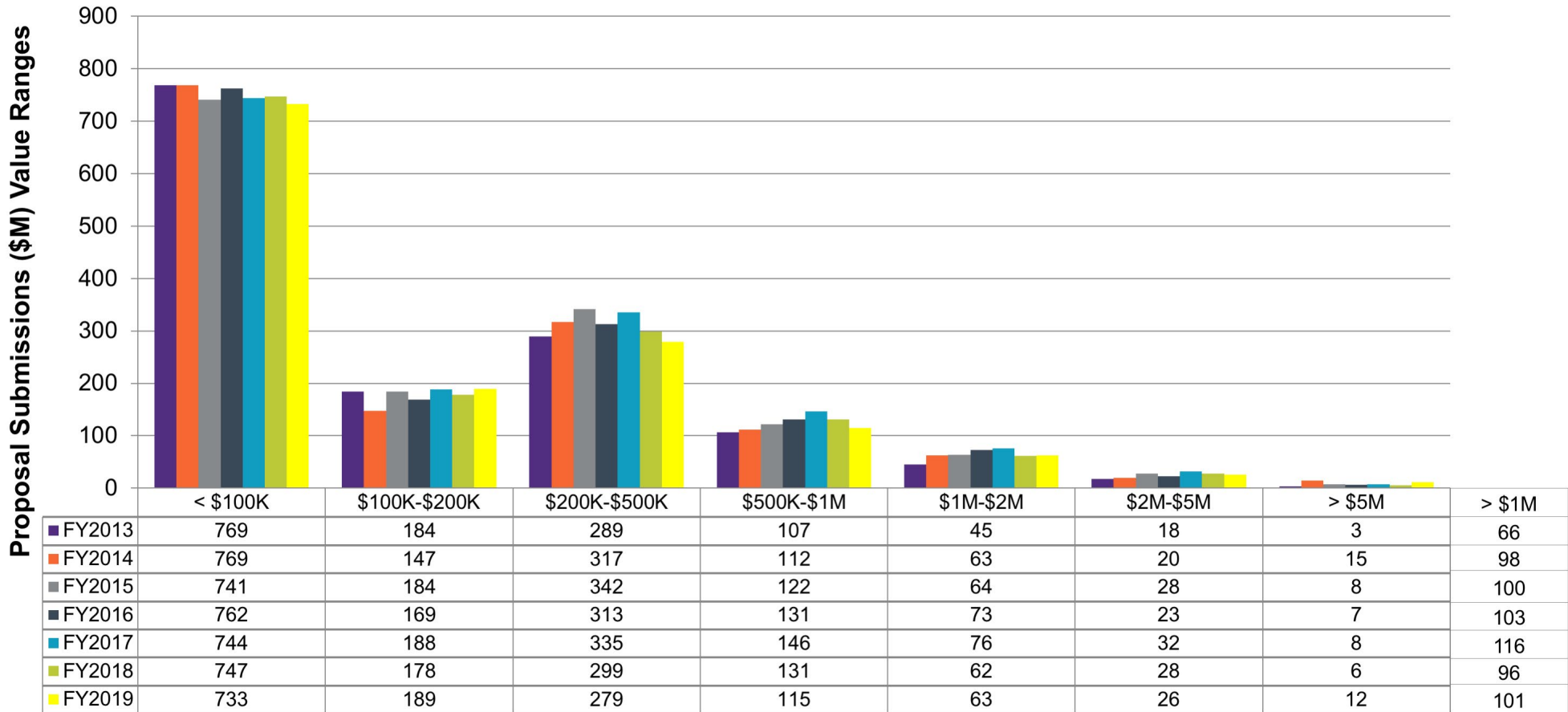
Source: National Science Foundation, HERD Survey 2017

Proposal Submissions: Requested \$ 2013-19



* The figure for FY2019 is heightened by a large \$107 million proposal from a multi-disciplinary collaborative between Clemson and Prisma Health. Without that proposal, submissions were ~\$486 million for FY2019.

Proposal Submissions: \$ Range 2013-19



Report Card: Fiscal Year 2019

		2013	2014	2015	2016	2017	2018	2019
RESEARCH INPUTS								
a. Proposal Submissions by Number		1,414	1,443	1,489	1,478	1,529	1,451	1,417
1	CAAH (College of Architecture, Arts & Humanities)	38	51	65	62	69	64	69
2	CAFLS (College of Agriculture, Forestry & Life Sciences)	235	230	224	222	241	229	377
3	CBSHS (College of Behavioral, Social & Health Sciences)	81	93	102	104	112	101	105
4	CECAS (College of Engineering, Computing & Applied Sciences)	549	555	582	617	618	587	562
5	COE (College of Education)	51	54	39	45	46	37	39
6	COB (College of Business)	7	15	13	15	7	10	5
7	COS (College of Science)	242	247	263	239	230	227	186
8	CCIT (Clemson Computing & Information Technology)	12	12	6	3	5	1	1
9	PSA (Public Service & Agriculture)	88	90	118	97	170	163	33
10	VP for Res & Interdisc Inst	31	17	7	17	14	12	25
11	All Other	80	79	70	57	17	20	15
b. Proposal Submissions by Dollar Value (FY2020 College Targets)		\$386M	\$547M	\$507M	\$510M	\$559M	\$470M	\$486.4M*
12	CAAH (\$5.5M)	N/A	N/A	\$9.4M	\$8.6M	\$3.1M	\$5.7M	\$4.4M
13	CAFLS (\$66.4M)	N/A	N/A	\$42.6M	\$23.8M	\$43.4M	\$37.1M	\$64.1M
14	CBSHS (\$49.6M)	N/A	N/A	\$28.4M	\$40.1M	\$41.4M	\$25.9M	\$47.9M
15	CECAS (\$283.1M)	N/A	N/A	\$260.5M	\$281.2M	\$306.4M	\$235.5M	\$255.3M
16	COE (\$12.2M)	N/A	N/A	\$13.8M	\$14.7M	\$18.1M	\$19.1M	\$10.1M
17	COB (\$2.2M)	N/A	N/A	\$7.5M	\$4.3M	\$2.8M	\$1.8M	\$2.1M
18	COS (\$84.7M)	N/A	N/A	\$100.2M	\$111.3M	\$95.9M	\$100.4M	\$73.8M
19	CCIT	N/A	N/A	\$4.3M	\$2.0M	\$4.0M	\$0.9M	\$0.4M
20	PSA (\$13.4M)	N/A	N/A	\$23.3M	\$10.4M	\$31.3M	\$25.8M	\$11.4M
21	VP for Res & Interdisc Inst	N/A	N/A	\$5.6M	\$7.7M	\$6.0M	\$12.7M	\$9.5M
22	All Other	N/A	N/A	\$11.4M	\$5.6M	\$6.0M	\$5.0M	\$7.4M

N/A - Data per college and unit was unavailable for FY2013 and FY2014.

*This figure excludes a large \$107 million proposal from a multi-disciplinary collaborative between Clemson and Prisma Health.

Report Card: Fiscal Year 2019

		2013	2014	2015	2016	2017	2018	2019
RESEARCH INPUTS continued								
c. Research Awards		\$78.0M	\$79.7M	\$89.3M	\$100.9M	\$109.5M	\$149.8M	\$106.3M
23	CAAH	\$0.2M	\$0.6M	\$0.7M	\$1.4M	\$0.5M	\$1.9M	\$2.0M
24	CAFLS	\$7.3M	\$6.7M	\$14.1M	\$8.6M	\$10.9M	\$13.9M	\$14.2M
25	CBSHS	\$2.7M	\$3.4M	\$4.8M	\$5.1M	\$4.6M	\$8.1M	\$5.9M
26	CECAS	\$34.2M	\$37.7M	\$48.2M	\$45.5M	\$54.0M	\$80.8M	\$50.4M
27	COE	\$2.6M	\$4.1M	\$3.2M	\$2.9M	\$2.8M	\$4.5M	\$3.3M
28	COB	\$2.0M	\$1.1M	\$1.3M	\$0.8M	\$1.2M	\$1.1M	\$0.8M
29	COS	\$10.3M	\$7.8M	\$9.9M	\$15.6M	\$19.9M	\$14.7M	\$18.7M
30	CCIT	\$1.6M	\$5.7M	\$0.7M	\$0.8M	\$0.5M	\$1.3M	\$0.1M
31	PSA	\$14.8M	\$12.3M	\$9.6M	\$13.0M	\$7.9M	\$6.6M	\$4.0M
32	VP for Res & Interdisc Inst	\$1.8M	\$0.3M	\$0.6M	\$5.1M	\$5.0M	\$15.1M	\$6.2M
33	All Other	\$0.3M	\$0.2M	\$1.2M	\$2.0M	\$1.2M	\$1.7M	\$0.7M
d. Notable Awards								
34	NSF CAREER Awards (by start date)	4	1	3	5	7	7	4
35	EPA CAREER Awards (by start date)	-	-	-	-	-	-	1
36	Air Force Young Investigator Awards	-	-	1	2	-	-	1
37	DOE Early CAREER Awards	1	-	-	-	-	-	-
38	NIH R01-Equivalent Awards (by start date)	-	-	2	2	2	3	6
e. Supporting Workforce								
39	Graduate Student Enrollment	4,206	4,372	4,670	4,664	4,425	4,985	5,282
40	Sponsored Graduate Research Assistants	822	745	707	693	696	761	558
41	Postdoctoral Fellows	48	64	83	85	90	97	98
42	Research Faculty: Permanent 100% Non-E&G Funded	6	6	6	11	17	14	29
43	Research Faculty: Temporary 100% Non-E&G Funded	18	18	15	14	24	27	11

Report Card: Fiscal Year 2019

		2013	2014	2015	2016	2017	2018	2019
RESEARCH PROCESS								
f. Sponsored Research Expenditures by Business Unit		\$75.4M	\$70.0M	\$73.3M	\$79.5M	\$89.5M	\$94.2M	\$104.5M
44	CAAH	\$0.5M	\$0.4M	\$0.4M	\$1.1M	\$1.3M	\$1.4M	\$1.7M
45	CAFLS	\$8.8M	\$7.7M	\$6.8M	\$8.6M	\$11.1M	\$11.0M	\$14.1M
46	COB	\$1.2M	\$1.2M	\$1.1M	\$1.0M	\$0.9M	\$0.8M	\$0.8M
47	CECAS	\$35.0M	\$35.0M	\$35.0M	\$37.5M	\$42.9M	\$45.1M	\$49.9M
48	CBSHS	\$3.1M	\$2.8M	\$3.7M	\$4.1M	\$4.4M	\$4.9M	\$5.3M
49	COE	\$3.3M	\$3.3M	\$3.8M	\$2.5M	\$2.6M	\$2.2M	\$2.5M
50	COS	\$13.2M	\$10.5M	\$9.3M	\$11.3M	\$14.8M	\$16.7M	\$17.2M
51	CCIT	\$2.0M	\$1.6M	\$3.4M	\$2.8M	\$0.4M	\$0.6M	\$0.2M
52	PSA	\$4.7M	\$4.9M	\$5.8M	\$5.6M	\$5.7M	\$5.9M	\$3.7M
53	VP for Res & Interdisc Inst	\$1.9M	\$1.3M	\$1.9M	\$3.5M	\$3.9M	\$3.9M	\$7.1M
54	All Other	\$1.7M	\$1.7M	\$2.2M	\$1.5M	\$1.5M	\$1.6M	\$1.9M
g. Sponsored Research Expenditures by Innovation Cluster		\$75.4M	\$70.0M	\$73.3M	\$79.5M	\$89.5M	\$94.2M	\$104.5M
55	Advanced Materials	\$14.3M	\$11.3M	\$10.7M	\$10.4M	\$10.7M	\$12.1M	\$15.4M
56	Cyberinfrastructure & Big Data Science	\$10.3M	\$10.5M	\$10.1M	\$8.9M	\$8.1M	\$9.6M	\$6.9M
57	Energy, Transportation & Advanced Manufacturing	\$4.7M	\$5.7M	\$7.2M	\$7.6M	\$17.8M	\$16.8M	\$17.1M
58	Health Innovation	\$13.1M	\$10.2M	\$10.2M	\$12.5M	\$16.3M	\$17.8M	\$23.8M
59	Human Resilience	\$8.2M	\$7.7M	\$9.7M	\$9.8M	\$7.8M	\$8.6M	\$9.0M
60	Sustainable Environments	\$18.3M	\$16.9M	\$17.9M	\$21.7M	\$18.9M	\$19.5M	\$20.6M
61	Other	\$6.5M	\$7.6M	\$7.4M	\$8.6M	\$9.9M	\$9.6M	\$11.7M
h. Sponsored Research Expenditures by Funding Source		\$75.4M	\$70.0M	\$73.3M	\$79.5M	\$89.5M	\$94.2M	\$104.5M
62	Federal Government	\$62.9M	\$56.9M	\$58.5M	\$65.1M	\$74.6M	\$78.2M	\$85.1M
63	Foundations, Societies, and Associations	\$4.2M	\$4.3M	\$4.7M	\$4.1M	\$4.7M	\$5.1M	\$7.4M
64	Industry/Other	\$4.9M	\$5.6M	\$6.1M	\$6.9M	\$6.8M	\$6.3M	\$5.3M
65	International	\$0.8M	\$0.6M	\$0.8M	\$0.8M	\$0.5M	\$0.4M	\$0.3M
66	Local Government	\$0.6M	\$0.6M	\$0.6M	\$0.5M	\$0.5M	\$0.5M	\$0.5M
67	State Government	\$1.9M	\$1.9M	\$2.7M	\$2.0M	\$2.4M	\$3.7M	\$5.7M

Report Card: Fiscal Year 2019

		2013	2014	2015	2016	2017	2018	2019
RESEARCH PROCESS continued								
i. Sponsored Research Expenditures per T/TT Faculty by College								
68	CAAH	\$3,299	\$2,264	\$2,343	\$5,841	\$8,177	\$8,945	\$10,159
69	CAFLS	\$88,570	\$81,120	\$69,612	\$84,618	\$105,396	\$103,814	\$134,555
70	COB	\$14,415	\$13,047	\$11,510	\$9,683	\$8,855	\$8,269	\$8,200
71	CECAS	\$169,754	\$160,698	\$163,406	\$163,685	\$194,323	\$214,280	\$223,666
72	CBSHS	\$27,982	\$26,853	\$33,764	\$42,376	\$34,751	\$39,532	\$40,301
73	COE	\$54,779	\$51,688	\$62,195	\$38,037	\$44,483	\$40,197	\$47,371
74	COS	\$95,724	\$72,421	\$61,912	\$77,589	\$95,956	\$110,206	\$118,600
75	CU average (Total exp/Total T/TT faculty)	\$83,858	\$75,089	\$78,826	\$85,753	\$84,297	\$103,706	\$99,125
RESEARCH OUTPUTS/OUTCOMES								
76	Doctorates Awarded (Aug, Dec, May)	187	217	237	233	231	234	301
77	STEM Doctorates Awarded (Aug, Dec, May)	118	153	165	138	156	171	174
78	Disclosures	102	129	70	60	65	48	61
79	Patents	16	15	15	14	18	11	18
80	Licenses/Options	9	7	7	5	10	10	16
81	Licensing Revenue	\$1,134,289	\$762,811	\$360,131	\$354,827	\$539,490	\$388,751	\$398,136
82	Start-up Companies (based on licenses/options)	1	4	4	2	3	3	5

STRATEGIES

1 INVEST IN PEOPLE

- Incentivize research investment, activity and doctoral productivity.
- Hire world-class faculty.
- Support faculty competitiveness through proposal development support from the Office of Research Development and external reviews of proposals.
- Pursue high-value, high-quality research grants with help from external consultants.
- Continue to implement R-Initiative funding programs to invest in high-quality research ideas.

2 INCREASE PROPOSAL SUBMISSIONS

We have taken several steps to boost submissions and maintain momentum:

- Provost has set goals with college deans, establishing submission targets in order to reach ClemsonForward goals ([see Report Card Section B on page 12](#)).
- Vice President for Research meets regularly with college deans and associate deans for research to discuss research strategies.
- We are developing more R-Initiative funding programs to incentivize research.
- The Office of Research Development continues to support faculty in the development of large, complex proposals.
- We are hiring an associate vice president for research development to lead research development efforts.
- CURF is working to support growth in federal and industry-funded research.
- The Office of External Affairs developed strategic initiatives to attract new industry research funding.

3 OPTIMIZE CAPACITY

- Complete the research space utilization study with the EVP for Finance and Operations to more efficiently utilize research facilities and equipment.
- Optimize the use of facility space and reduce downtime by incentivizing faculty use of equipment through our new Clemson University Core Incentivized Access program.
- Implement new software solutions that will allow us to better manage facility usage and laboratory risk. This will greatly reduce workplace inconsistencies, redundancies and workloads, while helping to achieve safe, efficient laboratories.
- Align efforts with priorities and opportunities of federal funding agencies and industry, and pursue high-value grant projects, such as Centers of Biomedical Research Excellence (COBRE), Engineering Research Centers (ERC), and Science and Technology Centers (STC).
- Invest in research equipment that will be relevant to industry and funding agencies.

This section lists the largest competitive grants recently secured by Clemson faculty.



Pictured: Hai Yao was awarded an \$11 million Center for Biomedical Research Excellence (COBRE) grant this fiscal year. This is Clemson's third COBRE. [LEARN MORE](#)

EXECUTIVE SUMMARY

CONSISTENTLY EARNING HIGH-VALUE AWARDS

- In FY2019, Clemson faculty earned 10 awards of at least \$2 million in value, for a combined value of \$33 million.
- Clemson has consistently earned large awards over the past five years. Since 2015, Clemson has received 37 major research projects with a combined value of \$180 million.
- These large grants are significant contributors to the growth of the university's research enterprise. As such, we continue to assemble faculty teams to strategically pursue high-value grant opportunities.
- Fiscal Year 2020 has started with a significant award; Hunter Endowed Chair of Bioengineering Naren Vyavahare received news that his NIH-funded Center for Biomedical Research Excellence has been approved for an additional \$5.7 million and will be advanced to a third phase. This is significant in that it allows Clemson to pursue another COBRE grant. Trudy Mackay, director of the Center for Human Genetics, is leading the development of our proposal.

1 Hai Yao received \$11 million from the National Institutes of Health

Project Title: NIH-COBRE: S.C. Translational Research Improving Musculoskeletal Health (SC-TRIMH)

Summary: The South Carolina COBRE for Translational Research Improving Musculoskeletal Health (SC-TRIMH) will develop a multidisciplinary and interactive center to promote translational research for musculoskeletal health by supporting junior investigators and enhancing their research competitiveness. This initiative will capitalize on the existing infrastructure and research collaboration in musculoskeletal diseases in the state of South Carolina through the Clemson University School of Health Research (CUSHR) plus its innovation campus in Greenville and the Clemson-MUSC Bioengineering Program in Charleston.



2 Chris Kitchens received \$4.3M from the National Science Foundation

Project Title: S-STEM: Collaborative Research: SPECTRA Student Pathways in Engineering and Computing for Transfers

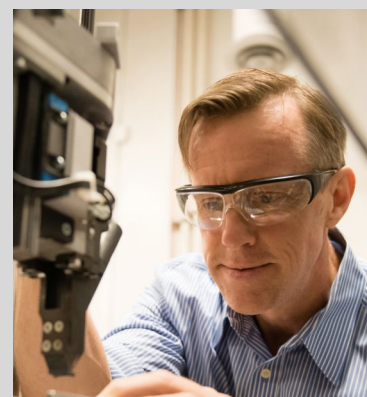
Summary: A national challenge in STEM education is the low graduation rate of engineering students who transfer from community colleges to four-year institutions. One driver of this low success rate is the insufficient preparation of community college students for the differences they will face at the four-year institution, including a lack of social and academic support. Clemson leads this project aimed at increasing the success of engineering and computer science students who transfer to Clemson University from Spartanburg Community College or Trident Community College, or from any of the 16 technical colleges in South Carolina.



3 Laine Mears received \$3 million from the National Science Foundation

Project Title: NRT-HDR: Technology-Human Integrated Knowledge Education and Research

Summary: As automobile manufacturing - and manufacturing in general - increasingly relies on seamless integration of digital technologies and human agents, more sophisticated methods of data-capture and analysis are required to deploy smart manufacturing processes. This award will support teams of graduate, undergraduate and technical college students as they solve problems emerging from the interaction of humans with the digital manufacturing domain.



4 Mark Thies received \$2.2M from the Department of Energy

Project Title: BEEPS Lignin Fractionation and Valorization

Summary: Clemson leads this collaboration with Michigan State University, Montana State University, Kansas State University and industry partners to ultra-purify lignin, a naturally occurring polymer present in the cell walls of plants. A novel lignin purification process has been developed by Clemson's Mark Thies. The purified lignin products have applications in the automotive, building and pharmaceutical industries.



5 Curtiss Fox received \$2.3M from the Department of Energy

Project Title: High Speed Medium Voltage CHP System with Advanced Grid Support

Summary: This project pairs Clemson University with TECO Westinghouse, a leading manufacturer of electric motors, generators and drives. Researchers will use the eGRID facilities in Charleston to develop and test a medium voltage high speed CHP, combined heat and power system, to improve power generation efficiency and reliability for manufacturing environments.



6 Narendra Vyavahare received \$2.2M from the National Institutes of Health

Project Title: Medial Arterial Calcification: Mechanisms and Therapy

Summary: Degradation and calcification of elastin fibers in arteries occurs as individuals age, but for patients with diabetes or chronic kidney disease, calcification of elastin can lead to cardiovascular disease or other unfortunate outcomes like lower extremity amputation. Clemson researchers, working with colleagues at MUSC, have developed nanoparticles that target calcified tissues in order to remove mineral deposits.



7 Ranjandeep Sekhon received \$2.1M from the National Science Foundation

Project Title: A Multiscale, Multiphysics, Modeling Framework for Genome-to-Phenome Mapping via Intermediate Phenotypes

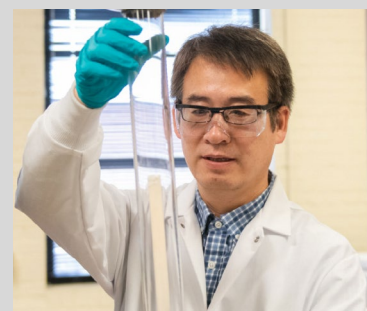
Summary: Clemson joins University of Kentucky and University of Idaho to examine how plant genetics lead to stalk lodging resistance, the breaking or snapping of plant stems prior to harvest, in maize and sorghum. Clemson will contribute its expertise in genetics and modeling to identify the genes responsible for this complex agricultural problem.



8 Jianhua Tong received \$2M from the Department of Energy

Project Title: Laser 3D Printing of Highly Compacted Protonic Ceramic Electrolyzer Stack

Summary: Four Clemson researchers will use laser 3D printing technology (L3DP), an emerging additive manufacturing technology, to manufacture complex ceramic parts rapidly and inexpensively. These ceramic parts are integral to the production of hydrogen gas for use in solid oxide fuel cells.



9 Brian Powell received \$2 million from the Department of Energy

Project Title: Radionuclide Waste Disposal: Development of Multiscale Experimental Modeling Capabilities

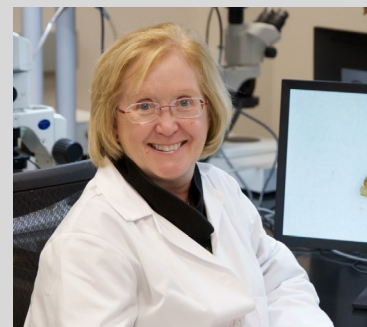
Summary: Containment of radionuclide waste, an environmentally damaging by-product of energy generation and medical technologies, is a problem with long-term health and environmental impacts. The funds awarded to the second phase of this project support the development of new instruments combined with existing technology to measure the efficacy of radionuclide containment systems.




10 Trudy Mackay received \$2 million from the National Institutes of Health

Project Title: Genetics of Cocaine and Methamphetamine Sensitivity in Drosophila

Summary: Substance abuse and addiction extract a monumental socioeconomic cost. While researchers have discovered a great deal about the neural mechanisms that mediate substance addiction, very little is known about the genetic risk factors for addiction. Using fruit flies as a genetic proxy for humans, researchers seek a fuller understanding of the genetic factors present in voluntary consumption of psychostimulants.



This section recaps university research news.



Pictured: Clemson University physicists will conduct a pair of NASA-funded rocket missions.

[LEARN MORE](#)

EXECUTIVE SUMMARY

RECOGNIZING EXCELLENCE AND NURTURING RESEARCH GROWTH

- Clemson University recognized high-performing faculty during its Researcher of the Year awards ceremony ([see page 22](#)).
- Our young faculty members have been successful in recent years securing early career awards from funding agencies. These are prestigious awards that can help jumpstart the careers of young faculty ([see page 23](#)).
- The Clemson University Research Foundation launched a new event series called INSPIRE to match Clemson researchers with industry collaborators and launched a new maturation fund in partnership with Prisma Health ([see pages 24-25](#)).
- The Electron Microscopy Facility partnered with Hitachi High Technologies to host an open house to showcase new equipment to industry customers ([see page 26](#)).
- More than 400 undergraduate students each year participant in a Creative Inquiry research project, which provide unique educational opportunities for students ([see pages 27-29](#)).
- Clemson faculty members are looking to make far-reaching impacts ([see page 30](#)).



The Researcher of the Year awards recognize the efforts of high-achieving faculty whose work is improving society through the generation and dissemination of new knowledge.

Each college nominated a senior faculty member and a junior faculty member who received his or her terminal degree within the past 10 years. Winners were selected by an interdisciplinary faculty committee and announced at the university's annual Research Symposium on May 8. [READ MORE](#)

Junior Researcher of the Year Mark Blenner



Senior Researcher of the Year Ken Marcus



Junior Faculty Nominees



Mark Blenner



Greg Cranmer



David Jachowski



Sandra Linder



Xian Lu



Eric Morris

Senior Faculty Nominees



Antonis Katsiyannis



Ken Marcus



Laine Mears



Catherine Mobley



John Rodgers



Phillip Roth



Will Stockton

Early Career Awards



Presidential Early Career Award for Scientists and Engineers (PECASE)

awarded to

Mark Blenner, associate professor of chemical and biomolecular engineering

PECASE is the highest honor bestowed by the U.S. Government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in science and technology. Blenner was nominated for the award by NASA.

Six Clemson faculty members received early career awards during the 2019 fiscal year from either the National Science Foundation (NSF), the Environmental Protection Agency (EPA), or the U.S. Air Force (AF).



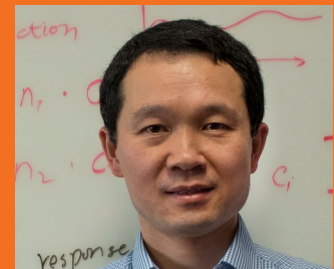
Ezra Cates (EPA)

Environmental Engineering & Earth Sciences



Eric Davis (NSF)

Chemical & Biomolecular Engineering



Hongxin Hu (NSF)

Computer Science



Ben Jaye (NSF)

Mathematical & Statistical Sciences



Yunyi Jia (NSF)

Automotive Engineering



Judson Ryckman (AF)

Electrical & Computer Engineering



CAREER Academy

To help faculty win CAREER Awards, the Division of Research offers a 6-month CAREER Academy with workshops, peer group meetings, and grant-editing support. The program provides valuable insights from CAREER awardees, former NSF program officers, and external consultants.



INSPIRE

Innovation Series for Partnering Industry with the Research Enterprise

The new INSPIRE event series presented by the Clemson University Research Foundation supports and enhances both new and existing relationships between Clemson University's research enterprise and industrial partners.

- Highlight Clemson's research expertise, personnel, capabilities, and facilities.
- Identify and share Industry research and development needs with the Clemson research enterprise.
- Build and enhance networks to foster research and development relationships between Clemson and Industry.
- Identify, review and discuss areas of joint interest to both Clemson and Industry with subject-matter experts and their respective organizations.
- Promote continued Industry engagement with the Clemson research enterprise to develop long-term collaborations.

Kick-off event

What: Pair Clemson faculty with industry to create winning Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants.

When: 8 a.m.-3:30 p.m. Oct. 22

Where: Clemson University Madren Center



CLEMSON
UNIVERSITY
RESEARCH
FOUNDATION

New Innovation Maturation Fund

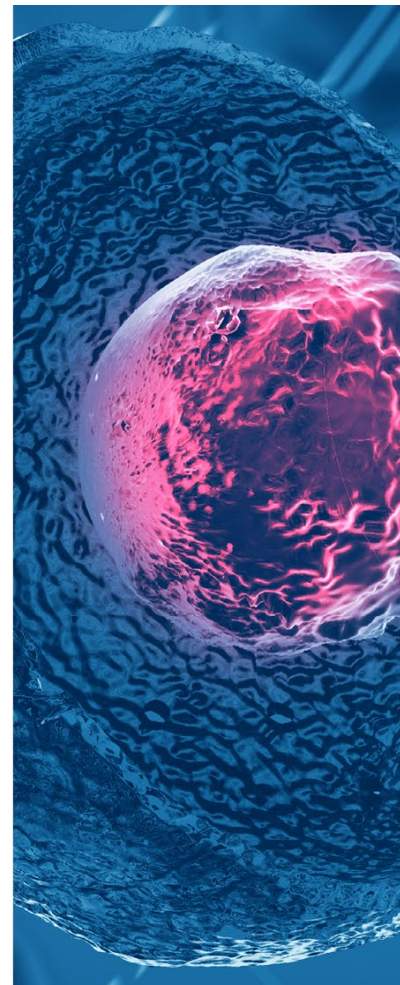
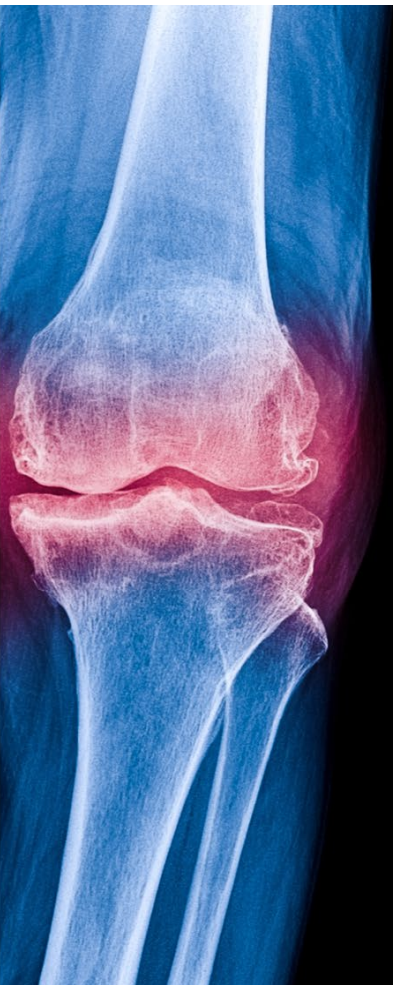
A joint effort of the Clemson University Division of Research and the Health Sciences Center (HSC) at Prisma Health, the new Innovation Maturation Fund provides health care-focused grants intended to advance the development and implementation of new medical initiatives, advance translational science, create job and educational opportunities, improve health care and drive economic growth in the region. The fund is managed by the Clemson University Research Foundation.

Funds up to \$200,000 per year in grants

Increases applied research collaborations with Prisma Health

Advances new medical innovations with opportunity for commercialization

First grants will be awarded during the Fall 2019 semester








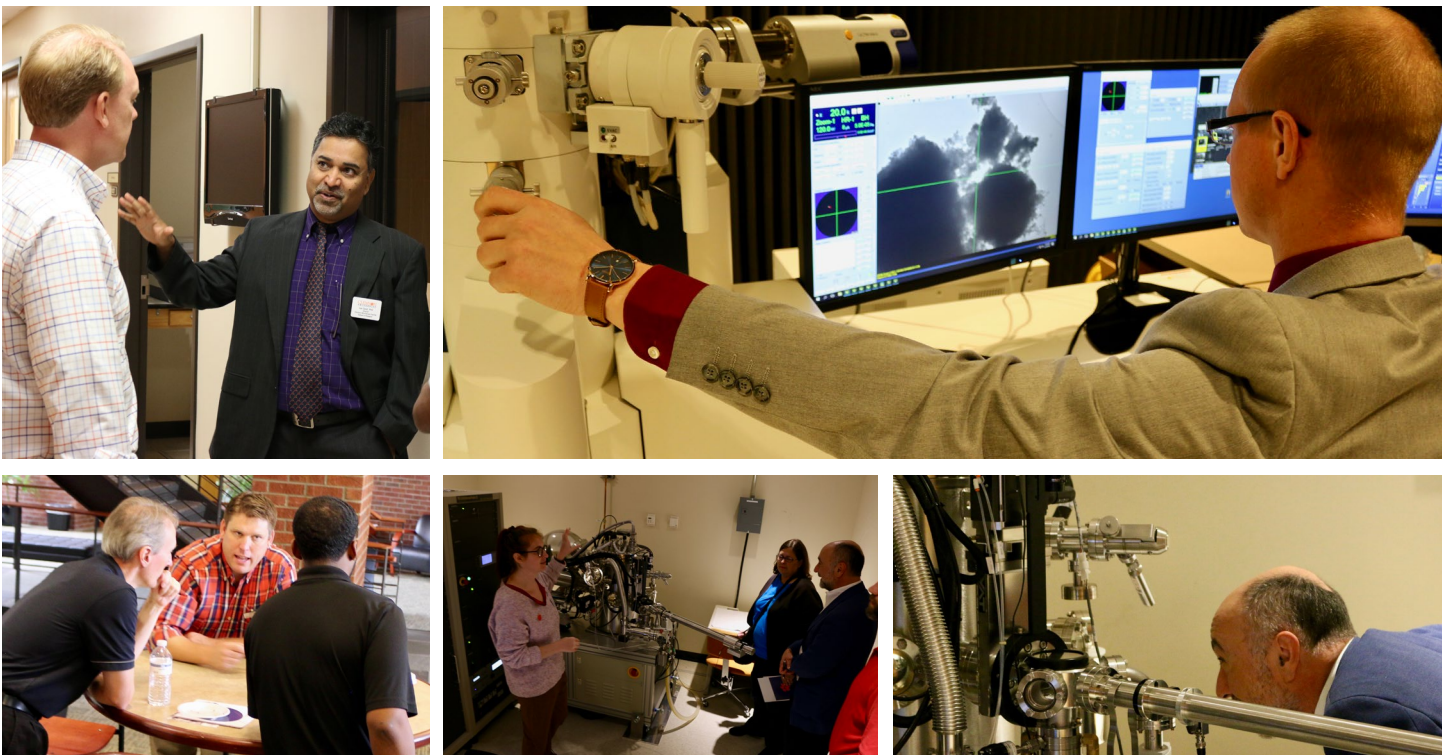
CLEMSON UNIVERSITY ELECTRON MICROSCOPY

Investing in new equipment to bring innovation into view

The Electron Microscopy Facility at Clemson University has added numerous highly advanced microscopes available for use by universities, educational institutions and organizations, and private companies, including:

-  **The world's most advanced scanning electron microscope**
-  **Combined X-ray Photoelectron Spectroscopy and Auger Electron Spectroscopy equipment**
-  **New highly advanced tunable energy transmission electron microscope**

To showcase this new equipment to industry, attract more external users, and increase revenue, the facility collaborated with Hitachi to host an Industry Open House on Sept. 19.



Creative Inquiry

Creative Inquiry has come to define Undergraduate Research at Clemson University. It's small-group learning for 20,000. It's the imaginative combination of engaged learning and undergraduate research, and it is undergraduate research unique to Clemson University.

Students take on problems that spring from their own curiosity, from a professor's challenge or from the pressing needs of the world around them. Team-based investigations are led by a faculty mentor and typically span two to four semesters. Students take ownership of their projects and take the risks necessary to solve problems and get answers.

Topics are boundless. Students often find themselves presenting their work at national conferences, fielding questions from professionals. This invaluable experience produces exceptional graduates. Our Creative Inquiry participants develop critical thinking skills, learn to solve problems as a team and hone their communication and presentation skills.



50,000 undergraduates have participated in Creative Inquiry since its start in 2005.

More than 400 CI projects are conducted each year, with 450 faculty mentors.

\$375,500 has been received from industry supporters since 2017.



Numerous Success Stories

The Watt Center Makerspace grew out of a series of Creative Inquiry projects. The makerspace now provides access to 3D printers, laser cutters and other equipment to all students throughout campus, in all disciplines.

Creative Inquiry

Better golf with 3D Motion Capture

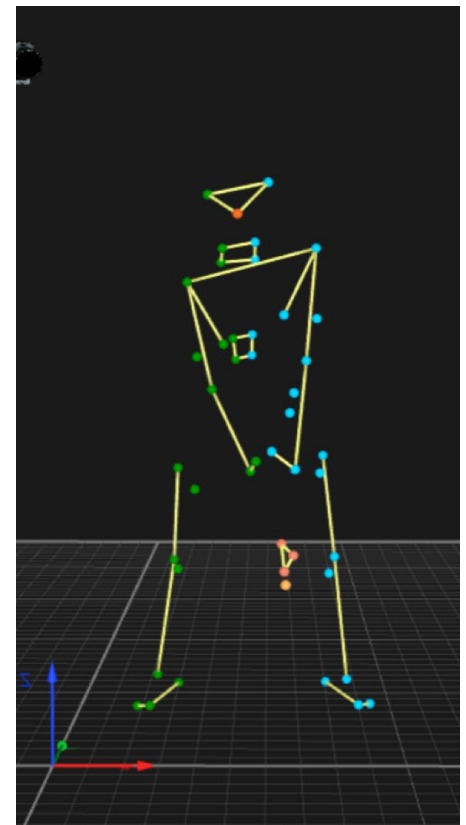
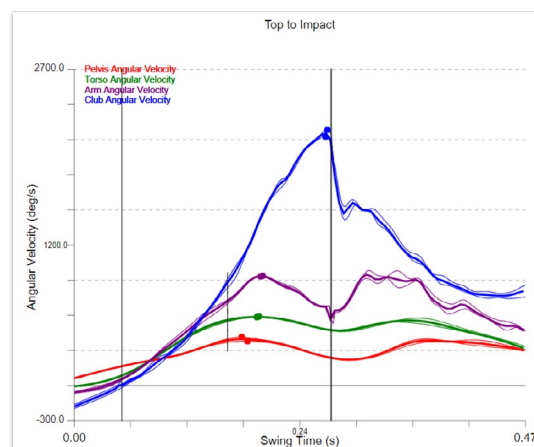
A team of Clemson University students are using three-dimensional, motion-capturing technology to help golfers find consistency in their swings.

But the technology can do more than knock strokes off your golf game. It could be used in rehabilitation for stroke patients or for horse-riding therapeutic treatments, for example.

To analyze golf swings, the system uses eight infrared cameras with 52 highly reflective markers placed on a golfer's body to track movements of the pelvis, torso, arm and club during each swing. Multiple swings are taken and recorded with the Qualisys Track Manager system. Kinematic sequencing then provides pinpoint, three-dimensional digital views of swing consistency, helping golfers target specific areas of their swing for improvement.

Undergraduate students Julia Gambill and Katie Van Damme are working under the direction of bioengineering professor John DesJardins and graduate student Meredith Owen to collaborate with the Men's Golf Team and the Oconoe School District. Other research teams are working with the university's equine facility to study movements during hippotherapy, and Clemson Athletics' Adaptive Sports program to study wheelchair tennis and basketball.

In addition to the funding received from Creative Inquiry and DesJardins's lab, the project has received funding from the Robert H. Brooks Sports Science Institute and the SC-INBRE (South Carolina IDeA Networks of Biomedical Research Excellence) Research Experience for Teachers Program at Furman University.



Creative Inquiry

Experimental Cardiovascular Systems

Clemson University undergraduate student Aparna Mahendranath is working to develop a “butterfly” actuating valve that would mimic the function of a heart valve to keep blood flowing through the heart in the correct direction.

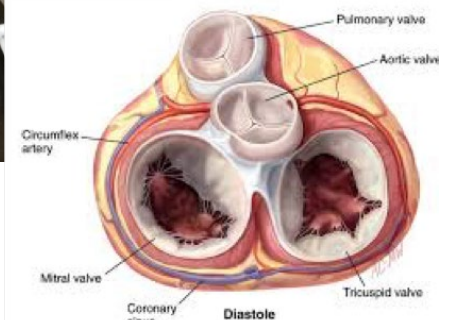
The research could one-day lead to a commercially available actuating valve to assist patients of heart valve disease, which can cause heart failure, stroke, blood clots and heart-rhythm abnormalities if not treated.

Mahendranath is working under the direction of mechanical engineering assistant professor Ethan Kung. Their butterfly valve is a control valve that actuates by turning 90 degrees to stop-and-start blood flow. The valve is connected to a solenoid and coded to shut on-and-off at a high pace. Currently she is testing the valve by incorporating it within a flow loop with flexible plastic tubing, a reservoir and a pump.

As part of her research, Mahendranath also is analyzing the shapes of devices used in Fontan procedures to redirect blood flow from the lower body to the lungs in children with abnormal hearts. She has already built 3D-printed models that will go through experimentation and computer-simulated analysis. Her goal is to make these complicated procedures safer and more effective.



A butterfly control valve (left) can mimic a heart valve (right) in regulating blood flow to the heart. Mahendranath is testing the system in a flow loop with flexible plastic tubing, a reservoir and pump (top).



Dr. Blenner: Engineering Better Medicines, and More

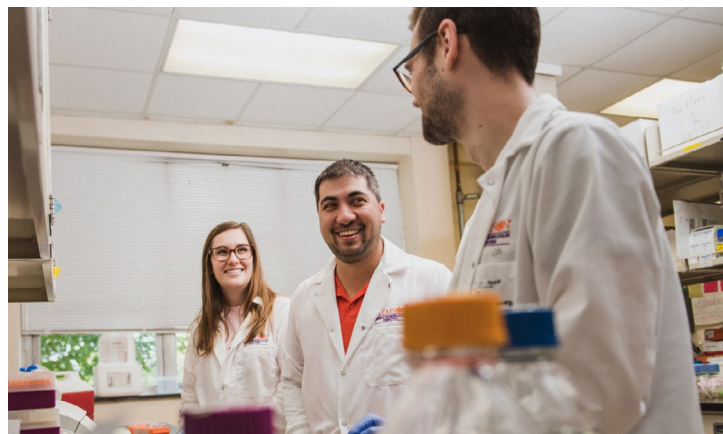
Plants have helped cure disease and relieve pain since ancient times, and new research at Clemson University could help tap even more of their potential.

Many plants hold promising pharmaceutical compounds but in quantities far too small to develop into marketable drugs. In some cases, the entire area of the United States could be farmed with a single crop and it would be enough to treat just a few patients.

Instead, Mark Blenner (at center in photo) and his team are exploring how it may be possible to synthesize pharmaceutical compounds by taking genes from plants and placing them in *Yarrowia lipolytica*, a strain of yeast.

“It could lead to new drugs to treat all kinds of diseases and cost-effective production of those drugs,” Blenner said. “This comes from the idea that plants can’t naturally make enough of these compounds to be able to test them broadly. We want to be able to make these compounds with much less farming and land and tending crops.”

The National Institutes of Health is providing



a \$1.8 million Outstanding Investigator Award to support five years of research.

This is just one of many research projects for Blenner, the McQueen-Quattlebaum Associate Professor in the department of chemical and biomolecular engineering. He is also discovering pathways in yeast that can use lignin to make fatty acids for fuels and chemicals; making yeast that turns industrial waste into fish-feed; and working with NASA to help astronauts sustainably travel farther from Earth.

Dr. Kresovich: Linking Research and Economic Development

A company born out of Clemson University’s Advanced Plant Technology (APT) Program seeks to revolutionize regional agriculture by building a feed grain pipeline through the Southeast.

The company, Carolina Seed Systems, is working to develop superior sorghum crops to address a shortage of animal feed. Grain sorghum is a cereal grain that is often used as a substitute for corn and feeding rations in the animal industry. Because it is highly tolerant to drought and also efficient in its nutrient use, grain sorghum is a highly sustainable crop option for farmers.

“Carolina Seed Systems represents a product of the vision, innovation, technology and commitment of Clemson’s Advanced Plant Technology Program to the agricultural stakeholders of South Carolina,” said Stephen Kresovich, director of the APT program.

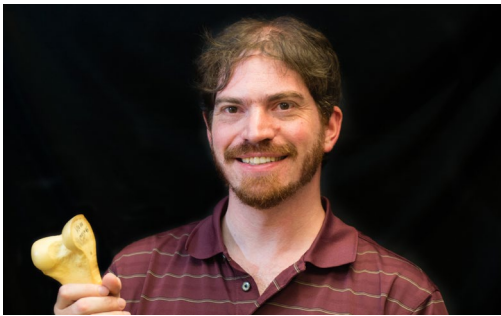


Kresovich recently received a \$5.4 million grant from the U.S. Department of Energy to use a ground-based robotic platform outfitted with non-contact sensors to conduct phenotyping that will identify favorable genetic markers that can be used in the development of superior crop hybrids.

Carolina Seed Systems will collaborate with Clemson to bring the sorghum germplasm to market.

FOCUS ON FACULTY

This section highlights the accomplishments of three faculty members from each college; information was provided by the colleges.



Chemistry professor Jeff Anker has been named a Senior Member of the National Academy of Inventors (NAI). He is one of 54 academic inventors from around the nation and world who were honored in the Spring 2019 class.

[READ MORE](#)



Mark Small, professor of psychology and director of the Clemson University Institute on Family and Neighborhood Life, received an honorary doctorate from the University of South Bohemia, Czech Republic, for his extensive work on community development there and elsewhere in the world.

[READ MORE](#)



Joseph Mazer, professor and chair of the communications department, has been named to a three-year term as editor of Communication Education, a flagship journal published by the National Communication Association and the nation's premier publication for research in the field.

[READ MORE](#)



Michael S. Caterino, PhD

John and Suzanne Morse Chair of Arthropod Biodiversity Plant and Environmental Sciences

Michael Caterino joined Clemson in 2014 as the first Morse Endowed Chair of Arthropod Biodiversity. He runs a research lab and training program addressing regional and global questions in arthropod taxonomy and evolution. He is also the Director of the Clemson University Arthropod Collection, a research collection of nearly 1.5 million specimens dating back to the late 1800s.

Caterino is an internationally recognized expert in the systematics of beetles, having published over 90 peer-reviewed papers and named more than 400 new species across several families. His research also uses molecular tools to investigate population genetic relationships and applies the results to landscape-level conservation planning.

Selected Accomplishments

- Received a National Science Foundation 'Collections Improvement' grant (\$505,000) for renovations to the Clemson University Arthropod Collection (2015–2019)
- Awarded \$706,000 as part of a collaborative NSF-funded project to survey the arthropod fauna of the highest peaks in southern Appalachia (2019–2022).
- Collaborates on two NSF-supported biodiversity collections digitization projects, supporting undergraduate students to capture and share specimen data.
- Described 16 new beetle species in 2018–2019.
- Served as the President of the international Coleopterists Society (2010–2012)
- Serves or has served on the editorial board of four professional journals.
- Presented at the Clemson University Life Sciences Outreach Center's Science on Tap series (Title: Untapped Biodiversity - Recent Insect Discoveries in Southern Appalachia).
- Currently the Graduate Program Coordinator for the M.S. and Ph.D. programs in Entomology.
- Serves on the Curriculum, Assessment, and Faculty Advisory Committees in the Department.





David Jachowski, PhD

Assistant Professor Wildlife Ecology

David Jachowski is an Assistant Professor of Wildlife Ecology in the Department of Forestry and Environmental Conservation with a 50% teaching and 50% research appointment. His teaching focuses on undergraduate and graduate courses in wildlife ecology, and his research centers around opportunities for science to help advance the restoration of wildlife populations. His research addresses these themes of adaptation and restoration, focusing on three main topics in wildlife ecology: (1) mammals in the changing world, (2) restoration of wildlife populations, and (3) mesocarnivore community ecology. He and his students conduct field-based research projects on these topics in the Great Plains (where he has created and run the Clemson Prairie Ecology Lab), South Africa, and the southeastern United States.

Selected Accomplishments

- During his 5 five years at Clemson he has published 2 books, 4 book chapters and 26 peer-reviewed journal articles, recruited and advised 21 graduate students and have been the principal investigator or co-principal investigator on 25 external grants worth a total of \$3,281,443.
- His research lab has gained national recognition for research on impacts of white-nose syndrome on bat communities, acquiring 8 competitive grants on this topic alone in the past 5 years.
- He has conducted research on many species' restoration projects, including one of the most impactful and longest-running projects is related to African elephant restoration in South Africa.
- His lab has become recognized for regional, national and international expertise in the ecology and conservation of mesocarnivores (i.e., mid-sized carnivores).
- Jachowskis is an Honorary Research Fellow, School of Life Sciences, University of KwaZulu-Natal (South Africa); Associate Fellow, Center for Great Plains Studies; a Finalist for the Stubbendieck Great Plains Distinguished Book Prize (2015); and the 2019 CAFLS Young Researcher of the Year.





Robert Benedict, PhD

Professor of Practice Real Estate

Prior to joining Clemson, Robert was a vice-president and partner with Carolina Holdings with project management responsibilities for over \$30 million in development including neighborhood retail, single-tenant retail and infill residential projects. With over 25 years of real estate finance and development experience, Robert started his career with The Travelers Insurance Company and was promoted to Real Estate Investment Manager with positions in Charlotte, Atlanta and Washington, D.C. He was also an assistant vice president with U.S. Shelter in Greenville, developing over 2,000 apartments in the Carolinas and Florida. In addition to his extensive development experience, Robert has been a historic preservation consultant specializing in historic tax credits, adaptive use rehabilitations and National Register of Historic Places nominations.

Selected Accomplishments

- Robert was named the 2018 recipient of the March of Dimes Real Estate and Economic Development Award. The award was presented at the organization's annual luncheon, which raised more than \$133,000 in support for the Greenville Hospital System's Neonatal Care Unit. When Benedict was recognized for his leadership in Upstate South Carolina, it was noted that the Clemson MRED program and its alumni are major contributors to communities in the Carolinas and the field of real estate development. Benedict will serve as chairman and host of the 2019 March of Dimes event.





Michael LeMahieu, PhD

Associate Professor English

LeMahieu joined the faculty of the College of Architecture, Arts and Humanities as an assistant professor in 2006, after earning his undergraduate degree in English and Spanish at Marquette University and an M.A. and Ph.D. in English from the University of Wisconsin-Madison. His research interests include 20th/21st Cent American Literature Civil War Memory. Philosophy of Language with a focus on Twentieth- and Twenty-First-Century American, African-American, and Anglophone Literature; Modernism and Postmodernism; History of Ideas; Critical Theory; and Anglo-American Philosophy of Language. He is the author of “Fictions of Fact and Value: The Erasure of Logical Positivism in American Literature, 1945-1975” (Oxford University Press, 2013), co-editor of “Wittgenstein and Modernism” (University of Chicago Press, 2017) and co-editor of the academic journal Contemporary Literature.

Selected Accomplishments

- Mike has been awarded a \$60,000 Fellowship to continue work on his book project “Reconstructing Civil War Memory in American Literature after Brown v. Board of Education. His book will analyze how, in the wake of the landmark United States Supreme Court desegregation case, leading American authors took up the pen as an instrument of civil rights. His project will examine the work of James Baldwin, Gwendolyn Brooks, Ralph Ellison, Langston Hughes, Harper Lee, Flannery O’Connor and other writers. Through their literature, these authors countered mythologies surrounding the Civil War, debunked Lost Cause narratives and rewrote cultural legacies. LeMahieu’s fellowship is part of \$14.8 million in grants and fellowships recently announced by The National Endowment for the Humanities, which will fund 253 humanities projects across the country, is one of the most prestigious awards given in the humanities, and this accomplishment comes in addition to LeMahieu’s receipt of the also very prestigious American Council of Learned Societies award last year.
- His research on Civil War memory in literature also earned LeMahieu a 2018 Fellowship in the amount of \$5,0000 from the American Council of Learned Societies, a private, nonprofit federation of 75 national scholarly organizations, which supports American scholarship across disciplines in the humanities and social sciences. This fellowship allowed for a fullyear dedicatd to research and wrting for his reserch on “Post-54: Reconstructing Civil War Memory in American Literature After Brown.”





Rhondda Thomas, PhD

Calhoun Lemon Professor English

Rhondda Thomas joined the Clemson faculty in 2007 and was named the Lemon Professor of Literature in 2018. Thomas earned her Ph.D. in English from the University of Maryland, master's degrees in literature from the University of New Hampshire and in journalism from the University of Georgia. She received her undergraduate degree in communication/media journalism at Columbia Union College. Rhondda Thomas's research and teaching interests are early African American literature and culture, politics of black identity, autobiographical scholarship, African American literature and the Bible, race and culture studies, African American historiography, migration narratives, and African American women writers.

Selected Accomplishments

- Rhondda received a National Endowment for the Humanities grant of \$11,165 to host a two-day "Documenting Your Roots" event in February 2020. The grant is part of the National Endowment for the Humanities' Common Heritage program, which supports community digitization and outreach events aimed at preserving America's cultural heritage. "This NEH Common Heritage grant will enable us to provide free digitizing services for African-Americans in local communities to preserve family artifacts for generations to come as well as enhance the Call My Name project's efforts to tell the complete story of African Americans in Clemson University history," Thomas said. The "Documenting Your Roots" project aims to preserve photographs, letters, marriage licenses, newspaper clippings and other printed materials associated with African-American history and culture in local communities. In the months leading up to the two-day event, a series of programs on campus and in local communities will raise awareness about the digitizing program and best practices for preserving and sharing African-American history.
- "Documenting Your Roots" is a collaboration between Thomas' Call My Name project, the Humanities Hub and Special Collections and Archives at Clemson University; and community partners the Bertha Lee Strickland Cultural Museum, the Clemson Area African American Museum and the Pendleton Foundation for African American History and Culture. This award comes after a Dr. Thomas was awarded a prestigious Whiting Public Engagement Fellowship last year.





Barry A. Garst, PhD

Associate Professor Youth Development Leadership

Barry Garst is a social scientist who studies critical and emerging issues impacting youth and parents within the context of out-of-school (OST) time. His research has examined overparenting, factors impacting youth development outcomes during OST experiences, and youth injury and illness monitoring and prevention in summer camps. His current and recent research has been supported by Boys and Girls Clubs of America, the Association of Camp Nursing, and the Children and Nature Network. Garst teaches graduate courses in Youth Development Leadership, a M.S. degree program targeting professionals working in youth-serving organizations. His courses include Assessment and Evaluation of Youth Programs, Creative and Ethical Leadership, Managing Staff and Volunteers, and a unique special topics course on Youth Development and Nature.

Selected Accomplishments

- Co-founded an out-of-school time research lab focusing on issues impacting youth and parents.
- Published 9 peer-reviewed journal articles between 2017-2018.
- Received the 2018 “Excellence in Graduate Teaching Award” from the College of Behavioral, Social and Health Sciences, Clemson University.
- Selected to participate in the 2017-2018 President’s Leadership Institute (PLI), Clemson University
- Invited to author a chapter on “Nature and Youth Development” for an undergraduate textbook.
- Currently serving on a National Academy of Sciences’ consensus study committee on Summer time Experiences and Child and Adolescent Education, Health, and Safety (2018-2019).
- Currently serving on the American Camp Association’s Healthy Camp Research Committee, leading an effort to monitor youth injury and illness rates and develop prevention strategies within the context of summer camp (2017-2019).
- Currently serving as Chair of the Research Committee for the Association of Camp Nursing, examining workplace fatigue within the context of summer camp. (2016 to present).
- Currently serving on the Children and Nature Network’s Nature-Based Learning Research Network and co-chairing the research to practice committee (2018-2019).





Darren L. Linvill, PhD

Associate Professor Communication

Since 2007 Darren Linvill has served as the Department of Communication's basic course director, supervising all oral communication general education classes taught by the department and helping to serve nearly 3000 student every year. This spring Linvill stepped down from that position to focus more on his ongoing research. Linvill has for, for several years, studied social media through Clemson's Social Media Listening Center. Recently, however, he has focused specifically on foreign state sponsored online disinformation. With colleague Patrick Warren (Department of Economics) he identified nearly three million tweets from Russia's Internet Research Agency, many aimed at influencing conversations in the United States. Through Nate Silver's Fivethirtyeight.com, Linvill and Warren made these tweets public to researchers around the world and have together they have facilitated further research in the understanding of disinformation. With funding from the Charles Koch Foundation, the two are currently trying studying this data and the impact of disinformation on social media users everywhere.

Selected Accomplishments

- Disinformation research has received national and international media attention, including The New York Times, The Washington Post, The Wall Street Journal, and CNN.
- Working with Fivethirtyeight.com, made public three million Russian Internet Research Agency tweets, setting off a "wave of academic papers on this dataset."
- Briefed various federal law enforcement and intelligence organizations, gaining acknowledgement in Sept. 5, 2018 Senate Intelligence Committee hearing by Senator Susan Collins of Maine.
- Research findings helped spur an Italian federal investigation into the influence of disinformation on elections in that country.
- In past four months, has received \$20,000 from Epic Games and \$50,000 from The Charles Koch Foundation for further research into online disinformation.
- Appeared on NPR's The Takeaway, with Tanzina Vega (Dec. 18, 2018).
- Published seven peer-reviewed academic publications in academic year 2017-2018.
- Winner of College of Behavior, Social, and Health Sciences' 2017 Award for Excellence in Undergraduate Teaching.





Nancy Meehan, PhD

Associate Professor
School of Nursing

Meehan is a nurse innovator, educator and researcher who truly embraces technology. Her goal is to create tomorrow's nurse innovators and change agents by empowering undergraduate freshmen nursing students to improve healthcare by working with nursing students by encouraging them to think innovation and change — “before” they are exposed to the “way things are” in the healthcare setting. Meehan founded the Nursing Innovation Project, and her course became a designated Clemson Think2 course in Fall 2017.

Selected Accomplishments

- Worked as UPIC mentor since fall 2012. All of these UPIC students have work to bring new innovative ideas to improve course experiences.
- Award for Excellence in Innovation, College of Behavioral, Social and Health Sciences 2017–2018
- Award for Excellence in Academic Advising, College of Behavioral, Social and Health Sciences 2016–2017
- Served as the Honors adviser for more than 100 Nursing Departmental Honors students since 2006
- Serves on University Calhoun Honors College committee
- Has been awarded HSC/GHS research grant funding for April 20, 2019 – March 20, 2020 to investigate “The Impact of Remote Telepresence on Interprofessional Healthcare Team Collaboration and Satisfaction.” PIs, Kenneth Becker MD and Janice Lannam RN MS CNS, FNP, and co-investigators, Nancy Meehan Ph.D., RN and Pat Smith, MHRD, MSN, RN.
- Worked as UPIC mentor since fall 2012. All of these UPIC students have work to bring new innovative ideas to improve course experiences.





Lawrence D. Fredendall, PhD

Trevillian Distinguished Professor Management

Larry joined the Clemson faculty in 1990 and began teaching the supply chain management courses within the department. He still teaches these courses at the Undergraduate, Masters and PhD levels. Lawrence D. Fredendall is currently conducting research that is concerned with the implementation of lean operations and quality management in both health-services and manufacturing. One book, which was published by The St. Lucie Press/APICS Series, is titled Basics of Supply Chain Management. He has recently co-authored two books lean operations -- "An Introduction to Lean Work Design (Part 1): Fundamentals of Lean Operations" and "An Introduction to Lean Work Design (Part 2): Standard Practices and Tools of Lean." He is also an active member of the Clemson University School of Health Research (CUSHR).

Selected Accomplishments

- Published one book titled: Basics of Supply Chain Management with E. Hill, (St. Lucie Press/ APICS Series on Resource Management), New York, NY: St. Lucie Press, 2001.
- He has two more books scheduled to be released in May 2016. They are: An Introduction to Lean Work Design, Volume I: Fundamentals of Lean Operations and Introduction to Lean Work Design, Volume II: Standard Practices and Tools of Lean, with M. Thurer, (Business Expert Press).
- He has published 61 refereed articles, 6 book chapters and made 130 presentations at Academic Conferences
- He is the Special Issue Editor for the Journal of Operations Management Healthcare Delivery and a senior editor at Production Operations Management Journal.
- Currently he is an investigative member of the AHRQ grant titled "Realizing Improved Patient Care through Human-Centered Design in the OR (RIPCHD. OR)". The total funding for grants of which he has been a team member or investigator during the last 10 years in excess of \$5.8 million.
- He is currently serving as the Clemson Research Director for the Health Sciences Center at Greenville Health Systems, where he facilitates research between Clemson faculty and GHS physicians.





Ryan Mullins, PhD

Associate Professor Marketing

Ryan Mullins is an award-winning author, professor, and consultant focused on helping organizational leaders improve sales force performance. In his 7 years at Clemson, Ryan has contributed 14 academic articles, with 6 of those appearing in the Financial Times Top 50 business journals in the world. In the classroom, Ryan teaches courses focused on personal selling, sales management, and sales leadership. He also serves as the faculty director for the newly-founded Sales Innovation Program with the goal of becoming internationally recognized in sales research, education, and leadership. In line with this mission, Ryan has also been awarded a Provost's Innovation Fellowship at Clemson to help deliver a new sales course in collaboration with industry partners. Ryan greatly enjoys industry collaborations and has conducted multiple research projects with Fortune 500 companies, providing data analysis, insight, and training interventions when needed.

Selected Accomplishments

- 2019 Provost's Innovation Fellowship
- 2018 Neil Rackham/Sales Education Foundation Research Grant Award
- 2017 James M. Comer Award for Best Contribution to Sales Management Theory
- 2015 Sales Excellence in Research Award
- Developed a \$2.5 million gift for the founding of the Sales Innovation Program
- Published 6 journal articles appearing in the Financial Times Top 50 Business Journals
- Highlighted for research contributions in 7 academic or industry press publications
- Recognized for 4 conference presentation awards
- Published 2 invited journal articles
- Delivered 3 invited academic presentations at Clemson and peer universities
- Delivered 2 invited training workshops with sales organizations
- Founding faculty advisor for the Clemson Sales Club





Thomas Springer, PhD

Professor Finance

Thomas Springer is a Professor of Real Estate. His studies focus on housing markets, brokerage, and the impacts of foreclosures on housing prices. He also researches real estate investment trusts (REITS), investment performance, and industry efficiency. He has published over 50 journal articles. Springer currently teaches courses in Real Estate including our Introduction to Real Estate course and our senior level Real Estate Investment course. He serves as faculty advisor for the department's Real Estate Club.

Selected Accomplishments

- Secretary of the American Real Estate Society (ARES) for the past 15 years
- Former board member of ARES
- President of the College of Business Faculty
- Member of the College of Business Faculty Advisory Council
- Chair of the department's tenure and promotion committee





Hans W. Klar, PhD

Associate Professor and Assistant Department Chair Educational and Organization

Klar's research is focused on leadership development in high-needs schools. Most recently, his work has centered on successful rural school leadership in South Carolina. Klar currently serves as the principal investigator of the Palmetto Priority School Project, through which he and his colleagues are identifying the leadership practices that can enhance learning in the poorest and lowest performing schools in the state of South Carolina. Klar is a co-developer of the Leadership Learning Community, which was created in partnership with 12 predominantly rural and high-poverty South Carolina School districts to address their leadership development needs. He is on the steering committee of the International Successful School Principals Project, a network of researchers from over 20 countries studying successful school leadership. Klar's research publications are frequently cited and widely recognized.

Selected Accomplishments

- Received over \$1,000,000 as PI or Co-PI on grants related to school leadership.
- Published over 35 manuscripts, 16 in peer-reviewed journals, which were cited 470 times.
- Served as a Visiting Associate Professor, Umeå University, Umeå, Sweden.
- Served as a Visiting Assistant Professor, Universidad Andres Bello, Santiago, Chile.
- Delivered over 50 peer-reviewed and invited conference presentations.
- Received the Highly Commended Award for an article on a successful rural South Carolina school in the Journal of Educational Administration.





Jacquelynn A. Malloy

Associate Professor Teaching and Learning

Jacquelynn Malloy is a teacher educator and researcher who is interested in motivation and engagement, English Language Arts integration, and teacher development. She developed several reading motivation assessments with colleagues at Clemson and other institutions that are widely used in classrooms and in motivation research. Malloy disseminated several research studies that focus on the synergy of integrating the English Language Arts in the content areas, such as in math and social studies, and participated in grant work with science teachers in the Upstate. With colleagues at George Mason University and the University of Washington, Malloy conducted a seven-year longitudinal exploration of how teachers negotiate obstacles to their professional practice that received a national research award.

Selected Accomplishments

- Recipient of 2018 Association of Teacher Educators Distinguished Research in Teacher Education Award, February, 2018.
- Seven publications in peer-reviewed journals in the past two years with several in high impact journals such as Elementary School Journal, the Journal of Educational Research, and Teaching and Teacher Education.
- Keynote speaker on motivation and engagement at the Utah State Reading Association and the Greater Washington Reading Council conferences, 2017.
- Participated in three grants at Clemson in the past three years: Project RES (\$100,000); iScience (\$123,000), and Building Bridges: Cultivating Agents of Change (\$3,000) – all focused on integration the language arts in the content areas.
- Developed a doctoral level course on an emerging research method in the field of education, Design-Based Research, and co-authored two publications on an adaptation of the method, Design-Based Case Studies.
- Google Scholar h-factor of 13 with 759 citations; 472 since 2014.
- Currently collaborating on the development of an online professional learning community to support recent graduates of the Clemson teacher education program as they navigate their first years of teaching. The project, titled A Place to Breathe, is designed to address the current state and national crisis of teachers leaving the field.





Susan King Fullerton, PhD

Associate Professor Education and Human Development

Susan Fullerton is a literacy educator who studies at-risk learners and development of teacher expertise in literacy instruction. Her most recent research has incorporated children's literature discussions, often with technology-enhanced environments and multi-component interventions that promote comprehension and interactions between the teacher, students, and technology or multi-media. She conducts research in classrooms located in high-poverty schools and in library settings. Her most recent grant, through NSF Eager, supported interdisciplinary multi-year research with faculty in architecture and engineering. This research on interactive read-alouds and discussion, enhanced by robotic technology, was conducted in classrooms in the upstate and Columbia, as well as the Richland County Library in Columbia.

Selected Accomplishments

- Best Paper Award at the International Designing Interactive Systems (DIS) in Hong Kong, 2018 – papers selected for “ingenuity and importance” (ACM).
- ACCelerate nomination and selection (ACC and Smithsonian Creativity and Innovation Festival) in Washington, DC, April 2019: LIT KIT selected by Clemson and the ACC committees as one of the projects on display.
- Eugene T. Moore School of Education Award of Excellence in Teaching.
- Received NSF-Eager as co-investigator: The LIT ROOM – A Networked Suite of Architectural-Robotic Artifacts Embedded in the Library for Advancing Literacy in Children, \$199,885.
- Published 5 peer-reviewed articles and one invited; an accepted peer-reviewed book chapter is in preparation.
- Invited interview about children's literature was published in Teaching Young Children.
- Presented 7 papers at national or international conferences; 6 included doctoral students as co-presenters.
- CAEP/ILA program accreditation lead, resulting in National Recognition for the Preparation of Reading Education Professionals for our Literacy M.Ed. program.
- Served as Coordinator of the Literacy area and promoted an online M.Ed.; this change and our recruitment resulted in more than a 40% increase in enrollment.
- Serves on the editorial review board of 6 journals, 2 are top research journals in literacy; served on the Early Literacy Committee of the International Literacy Association.





Karen High, PhD

Professor

Engineering and Science Education

Karen High holds an academic appointment as professor in Engineering Science and Education (ESED) and joint appointments in Chemical and Biomolecular Engineering and Environmental Engineering and Earth Sciences (EEES). Previously High was a professor at Oklahoma State University for 24 years and served as the Director of Student Services and the Women in Engineering Coordinator. High's educational and research emphasis includes STEM faculty development, graduate students, critical thinking and communication skills, online learning, enhancing mathematics success, and promoting inclusion in STEM. She is an emerging national leader in STEM faculty development. High has also focused on sustainable chemical process design, computer aided design, mixed integer nonlinear programming, and multicriteria decision making. She currently advises three and co-advises one ESED PhD and two EEES PhD students.

Selected Accomplishments

- PI on National Science Foundation (NSF) grant “Building Research Capacity for STEM Faculty Development” (\$99,987).
- Co-PI on NSF grant “Developing Engineering Experiences and Pathways (DEEP) in Engineering Technology Career Formation” (\$285,157).
- Led national workshop at Clemson to develop a research agenda on STEM Faculty Development (teaching, research, leadership and service).
- Developed the STEM Faculty Development Collaboratory (SFDC) (www.stemfacdev.org) in 2015 with nearly 100 affiliates from Clemson and across the nation.
- Managed of a three-year study supported by the Provost Office (\$90,000) to improve calculus student success at Clemson.
- Engaged with Clemson Online to develop faculty development modules
- Affiliate Director of the Clemson Alan Alda Center for Science Communication, 2017-2018.
- Program Co-chair, Reimagining Engineering Workshop for Disney, Fall 2017.
- Elected as CECAS senator to University Faculty Senate in 2018, Chair Ad Hoc Committee on the Status of Women Faculty and member of Policy Committee.
- Elected as CECAS representative to Clemson Graduate College Advisory Committee, in 2017.
- Selected as CECAS representative for the Steering Committee of NSF TIGERS ADVANCE; Policy Committee on TPR and Teaching Evaluation; and Clemson Trailblazer Leadership Development Program.





Scott Mason, PhD

Professor and Fluor Endowed Chair Industrial Engineering

As Chair of the SmartState Center of Economic Excellence in Supply Chain Optimization and Logistics, Scott Mason is responsible for developing and maintaining active research relationships with both private and public-sector organizations to foster economic development, increased efficiencies, and job creation in the state of South Carolina. Prior to joining Clemson, Mason spent 10 years in the Department of Industrial Engineering at the University of Arkansas. Mason's research team uses operations research techniques to model and analyze large-scale supply chain, logistics, manufacturing, and energy systems, with expertise in developing and implementing optimization- and heuristic-based decision support systems. He received his PhD in Industrial Engineering from Arizona State University after earning BS and MS degrees from The University of Texas at Austin. He is a Fellow of the Institute of Industrial and Systems Engineers and a member of INFORMS.

Selected Accomplishments

- Awarded over \$6 million in research funding and has authored more than 100 refereed articles and papers.
- Recently completed a one-year sabbatical leave at Amazon in Seattle, working in the Inventory Placement group within Supply Chain Optimization Technologies.
- Supervised over 800 Capstone Design projects for undergraduate and graduate students with industry partners over his academic career.
- Responsible for chairing the committees of and graduating 14 PhD students and 24 MS students during his academic career.
- Industrial engineering, manufacturing, supply chain, and logistics consultant to over 40 organizations on four continents.
- Formulating and solving strategic supply chain models for the extraction, storage, and handling of the United States' tritium supply with Savannah River National Laboratory.
- Developing novel optimization models and solution methodologies for routing fleets of unmanned vehicles tasked with target detection and information collection.
- Seeking ways to minimize the total economic losses resulting from preparing for, ceasing operations, repairing, and resuming operation of a transportation system within a major city due to major climatic events.





Jacob Sorber, PhD

Associate Professor School of Computing

Jacob Sorber is a computer scientist and electrical engineer, whose work makes embedded systems, mobile sensors, wearables, and other small computational things smaller, more efficient, lower cost, longer-lasting, and easier to deploy. He develops and deploys new hardware and software technologies, tools, and abstractions that help small computing devices adapt to changing conditions, recover from frequent power failures, and operate maintenance-free for decades. His work lies at the intersection of the Internet of Things — a vi-sion of billions or trillions of small connected computing devices that will transform both science and society with new data — and the realities imposed by physics, the environment, and human behavior. Energy budgets are tight, computing resources are limited, and harvested energy is difficult to predict. Batteries in-crease cost and size, wear out quickly, and are environmentally hazardous.

Selected Accomplishments

- Dean's Professor of Computer Science, 2016.
- Awarded \$6.7M (\$3.2M to Clemson) in external research funding.
- Received an NSF CAREER award, 2015.
- His student (Josiah Hester) was awarded the School of Computing's Outstanding CS Ph.D. Student award.
- Recently graduated a Ph.D. student (Josiah Hester, 2017) — now an Assistant Professor at Northwestern University.
- Published the most papers at ACM SenSys (the premiere publication venue for Embedded Networked Systems research) of any author throughout the history of the conference.
- Best Paper Award at ACM SenSys, 2014.
- Best Poster Award at ACM SenSys, 2015.
- Regularly serves on the technical program committees for the top conferences in his field (ACM SenSys, ACM MobiSys, ISLPED).
- His MS and BS research advisees have gone on to successful industrial positions at companies like Google, NetApp, Microsoft and LinkedIn and to doctoral study at institutions like the University of Michigan, Dart-mouth College, and Carnegie Mellon University.





Weiguo Cao, PhD

Professor Genetics and Biochemistry

Cao's research focuses on understanding the molecular and cellular mechanisms of DNA repair. Cao has trained twenty graduate and post-doctoral fellows. More than thirty undergraduate students have received training in his laboratory. Cao regularly teaches Physical Approach to Biochemistry, an upper-level Biochemistry major requirement.

Selected Accomplishments

- Received a \$450,000 award from the National Institutes of Health.
- Co-investigator on a \$1,482,000 award from the National Institutes of Health.
- Received a \$15,000 award from State Key Laboratory of Biocontrol.
- Published peer-reviewed articles in DNA Repair, Scientific Reports, The FEBS Journal, and The Biochemical Journal in 2017.
- Has a peer-reviewed manuscript in press at ACS Chemical Neuroscience
- Graduated a doctoral student Dec 2017.
- Gave invited talks at the American Chemical Society National Meeting in Washington D.C. and Shenzhen University in China.
- Serves as Chair of the University Research Grant Committee.
- Serves as Chair of the Departmental, Tenure, Promotion, and Reappointment Serves on Dean's Advisory Committee on Tenure, Promotion, and Reappointment.





Emil Alexov, PhD

Professor

Physics and Astronomy and Material Sciences

Alexov is a computational biophysicist who investigates molecular origin of human diseases and develops methods and software for modeling biologically relevant phenomena in molecular biology. Emphasis is given to structure-based drug discovery to mitigate the effect of disease-causing mutations and extending the limits of existing computational approaches to be able to handle large molecular objects. He utilizes state-of-the-art computational techniques as parallel computing with distributed memory along with biophysical approaches to guide and enhance the sampling. Current research projects are supported by the National Institutes of Health (NIH), the National Institute of General Medical Sciences. His lab consists of two postdoctoral fellows, four PhD students and two technicians. Most of his former postdocs and PhD students are now holding faculty positions in various institutions.

Selected Accomplishments

- Awarded R01 grant from NIH of \$4.1M for period 2010-2020 (single PI).
- Awarded R01 grant from NIH of \$2.3M for a period (2018-2022) for a team of researchers (Co-PI).
- Organized and chaired Gordon Research Conference of “Human SNPs and Disease” 2014.
- Organized seventeen symposia each 3-5 days duration at the Annual Meeting of American Chemical Society.
- Editor-in-Chief of the Journal of Theoretical and Computational Chemistry, Associate Editor for International Journal of Molecular Sciences, Frontiers Molecular Biosciences, and Computational and Mathematical Methods in Medicine
- Published more than 140 peer-reviewed papers.
- Since 2014, three of his students were awarded the Outstanding GRA of College and Department awards.





Vincent Richards, PhD

Assistant Professor Biological Sciences

Sekhon's lab's primary research focus is microbial genomics and we seek to better understand how bacteria evolve and adapt to their environment, are transmitted among environments and hosts, and interact at the community level. The study of complex microbial communities (microbiomes) is of particular interest and the profiling of communities from the perspective of species, genes, and gene expression has the potential to aid in the development of novel disease therapeutic and prevention strategies. The human oral microbiome is a particularly diverse microbial community and a major emphasis of my research aims to better understand the relationship between this community and dental caries. Ultimately, this information can be used to help develop improved intervention and prevention strategies for dental caries such as biofilm disruption and the informed design of pro-, pre- and synbiotic oral therapies. Current research is supported by the NIDCR at the NIH.

Selected Accomplishments

- Eight publications in the past two years (29 total, h-index=16, 736 citations).
- Two active federal grants (three federal awards since arriving at Clemson in 2014: \$484,767).
- Awarded \$111,225 through the Clemson University Major Research Instrumentation Program.
- Presented research at two national conferences (American Association for Dental Research and American Dairy Science Association) and invited talks at University of Georgia and Louisiana State University.
- Awarded Alumni of the Year from NOVA Southeastern University.
- Designed and implemented a new genomics/bioinformatics course (BIOL4030/6030) at the undergraduate/graduate level.
- Mentored two postdoctoral scholars (one currently in the lab and a second now working as a research scientist at the University of Illinois).
- Major advisor for two PhD students and two Masters students.
- Graduated one Masters student (now working on her PhD at Virginia Tech).
- Mentoring ten undergraduates in research (one recently accepted into the College of Dental Medicine at the Medical University of South Carolina) (three former students; one attending the University of South Carolina School of Medicine in Greenville).



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