Executive Summary

Blueprint for Academic Excellence
College of Engineering & Computing
AY2022-2023

Introduction

CEC offers 10 UG degrees, 9 UG minors, 9 PhD degrees, 11 MS degrees, 7 ME degrees, a Master of Health IT degree, and 3 graduate certificates. UG Enrollment for 2021 has decreased by 5.9%, from 3168 to 2980. However, compared to 2016, UG enrollment has increased by 2.05%, from 2920 to 2980. The number of enrolled undergraduate URM students has increased by 32.8%, from 615 in 2016 to 817 in 2021. Enrollment for graduates for Fall 2021 is currently 545, up 5.6% compared to last year. CEC has 25 full-time instructors today. The significant investments in student success, expansion and modernization of facilities, and improvements to curricula, have made CEC a destination of choice for students seeking a rigorous education with successful graduation outcomes, and post-graduation placement, as is evident below. Sponsored research awards to the college are at their highest level, closing FY21 at over $31M, and for FY22 YTD at close to $36M, expecting to be above $40M for the year.

Highlights

Overall, our 4yr graduation rate has improved from 47% in 2014 to 56% in 2017. The 6yr rate has improved from 64% in '11 to 74% in '15. The 6yr rate from CEC has increased from 44% to 57%. URM 4yr rate improved from 39% in 2014 to 53% in 2017, and the 6yr rate increased from 59% in 2013 to 69% in 2015. For 1st-generation students, the 4yr rate has improved from 38% in '14 to 52% in '17. CEC places 81% of its graduates within 6 months of graduation, at $71K ($75K w/ internship). CEC enjoys the highest percentage of Honors and Capstone scholars among its students compared to the rest of UofSC. CEC awards the highest number of BS degrees to African American students among all its peers and peer aspirants (59 in 2021, up from 40 in 2018).

Hossein Haj-Hariri , Dean
USC Educational Foundation Distinguished Professor
College of Engineering and Computing

UNIVERSITY OF
SOUTH CAROLINA
College of Engineering and Computing

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Foundation for Academic Excellence

Mission Statement

We create and disseminate knowledge that advances the practice of engineering and computing. We are committed to working on complex projects that are inherently inter- and multidisciplinary. We leverage the comprehensive nature of the state's largest university to graduate liberally educated engineers and computer scientists capable of teaching themselves new knowledge beyond the boundaries of their education. We cultivate a diverse, equitable, and inclusive culture for all our students, staff and faculty to reach their full potential and succeed in their academic and professional endeavors.

Updated: 03/01/2017

Vision Statement

- **Teaching Excellence:** Our College will be the premier destination of choice in the Southeastern U.S. for engineering and computing students, as well as the companies that hire them.
- **Research/Scholarship:** Our research productivity will be internationally recognized based upon the reputation of our faculty scholarship and its impact upon society.
- **Service:** We will lead the university and the state that supports us in the advancement and dissemination of knowledge in our fields of expertise.

Updated: 03/01/2017

Values Statement

We value innovation, societal relevance, inclusivity, and collaboration.

Updated: 03/01/2017

Goals for the previous Academic Year.

Goals - Looking Back
No goals have been entered for this section.

Goals - Real Time

<div align="center">Goals for the current Academic Year.</div>

Goal 1 - Student Success and Teaching Excellence

Goal Statement	Attract, inspire, and enable students to become innovative thinkers, life-long learners, and transformative leaders in engineering, computing, and related fields, through: promotion of active learning in the classroom and outside; focus on fundamentals; emphasis on rigor; use of state-of-the-art tools and equipment; leveraging the comprehensive nature of the university and her Carolina Core; and delivering a high-quality, student-centric educational experience.
Linkage to University Goal	• Attract, inspire, challenge and enable our students to become innovative thinkers and transformative leaders. • Assemble and cultivate a world-class faculty and staff. • Create new pathways to research excellence to become AAU eligible. • Cultivate a more diverse, equitable, and inclusive campus culture where every individual, regardless of background, has the full opportunity to flourish and thrive. • Harness the power, attributes and institutional diversity of an integrated and interoperative university system that enhances access, success and affordability for every eligible SC student.
Alignment with Mission, Vision, and Values	Fully aligned
Status	Progressing as expected (multi-year goal)

Action Plan	• Ensure and monitor that the students show growth in critical analysis and thinking, analytical skills, leadership and communication skills, and problem solving
	  ◦ more open-ended hypothesis-based projects, lab/design/research experiences
	  ◦ injection of ethics and professional development throughout the curriculum
	  ◦ thoroughly document the progress, as needed for professional accreditation
	• Expand the number of the faculty by hiring the best researchers and instructors, with interest and expertise in addressing grand-challenge problems, and mentoring them
	  ◦ to achieve an UG/TTT ratio of 20, at the current level of 3,200 UG students, the TTT faculty ranks need to grow to 160. CEC has settled at only 125 since 19-20 AY because of a combination of external-to-college factors.
	  ◦ full-time instructor ranks need to be 15-20% of the total
	• Ensure that the degrees are timely, rigorous, and sustainable:
	  ◦ Biomedical Engineering (BME) degrees are offered for 15 years

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as a program, by faculty who have tenure home in other departments. During that period, almost all other BME programs in the US have become departments. We remain a true singularity, and as such at a disadvantage for recruiting of faculty and graduate students, which then affects the academic program. We will move towards creating a department, with help from Provost's strategic investment.

- Sustain (or expand) undergraduate Engineering and Computing Honors curricula tracks (5-6 HC specific courses per CEC major).
- Continue to improve recruiting strategies that target underrepresented students.
- Stay focused on improving retention and graduation rates, and post-graduation success.
- First-Gen Scholars program is up and running on a cash basis (~$160K/year). Will collect positive data and move to endow the program through philanthropy.

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Achievements

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- Since 2016 Hired 38 TTT and 22+ full-time instructors, and addressed the ongoing large deficit of the college so that today the student/TTT is (3200/125=) 25.6 instead of (3200/80=) 40 that it would have been. Addition of instructors has been transformative. including the instructors, the ratio is 3200/(125+22)=21.8, which is almost half of what it would have been otherwise.
  - Need to hire to address the critical needs of aero, BME, and chemical.
- Significant investments in engineering and computing laboratory and classroom modernization and addition. This is required for successful accreditation.
- Have created multiple timely and rigorous degrees:
  - created an online BS in IIT, as well as a PhD informatics.
  - created the only aerospace program in the state (one of the largest in the US already)
- All four years are now advised by professional staff. Increased the staffing of Student Services by almost a factor of three.
- Instituted peer mentoring.
- Expanded undergraduate Engineering and Computing Honors curricula tracks (5-6 HC specific courses per CEC major). Modernized almost all of our curricula to ensure logical prerequisite sequencing, and create significant elective flexibility for taking advantage of the comprehensive nature of the university, including enabling the students to take advantage of timely minor sequences within or outside CEC. CEC continues to have significant recruiting and outreach activities throughout the year. COVID slowed our progress, but we are restarting.
- First-Scholars program was rolled out successfully for a cohort of 20. All 20 students have progressed to second semester, and their average GPA is 3.65, compared with about one point lower

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	for those who have not gone through this program. We are now recruiting for this summer. The program will again run on cash basis from donors ($160K/year).
	• The 6-year graduation rate has gone from 44% to 57% from CEC and up to 72% from USC.
	• CEC places 81% of its students, with an average starting salary of $71,000, which is $13,000 higher than it was in 2015.
	  ◦ more than 2/3rd of the students who did not go to graduate school have done an internship as an undergraduate.
	  ◦ The average starting salary for students with internship experience is $75,000.

Resources Utilized	• Nearly tripled the staffing of Student Services. • Significantly invested in hiring of faculty and instructors. • Invested in improving all classrooms, hallways and public spaces, as well as student services. • Improved the Career Services offices; likely correlated with the significant increase in the starting salaries and placement rates for bachelor degrees.
Goal Continuation	
Goal Upcoming Plans	• Increased TTT hiring (net positive) is needed in order to lower the student-to-faculty ratio from mid 20's to 20-21. Peers and peer aspirants are in the high teens to 20. ◦ slowing down in rate of hiring can lead to loss of faculty. • CEC will continue investing heavily in laboratory upgrades and creation of collaborative and maker spaces. • Encourage the University to create a general classroom building on the west side of campus (east tower of old law school).

Resources Needed	• Faculty growth needed to achieve UG/TTT=20:
	  ◦ Need 30-35 more TTT at average startup of $650K, for a total of ~$20M
	  ◦ Some of these have been, and are being, rolled into the several multi-million- dollar/year research programs from DoD.
	  ◦ Another portion could come from flowing the majority of SRNL match funds to CEC.
	  ◦ An outstanding naming gift can provide resources to maintain the size at 160 TTT faculty, but should not be the vehicle for growth to 160.
	  ◦ We ask that the University does not tax the IDC from DoD programs for their first 5 years, and contribute those sums to the necessary startups.
	• Thankful to the provost for the commitment of $2M/year to hire faculty and create BME department, which is a necessary condition for AAU eligibility, and support of the growing emphasis on health sciences in USC.

Goals - Real Time

Goal Notes	

Goals - Real Time

Goal Statement	Promote a culture of excellence, and the infrastructure, which attracts, cultivates, and retains world-class faculty and staff, and which provides all students and post-doctoral researchers with leading-edge opportunities in research.
Linkage to University Goal	• Attract, inspire, challenge and enable our students to become innovative thinkers and transformative leaders. • Assemble and cultivate a world-class faculty and staff. • Create new pathways to research excellence to become AAU eligible. • Cultivate a more diverse, equitable, and inclusive campus culture where every individual, regardless of background, has the full opportunity to flourish and thrive. • Harness the power, attributes and institutional diversity of an integrated and interoperative university system that enhances access, success and affordability for every eligible SC student.
Alignment with Mission, Vision, and Values	Fully aligned.
Status	Progressing as expected (multi-year goal)
Action Plan	• Hire new faculty in targeted areas that build upon existing research strengths, or create timely areas of research, that develop high-value multidisciplinary research opportunities. 　○ we will not cover all fields, but what we do, we will do extremely well. We will attract strong research faculty (possibly jointly appointed). 　○ ensure the senior hires have a track record of effective mentorship, and continuously funded programs. 　○ promote shared governance. • Support and resource existing research active faculty. • Create critical mass in areas of strength. • Incentivize and support (inter-college and other) collaborative and large projects having high societal impact: 　○ in materials, informatics, data science, robotics, AI, electrochemistry, catalysis, water resources and environment, education, assessment, etc. • Invest in infrastructure and graduate student support through research startups. • Continue to offer and improve the PI Academy. • As much as possible, leverage existing equipment and capabilities to attract new faculty.
Achievements	• CEC is doing its part to make UofSC become AAU eligible. • Since 2016 have had three faculty members elected to the NAE, and added a fourth one as special advisor to the dean. Have three nominated again this year. • Hired 38+ new TTT faculty (since 2016) in targeted areas that

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build upon existing research strengths, or create timely areas of research, that develop high-value multidisciplinary research opportunities.
- All graduate programs were reviewed externally through a virtual process of collecting data, and making videos of the labs and our research.
- The UofSC AI Institute is moving along:
  - Added 10,000 sq. ft. iconic space atop the west tower of the old law school, planning for the second 10,000 sq. ft. phase.
- Supported and incentivized large, multidisciplinary proposals:
  - Starting from $18M/year in FY16, CEC is currently $35M+ YTD in FY22, and fully expected to get to $60M in FY24 based on the DoD programs alone. Creation of BME will drastically enhance the ability of CEC to add NIH $s to its portfolio.
- Incentives via return of indirect funds, allocation of CEC-supported graduate students, and creation of central pool of funds for maintenance of large and shared equipment.
- Significant PFP each year for top performers.

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<tr><td>**Resources Utilized**</td><td>

- Market-competitive startups, and adequate square footage:
  - CEC has acquired 70,000 additional square feet since 2016 (40,000 for CSE+IIT, 20,000 in SCRA building, and 10,000 atop the old Law School, with another 10,000 to follow).
- A third of the IDC is returned to the departments, for generous sharing with the PIs.
- Significant proactive retention and PFP every year. (~$100-120K of recurring money is invested each year to address the salaries of 30-40 faculty members).
- Continued position of Associate Dean for Research, with focus on coalescing and supporting large interdisciplinary teams and partners to put through large proposals, and increase awards.
- New position of Proposal Development Director to coordinate proposals for large multidisciplinary research teams.
  - 3 NASA ULIs ($5-6M), three large (two at $10M/year each, one at $18M/year to start FY23) DoDs, etc.
- Significantly expanded pre-awards group from zero to four FTEs (identification of opportunities and teaming, preparation, submission).
- Significantly expanded post awards group (awards management tools, including a real-time app for the PIs to monitor balances, burn-rates, encumbrances, and deadlines.

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<tr><td>**Goal Continuation**</td><td></td></tr>
<tr><td>**Goal Upcoming Plans**</td><td>

- With the actual details of the budget model known, re-develop a hiring plan to build up the size of the faculty (across all ranks); the size has stagnated for two years.
- Continue to shepherd the large research programs that are near being awarded.
- Continue to seed or identify new large initiatives for the College.

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	○ INSURE and ARLIS partnerships (all DoD and cyber/intelligence) are being formalized and finalized. - Work with the Architect to start on the Phase-2 10,000 sq.ft. space for the UofSC Artificial Intelligence Institute.
Resources Needed	- Continuation of some form of matching funds is needed to provide for startups. ○ _Every_ hire in CEC requires a very significant startup. We are the _only_ college which has this characteristic (whereas some chemistry or physics hires can be expensive, they add up to a much lower value when averages across CAS). - FRIP and other similar incentives should be continued, and _not be taxed_ under the new model. - There needs to be flexibility in the types of funds that can be used to pay rent for space in non-university property.
Goal Notes	Our hiring has slowed down.

Goals - Real Time

Goal Statement	Keep the College on sound financial and administrative footing to sustain the goals in teaching, research/scholarship, and service. This goal underpins all other goals.
Linkage to University Goal	• Attract, inspire, challenge and enable our students to become innovative thinkers and transformative leaders. • Assemble and cultivate a world-class faculty and staff. • Harness the power, attributes and institutional diversity of an integrated and interoperative university system that enhances access, success and affordability for every eligible SC student.
Alignment with Mission, Vision, and Values	Enables the Mission, and the Vision.
Status	Progressing as expected (multi-year goal)
Action Plan	• Align with the new budget model. • Expand the number of TTT faculty significantly. • Continue investing in the undergraduate laboratories, pre-awards office personnel, professional advising and student services, TA support, lecturer support (moving toward elimination of TA-taught courses/sections). • Continue seeking and establishing national and international partnerships. • Return of 30% of the overhead to the department, and 1/3rd thereof to the faculty in further support of their research. • Finalize development of departmental budgets, with some elements of hybrid RCM.
Achievements	• Working to optimize the alignment with the new budget model. • We have slowed down the hiring rate, but are interviewing for critical need areas such as aero and BME. • Continued investing in the undergraduate laboratories, pre-awards office personnel, professional advising and student services, TA support, lecturer support (moving toward elimination of TA-taught courses/sections). • Finalized the partnership with NUST in Oman. • Returned of 30% of the overhead to the department, and 1/3rd thereof to the faculty in further support of their research. • The departmental budgets remain ad hoc. Will be addressed this year.

Resources Utilized	• Faculty lines
	• PFPs
	• Competitive startups
	   ◦ graduate student support
	   ◦ summer salary
	   ◦ equipment
	• Space, including investment to acquire, update, renovate, as the

	case may be
Goal Continuation	This goal remains in effect every year.
Goal Upcoming Plans	• Align with the new budget model. • Expand the number of TTT faculty significantly. • Continue investing in the undergraduate laboratories, pre-awards office personnel, professional advising and student services, TA support, lecturer support (moving toward elimination of TA-taught courses/sections). • Continue seeking and establishing national and international partnerships. • Return of 30% of the overhead to the department, and 1/3rd thereof to the faculty in further support of their research. • Finalize development of departmental budgets, with some elements of hybrid RCM.

Resources Needed	• In order to lower the UG/TTT to 20, a significant level of hiring of TTT faculty is needed (35) with a startup of ~$20M:
	  ◦ Central help, in direct form, or indirect form (returning of the IDC on large contracts/grants) would be needed.
	• To cover 24 Honors specific sections need to hire more instructors:
	  ◦ Central help with lab, office-space needs, and startups.
	• For creating Biomedical Engineering Department:
	  ◦ Continue the $2M/year strategic investment for at least 4 years.
	• Expand FRIP to very large multi-PI proposals, so that colleges can afford to hire the personnel that are needed to ensure the success of the program, as well as building capacity to create new programs.
	• Would be highly strategic and desirable if the IDC to the colleges was not figured into the tax for central services.

Goal Notes	

Goals for the next Academic Year.

Goals - Looking Ahead
No goals have been entered for this section.

Academic Programs

Program Rankings

Academic programs that were nationally ranked or received external recognition during the Academic Year.

The US News & World Report 2022 graduate (PhD-granting) program ranking for the College as a whole is #101 (7-way tie with Brigham Young University, Embry-Riddle Aeronautical university, University of Alabama-Huntsville, University of Kentucky, University of Miami-FL, and University of Oklahoma). Graduate rankings are based on data quantitative submitted in Spring 2021. There are 23 private engineering colleges ranked above us by U.S. News. The two most important metrics that bring down the college is the low ratings given by Peers (other academic engineering deans and associate deans) and by Recruiters (non-academic leaders who hire advanced degree candidates). These two metrics together account for 40% of the total USNWR ranking score.The US News & World Report 2021 undergraduate program ranking for the College as a whole is also #96. Undergraduate rankings are based solely on a reputation survey conducted in Spring 2021. US News also conducts a reputational survey of individual graduate programs (See Appendix 1 for the engineering programs/departments). The highest-ranked programs in the College are nuclear engineering (25, out of 28, a decrease of 4 spots compared to 2021), chemical engineering (60 out of 128, an improvement of 6 spots compared to 2021) and civil engineering (84 out of 154, a drop of 9 spots compared to 2021). Other program rankings are Biomedical (89 out of 136), Computer (97 out of 153), Electrical (99 out of 187), and Mechanical (83 out of 182). Each program is ranked higher than 100, and so the overall college ranking is lower than the individual ranking of any program. Our Electrical Engineering and Mechanical Engineering were actually two of the highest-ranked programs in the 2010 National Research Council Rankings; Electrical Engineering at # 10 and Mechanical Engineering at # 34. While NRC data are quite dated now, the fact remains that the USNWR rankings are unreasonably skewed by the reputational rankings.

Instructional Modalities

Innovations and changes to Instructional Modalities in unit's programmatic and course offerings that were implemented during the Academic Year.

We continue to offer all of our undergraduate and graduate programs 100% on-campus. Graduate programs in Civil Engineering, Computer Science and Engineering, Health Information Technology, Mechanical Engineering, and Nuclear Engineering are also available 100% online. All undergraduate Integrated Information Technology classes, and select other CEC classes, are offered both online and face-to-face on a regular basis. Online instructional modalities include both asynchronous and synchronous instruction, and vary by course and section.

Program Launches

Academic Programs that were newly launched during the Academic Year; those that received required approvals but which had not yet enrolled students are not included.

Academic Programs

- PhD in Informatics
- Chemical Engineering Minor
- Cybersecurity Operations Minor

Program Terminations

Academic Programs that were newly terminated or discontinued during the Academic Year.
None

Academic Initiatives

Experiential Learning For Undergraduates

Initiatives, improvements, challenges, and progress with Experiential Learning at the Undergraduate level.

- Modernizing and upgrading the undergraduate laboratories and curricula ($500K/year)
- Built and soft-opened a Rapid Prototyping Laboratory in Swearingen. This makerspace is scheduled for open access to all CEC students starting Fall 2021.
- Expanding on the existing required capstone-design experience of our students, by developing a college-wide capstone design experience which can address more complex and multi-disciplinary projects sponsored by companies. The teams will be drawn from multiple departments in CEC, or from other colleges as well. Today more than 50 of the projects are sponsored by funds from industry. The goal is to expand to over 90 next year.
- Pathways for Graduation with Leadership Distinction in Research are well-established and include applicable CEC coursework. This year we identified applicable coursework that we can offer that meets the expectations of other GLD pathways in all majors.
- Undergraduate Research: Many undergraduates participate in research but do not pursue GLD.
- Co-ops and Internships: CEC provides space and collaboration with the university Career Center to house a satellite office in Swearingen. This office focuses on engineering and computing students and the companies that hire them, and facilitates co-op and paid internship placements. An ongoing challenge is expanding the number and types of co-op and internship opportunities.
- McNair Junior Fellows Program: This highly selective program brings about 40-50 undergraduates into McNair Center and engages them in research for 5-10 hours per week. The students get real-world experience in research; many publish papers or give presentations and many also work closely with the sponsors of the research projects. The summer 2020 on-campus research experience was put to a halt because of COVID-19, but we had a mini MJF program where we supported about 15 students do remotes research.

First Generation Students

- Created SPUR program for first-generation low-income engineering and computing students with $1M grant support from the National Science Foundation. SPUR provides substantial scholarships and year-round support.
- Received private gift and initiated CEC Summer Start for 20 first-gen students (and another 20 next year) , which includes a three-week residential program including a Carolina Core class and activities promoting student engagement and success. These students will also each receive four years of scholarships (~$1,000/year).

Experiential Learning For Graduate Students

Initiatives, improvements, challenges, and progress with Experiential Learning at the Graduate or Professional level.

A graduate degree in engineering or computing, unless it is purely-course-based, by definition has a significant experiential learning component in the form of a thesis, dissertation, or project. As we continue to bring on board research active faculty who establish new research areas and new laboratories, we will continue to expand the options for our graduate students. Furthermore, we provide opportunities for collaborative research with international institutions.

Academic Initiatives

Affordability

Assessment of affordability and efforts to address affordability.

- At the graduate level, with the exception of self-paid masters students (not large in number), the rest of the students receive some level of stipend and tuition support. The packages are competitive so that we can attract them to USC.
- At the undergraduate level, the good students from within or outside of the state have access to full-ride scholarships (some with stipends). In addition to many other university and state level scholarships, the College itself hands out close to $500,000 in scholarships annually to over 500 students.
- UofSC CEC provides the top-ranked (by NRC) programs in the state, without being the most expensive: For CEC the tuition plus the fees are lower than the tuition alone for Clemson University, which has significant fees of its own.
- The average starting salary for CEC graduates has increased by nearly $13K since 2016, now at $71K ($75K if internship), with 81% placement, thereby making the CEC degree not only affordable, but a great investment. The salaries are exactly in line with those of Georgia Tech and NC State graduates.

Reputation Enhancement

Contributions and achievements that enhance the reputation of UofSC Columbia regionally and nationally.

- Hiring world-class faculty, and attracting great students
- Nominating the faculty and students for awards, and winning these
- We had a third faculty member elected to the National Academy of Engineering (NAE). Three more are nominated currently, and we are in conversations with several more to attract them to USC.
- Engaging and partnering with local and regional industry, schools, and the state government
- Engaging and partnering with other universities, and national labs
- Development of national and international collaborations with institutions all over the globe to enhance reputation

Challenges

Challenges and resource needs anticipated for the current and upcoming Academic Years, not noted elsewhere in this report and/or those which merit additional attention.

- Increasing grants and contracts from NASA, DOD, and DOE have increased sponsor requirement for U.S. citizenship on the part of research personnel (graduate students and post-docs especially). We are in fierce competition for domestic graduate students.
- Likewise, increasing security provisions (EAR, ITAR, CUI) in our contracts have increased demands for secure IT systems; this is an additional administrative overhead cost.
- Graduate student recruitment has been greatly limited by COVID; most national events have been virtual, which severely limits the effectiveness of recruitment. CEC needs one additional staff member (at least part-time) to support more focused graduate recruitment efforts.

Faculty Population

Faculty Employment by Track and Title

The following data was provided by UofSC's Office of Institutional Research, Assessment, and Analytics.

Table 1. Faculty Employment by Track and Title.

	Fall 2021	**Fall 2020**	**Fall 2019**
Tenure-track Faculty		124	125
Professor, with tenure		57	56
Associate Professor, with tenure		42	43
Assistant Professor		25	26
Librarian, with tenure		0	0
Research Faculty		14	15
Research Professor		5	5
Research Associate Professor		1	1
Research Assistant Professor		8	9
Clinical/instructional Faculty		24	24
Clinical Professor		0	0
Clinical Associate Professor		0	0
Clinical Assistant Professor		0	0
Instructor		24	24
Lecturer		0	0
Visiting		0	0
Adjunct Faculty		24	23

Faculty Population

Faculty Diversity by Gender and Race/Ethnicity

Note: UofSC follows US Department of Education IPEDS/ National Center for Education Statistics guidance for collecting and reporting race and ethnicity. See this link: https://nces.ed.gov/ipeds/Section/collecting_re

Table 2. Faculty Diversity by Gender and Race/Ethnicity.

	Fall 2021	**Fall 2020**	**Fall 2019**
Gender		196	189
Male		167	161
Female		29	28
Race/Ethnicity		196	189
American Indian/Alaska Native		0	0
Asian		51	48
Black or African American		4	4
Hispanic or Latino		6	6
Native Hawaiian or Other Pacific Islander		0	0
Nonresident Alien		44	35
Two or More Races		1	1
Unknown Race/Ethnicity		0	0
White		90	95

Illustrations 1 and 2 (below) portray this data visually.

Faculty Population

Illustration 1. Faculty Diversity by Gender

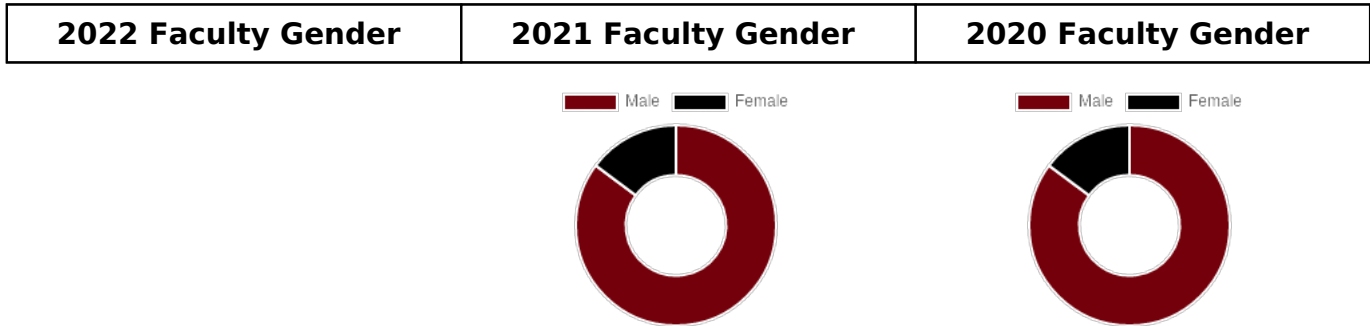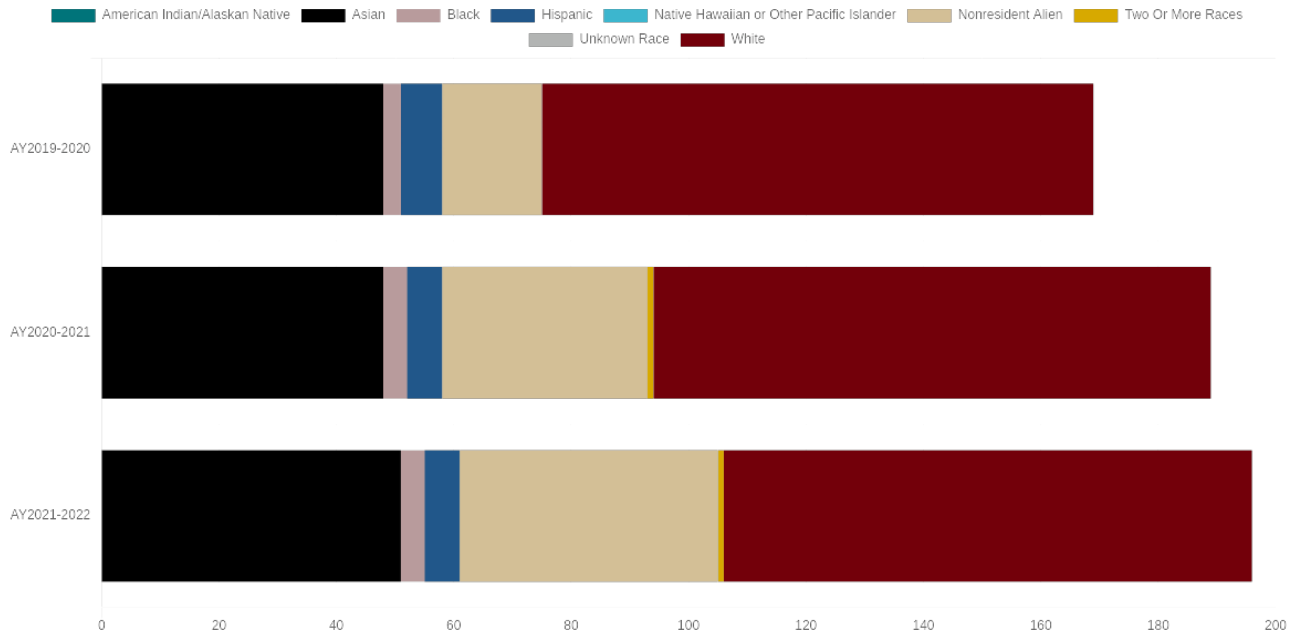| 2022 Faculty Gender	2021 Faculty Gender	2020 Faculty Gender

Illustration 2. Faculty Diversity by Race & Ethnicity

Faculty Information

Research and Scholarly Activity

Please refer to Appendix 3, which provides detailed information from the Office of the Vice President for Research, department of Information Technology and Data Management, including:

1) The total number and amount of externally sponsored research proposal submissions by funding source for the appropriate Fiscal Year.

2) Summary of externally sponsored research awards by funding source for the appropriate Fiscal Year. Total extramural funding processed through Sponsored Awards Management (SAM) in the Fiscal Year, and federal extramural funding processed through SAM in the Fiscal Year. (Available at: http://sam.research.sc.edu/awards.html) Amount of sponsored research funding per faculty member for the appropriate fiscal year (by rank, type of funding; e.g., federal, state, etc., and by department if applicable).

3) Number of patents, disclosures, and licensing agreements for three most recent Fiscal Years.

ACADEMIC ANALYTICS STUDY

Please see Appendix 1

Faculty Development

Efforts at Faculty Development, including investments, activities, incentives, objectives, and outcomes.

The college continued its cross-departmental approach to faculty searches and hires in the prior year, with searches organized across technical focus areas. In particular, we retained a robust rate of hiring for USC AI Institute to continue to meet our commitments to that Institute. We are currently searching for multiple aerospace faculty to support the nascent but well-subscribed aero BS program, which remains the sole aero program in the state. Two of the six chairs in CEC are female, and a third is hispanic, representing a significantly higher fraction compared with the make-up of the overall faculty. We had a successful internal search for chair of electrical engineering. Also so far this year we have three NSF CAREER awardees, and expecting a fourth one to be announced soon.

CEC has continued efforts to form inter-college and inter-university teams to pursue large interdisciplinary research projects. Several pre-proposals have been submitted for significant multidisciplinary efforts including DoD MURIs, NSF MRIs, NSF ERCs, NSF COPE, NASA University Led Initiatives, NASA HiCAM, and others, as well as conversations with and real and virtual visits by DoD program managers, including the two day visit by the Chief of Naval Research, RADM Selby. We have had several successes to date. In-person discussions with the National Center for Credibility Assurance have likewise been initiated and continue. Professor Srihari Nelakuditti in the Department of Computer Science has been awarded an NSF Major Research Instrumentation grant to build a laboratory facility to allow investigators to ascertain "ground truth" measurements. A NASA ULI grant ($5.7M) has been awarded with UofSC as the lead institution and a second has been awarded with UofSC as a supporting institution. A significant award ($2M) has been received from the Army Research Office in the area of fundamental microscopy. JR Regalbuto of Chemical Engineering has submitted an NSF MRI.

Faculty Information

Dr. Kevin Huang has submitted a significant DOE EPSCoR proposal. Professor Amit Sheth received an NSF Planning Grant to enable pursuit of a significant Center proposal and has submitted a major NSF proposal ($11M) as an outcome. Professor Chaudhry is proposing a significant award related to protection of levees and is in discussion with an established water institute. The college has hosted multiple meetings with various organizations from the U.S. Army and continues discussions about major initiatives in relation to energy.

Supplemental Info - Faculty Information

Any additional information on Faculty Information appears as 'Appendix 1. Faculty Information' (bottom).

Teaching

Faculty to Student Ratio

The following data was provided by UofSC's Office of Institutional Research, Assessment, and Analytics.

The formula used to compute the ratio uses data from Faculty Population by Track and Title and Student Enrollment by Time Basis, as follows:

$$\frac{(Total\ Full\text{-}time\ Students\ +\ 1/3\ Part\text{-}time\ Students)}{((Total\ Tenure\text{-}track\ Faculty\ +Total\ Research\ Faculty\ +\ Total\ Clinical/Instructional\ Faculty)\ +\ (1/3\ Adjunct\ Faculty))}$$

Analysis of Ratio

Analysis of the ratio, agreement with the data, and plans for the future to impact this ratio.
The goal at the start of my deanship was to reverse the alarming trend in our student/faculty ratio. Using the nationally normed metric of undergrad students to TTT faculty our numbers from 2015, 2016, 2017, 2018, 2019, 2020, and 2022 are: 24.5, 26.8. 27.0, 26.0, 26.2, 24.6, and 24.0. Our student enrollment increased faster than our net faculty growth. Moreover, the drop form 24.6 to 24.0 is mainly due to the slight drop in CEC enrollment due to the pandemic, and not thr growth fo the faculty. By all indications, we are recovering well from the pandemic drop, which means that the student/faculty ratio may reverse trend and start going up again. The college has also added 22 full-time instructors, so that the student to total faculty ratio is just under 21. But the nationally normed ratio is students to TTT faculty. Therefore CEC needs more resources to hire faculty. Incidentally, the formula used in the blueprint exercise has no relevance to CEC. Inclusion of adjuncts, research faculty, and part-time students are not relevant to how engineering and computing programs measure their student to faculty ratios.

Table 4. Faculty-to-Student Ratio.

	Fall 2021	**Fall 2020**	**Fall 2019**
Analysis of Ratio		01:21.6	01:17.4

Student Recruiting and Retention

Student Recruitment
Efforts, including specific actions, to recruit students into College/School programs.
Undergraduate Recruitment:

- Presentations to students at K-12 schools, in classrooms and at college and career fairs. Participation was done virtually as needed.
- Participation in high school Robotics competitions.
- Website, Flyers, and Brochures
- College "Daily Tours" provided throughout the year: Daily tours are led by CEC student ambassadors that are trained and supervised by the Director of Outreach and Recruitment.
- Virtual information sessions provided weekly.
- Three "Big Fridays" each semester: Big Fridays include presentations by the Dean and the Director of Outreach and Recruitment, a student panel Q&A, and tours of the departments led by faculty.
- College-Specific Admitted Student Yield Efforts:
  - Email sent to all admitted students by Director of Enrollment Management
  - Letters to families of admitted students sent by Associate Dean.
  - Postcards to Underrepresented Minority admitted students sent by CEC students.
  - Signed postcards to all female admitted students
  - Dean's Letter to admitted students, crafted by the college's Associate Dean for Academic Affairs and Director of Enrollment Management.
  - Dean, Associate Deans, Department Chairs, and Faculty participate in Admissions Office events, including Fall Open House, Admitted Student Days, Scholar Socials, Meet the Honors College Social, Carolina Top Scholars Weekend and Out of State Top Scholars Weekend (some done virtually)
- CEC provides hundreds of students with scholarships: Most target new freshmen.
- Articulation Agreements: Transfer student recruitment is facilitated through active articulation agreements with UofSC System campuses, SC Technical Colleges, as well as with SC State University and Claflin University.

Graduate Recruitment:

Senior Associate Dean Mike Matthews is co-PI and co-Director of the NSF Bridge to the Doctorate award from the Louis Stokes Alliance for Minority Participation. This award supports a cohort of 10 new STEM doctoral students who are from URM groups; five of the 10 are in CEC. CEC welcomed one new GEM Fellow Fall 2021; this student was recruited by the Bridge to the Doctorate program. Also, we have direct internal funds to be used as top-off stipend funding for highly-qualified U.S. citizens and permanent residents who are seeing PhDs in CEC. We call this the CEC Teaching Fellows program. So far we have supported five Teaching Fellowships. We have also promoted funding support for students in accelerated Bachelors to Graduate Degrees, and for Masters students who work on projects with national security restrictions. We have already awarded one Masters National Security Fellowship for 2022. We have established a relation with the Koerner Family Foundation, which supports engineering doctoral students during their graduate programs. In 2021, two students received fellowships of $10,000 each, and in 2022 six students will each receive a $10,000 stipend enhancement fellowship.

Student Recruiting and Retention

Student Retention

Efforts at retaining current students in College/School programs.
Undergraduate Retention:

- New Student Orientation: The presentation by Associate Dean for Academic Affairs to all incoming students and families is data-driven and focuses on academic success strategies and student engagement recommendations.
- Hand-Off Advising Model: CEC uses professional staff advisors for the first two years for freshmen and at least one semester for transfer students to help new students transition successfully.   Faculty Advisors advise continuing students to help students connect with their fields of study and career opportunities.
- Tutoring: In collaboration with the Student Success Center, the college provides tutoring centers in Swearingen and in the Engineering and Computing Community. CEC currently has the only academic building with a satellite of the Student Success Center.
- Engineering and Computing Community: In collaboration with Housing, a CEC Faculty Advisor and the Assistant Dean for Student Services provide linked courses and beyond-the-classroom activities for this themed living-learning community.
- Student Organizations: College provides meeting rooms, storage, advisors, administrative, and other support to over 35 CEC-oriented student organizations.
- Peer Mentorship program: hundreds of new CEC students are matched with an upper class CEC Peer Mentor to help guide them through their transition into college and their major.
- Big Wednesday: The day before classes start, new students interact with representatives of over 30 CEC-orientated student organizations, with the intended outcome of improved student engagement.
- Events for Current Students: On-going student professional development and engagement events that are coordinated at the college-level include e-week events, a Women in Engineering and Computing Panel, Dean's Leadership Conversation, and CEC Organizational Leaders Workshop.

Student Enrollment & Outcomes

The following data was provided by UofSC's Office of Institutional Research, Assessment, and Analytics.

Note: Student enrollment and outcomes data are calculated by headcount on the basis of primary program of student only.

Student Enrollment by Level & Classification

Table 5. Student Enrollment by Level & Classification.

	Fall 2021	Fall 2020	Fall 2019
Undergraduate Enrollment			
Freshman	588	646	737
Sophomore	621	660	696
Junior	693	705	652
Senior	1078	1157	1107
Dual/Non-Degree	0	0	0
Sub Total	2980	3168	3192
Graduate Enrollment			
Masters	204	206	224
Doctoral	341	309	339
Graduate Certificate	0	0	0
Sub Total	545	515	563
Professional Enrollment			
Medicine	0	0	0
Law	0	0	0
PharmD	0	0	0
Sub Total	0	0	0
Total Enrollment (All Levels)	3525	3683	3755

Student Enrollment & Outcomes

Illustration 3. Undergraduate Student Enrollment by Classification

Freshman | Sophomore | Junior | Senior | Dual/Non-Degree
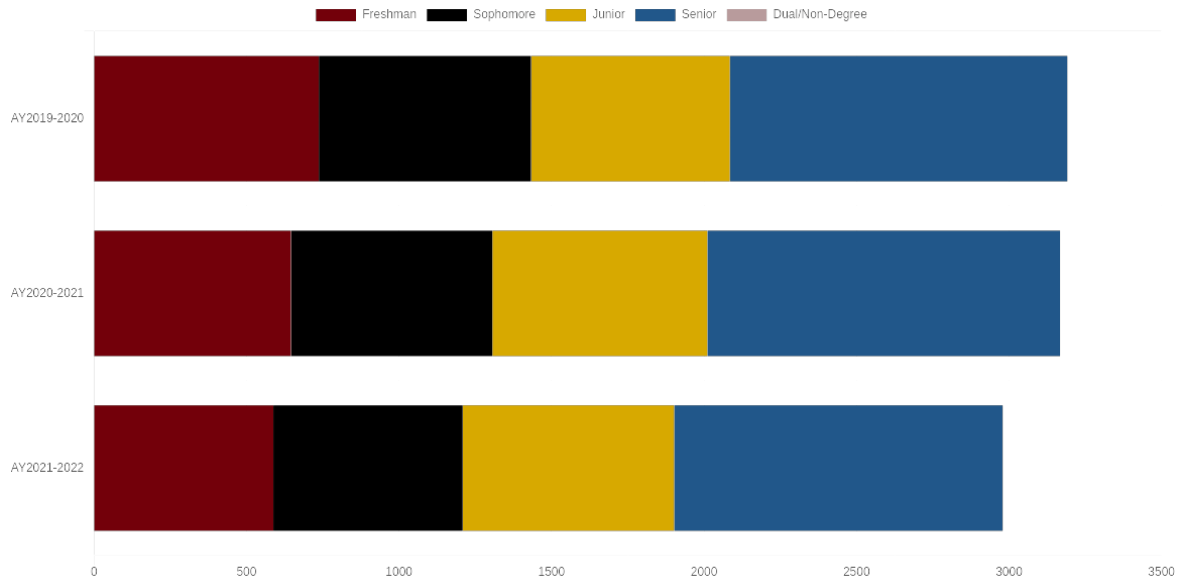
Illustration 4. Graduate/Professional Student Enrollment by Classification

Masters | Doctoral | Graduate Certificate | Medical Doctorates | Pharmacy | Law
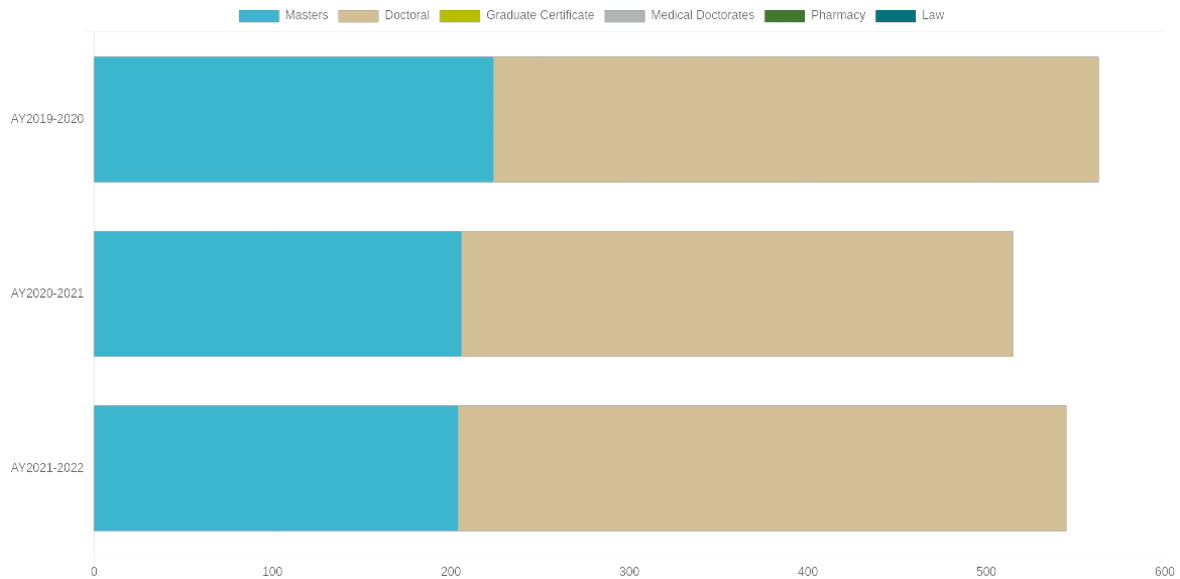
Student Enrollment & Outcomes

Illustration 5. Total Student Enrollment by Classification (All Levels)

Legend: Freshman, Sophomore, Junior, Senior, Dual/Non-Degree, Masters, Doctoral, Graduate Certificate, Medical Doctorates, Pharmacy, Law
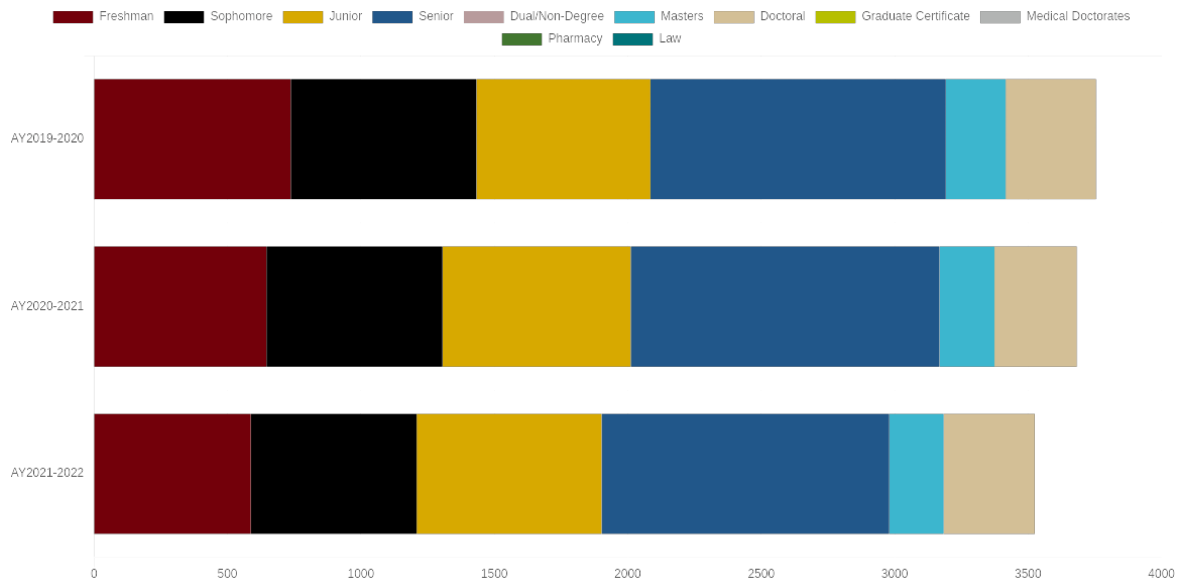
Enrollment by Time Status

Table 6. Student Enrollment by Level and Time Status

	Fall 2021	**Fall 2020**	**Fall 2019**
Undergraduate	2980	3168	3192
Full-Time	2850	3030	3056
Part-Time	130	138	136
Graduate/Professional	545	515	563
Full-Time	435	407	433
Part-Time	110	108	130
Total - All Levels	3525	3683	3755
Full-Time	3285	3437	3489
Part-Time	240	246	266

Student Enrollment & Outcomes

Student Diversity by Gender

Table 7. Student Enrollment by Gender.

	Fall 2021	**Fall 2020**	**Fall 2019**
Undergraduate	2980	3168	3192
Female	670	684	680
Male	2310	2484	2512
Graduate/Professional	545	516	563
Female	151	142	146
Male	394	374	417

Illustration 6. Undergraduate Student Diversity by Gender

AY2021-2022 Undergrad Gender	**AY2020-2021 Undergrad Gender**	**AY2019-2020 Undergrad Gender**
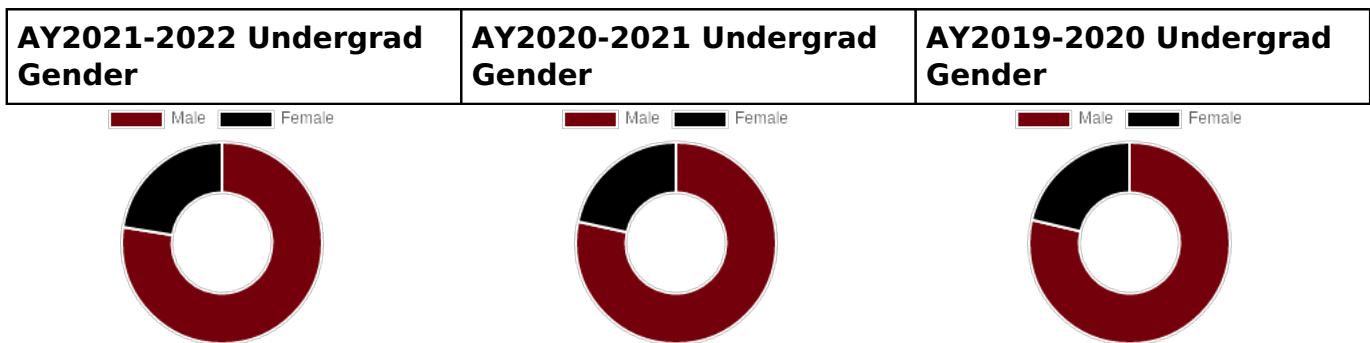
Illustration 7. Graduate/Professional Student Diversity by Gender

AY2021-2022 Graduate Gender	**AY2020-2021 Graduate Gender**	**AY2019-2020 Graduate Gender**
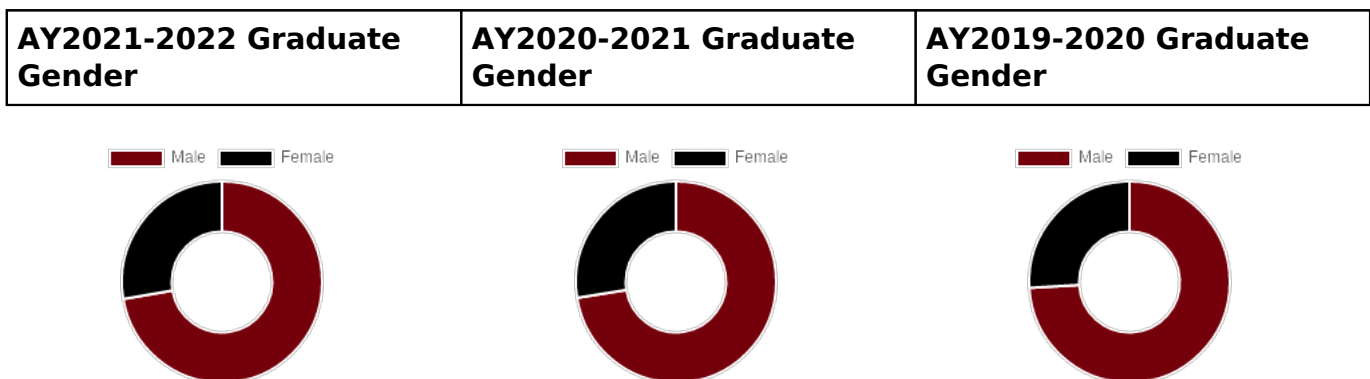
Student Enrollment & Outcomes

Student Diversity by Race/Ethnicity

Table 8. Student Enrollment by Race/Ethnicity

	Fall 2021	Fall 2020	Fall 2019
Undergraduate	2980	3168	3192
American Indian/Alaska Native	9	8	9
Asian	203	208	172
Black or African	289	302	278
Hispanic or Latino	185	195	186
Native Hawaiian or Other Pacific Islander	4	2	3
Nonresident Alien	95	107	132
Two or More Races	127	139	135
Unknown Race/Ethnicity	38	35	26
White	2030	2172	2251
Graduate/Professional	545	516	563
American Indian/Alaska Native	0	1	1
Asian	27	18	16
Black or African	23	24	31
Hispanic or Latino	13	11	16
Native Hawaiian or Other Pacific Islander	0	0	0
Nonresident Alien	295	288	310
Two or More Races	11	11	14
Unknown Race/Ethnicity	8	7	8
White	168	156	167

Student Enrollment & Outcomes

Illustration 8. Undergraduate Student Diversity by Race/Ethnicity
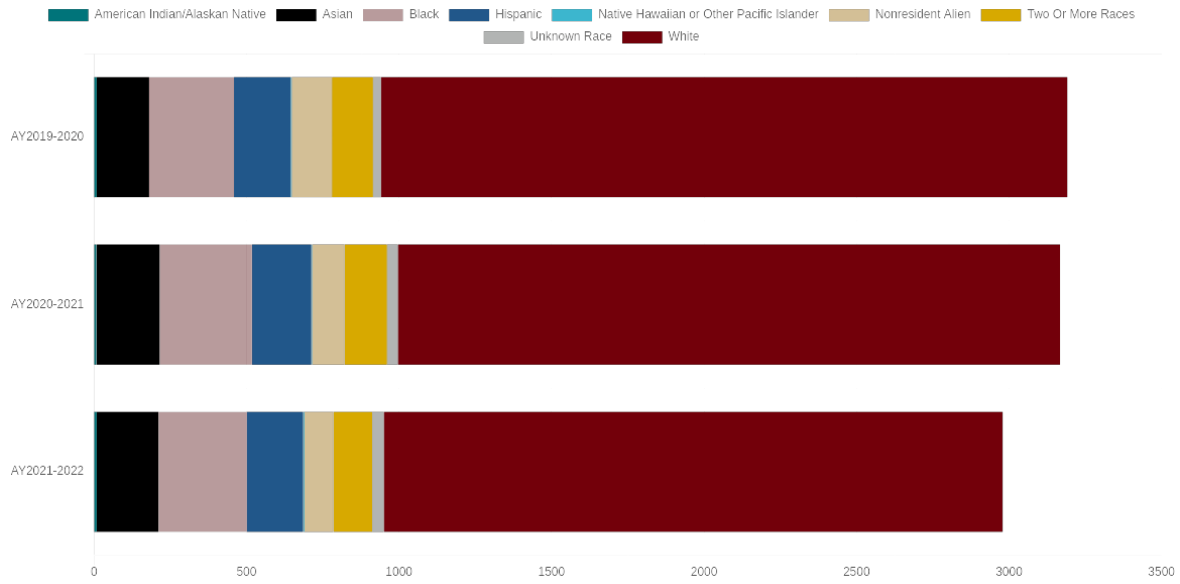
Illustration 9. Graduate/Professional Student Diversity by Race/Ethnicity
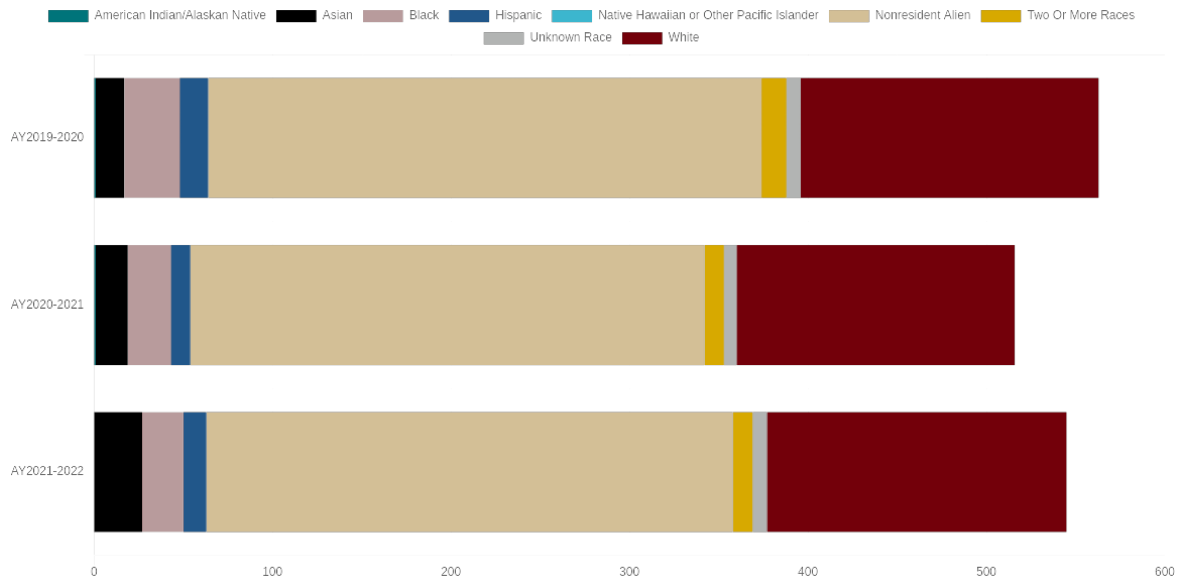
Student Enrollment & Outcomes

Undergraduate Retention

Table 9. Undergraduate Retention Rates for First-time Full-time Student Cohorts

	First Year	Second Year
Fall 2021 Cohort	0%	N/A
Fall 2020 Cohort	67.26%	12.88%
Fall 2019 Cohort	73.1%	13.8%

Illustration 10. Undergraduate Retention, First and Second Year

First Year

Second Year
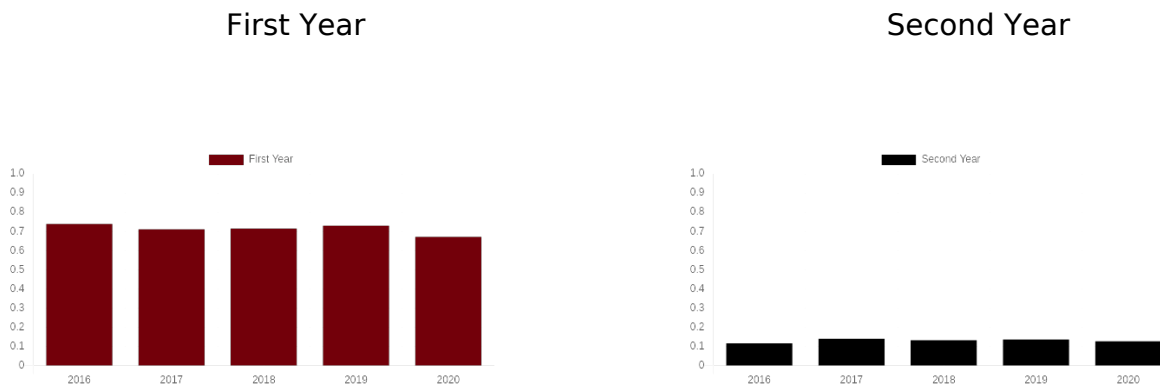
Student Completions

Graduation Rate - Undergraduate

Table 10. Undergraduate Graduation Rates for First-time Full-time Student Cohorts at 4-, 5-, and 6 Years.

	Fall 2021	Fall 2020	Fall 2019
4-Year Same Cohort	39.3%	0%	39.09%
4-Year Diff Cohort	12.8%	0%	14.64%
4-Year Total Cohort	52.1%	0%	53.73%
5-Year Same Cohort	52.5%	0%	51.83%
5-Year Diff Cohort	17%	0%	18.59%
5-Year Total Cohort	69.5%	0%	70.42%
6-Year Same Cohort	54.3%	0%	54.17%

Student Enrollment & Outcomes

6-Year Diff Cohort	17.8%	0%	20.06%
6-Year Total Cohort	72.1%	0%	74.23%

Degrees Awarded by Level

Table 11. Degrees Awarded by Level.

	Fall 2021	**Fall 2020**	**Fall 2019**
Associates Degree		0	0
Bachelors		708	602
Masters		90	118
Doctoral		43	53
Medical		0	0
Law		0	0
Pharmacy Doctorate		4	6
Graduate Certificate			

Illustration 11. Degrees Awarded by Level
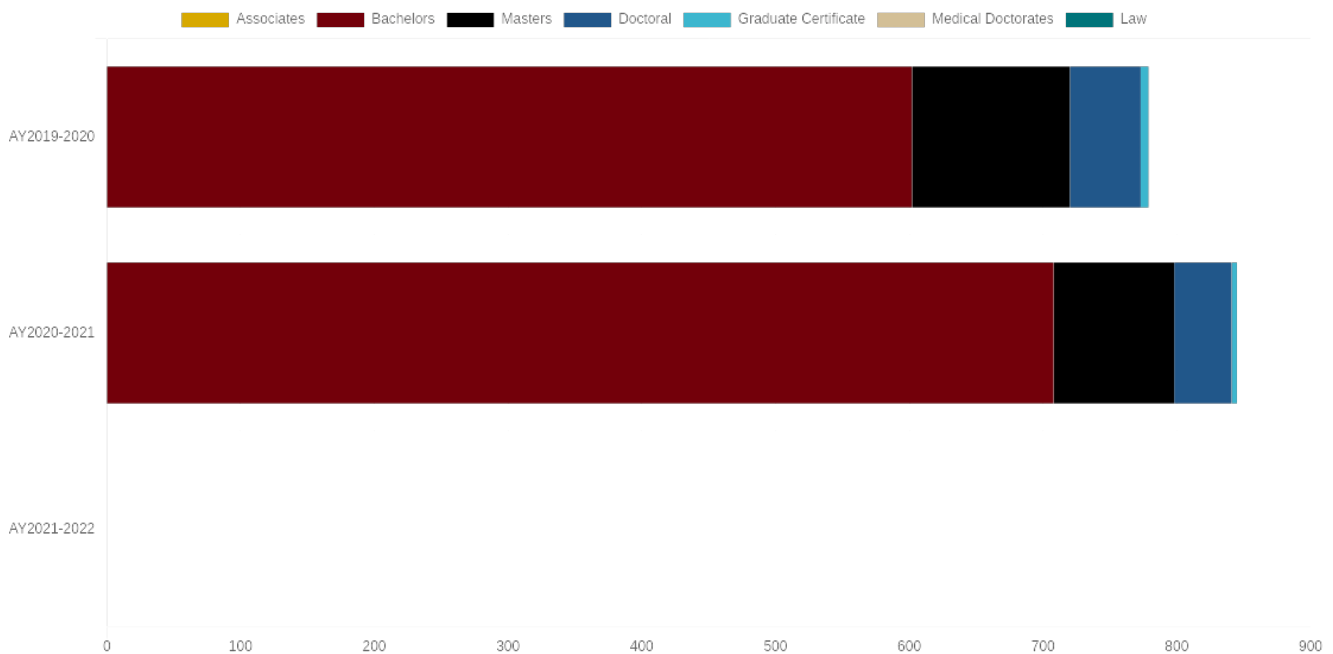
Faculty Awards Nominations

Faculty nominated for the following awards in the categories of Research, Service, Teaching, or Other.

Research Award Nominations

Recipient(s)	Award	Organization
Ginn, Herbert	Research Achievement Award	University of South Carolina College of Engineering and Computing
Wang, Guoan	Research Progress Award	University of South Carolina College of Engineering and Computing
Li, Chen	Research Achievement Award	University of South Carolina College of Engineering and Computing
Mustain, William	Research Achievement Award	University of South Carolina College of Engineering and Computing
Yoon, Yeomin	Research Achievement Award	University of South Carolina College of Engineering and Computing
Ziehl, Paul	Research Achievement Award	University of South Carolina College of Engineering and Computing
Banerjee, Sourav	Research Progress Award	University of South Carolina College of Engineering and Computing
Wang, Yi	Research Progress Award	University of South Carolina College of Engineering and Computing
Sockalingam, Subramani	Young Investigator Award	University of South Carolina College of Engineering and Computing
Liu, Chang	Young Investigator Award	University of South Carolina College of Engineering and Computing
Qian, Yu	Young Investigator Award	University of South Carolina College of Engineering and Computing
Zeng, Qiang	Young Investigator Award	University of South Carolina College of Engineering and

Faculty Awards Nominations

		Computing

Faculty Awards Nominations

Service Award Nominations

Recipient(s)	Award	Organization
Dougal , Roger	Joseph Biedenbach Award	University of South Carolina College of Engineering and Computing
Huynh, Nathan	Joseph Biedenbach Award	University of South Carolina College of Engineering and Computing
O'Kane, Jason	Joseph Biedenbach Award	University of South Carolina College of Engineering and Computing
Uline, Mark	Joseph Biedenbach Award	University of South Carolina College of Engineering and Computing
Crichigno, Jorge	Samuel Litman	University of South Carolina College of Engineering and Computing
Huang, Chin Tser	Samuel Litman	University of South Carolina College of Engineering and Computing
Rizos, Dimitris	Samuel Litman	University of South Carolina College of Engineering and Computing

Faculty Teaching Awards Nominations
No Award Nominations have been entered for this section.

Faculty Awards Nominations

Faculty Other Awards Nominations
No Award Nominations have been entered for this section.

Faculty Awards Received

Faculty were recognized for their professional accomplishments in the categories of Research, Service, Teaching, or Other.

Research Awards

Recipient(s)	Award	Organization
Goharian, Erfan	2021 Young Engineer of the Year	South Carolina Section of the American Society of Civil Engineers
Qian, Yu	2022 Breakthrough Award	University of South Carolina
Yoon, Yeomin	2021 Research Achievement Award	University of South Carolina College of Engineering and Computing
Qian, Yu	2021 Young Investigator Award	University of South Carolina College of Engineering and Computing
Khan, Asif	ELECTRON DEVICES SOCIETY LESTER F EASTMAN AWARD	IEEE ELECTRON DEVICES SOCIETY
Matolak, David	Research Achievement Award	USC College of Engineering and Computing
Matolak, David	IEEE Fellow	IEEE
Zhang, Bin	Group Achievement Award	NASA (Member of Advanced Composites Project Team
Nasiri, Adel	IEEE Fellow	IEEE
Yi, Wang	2021 Breakthrough Star Award	University of South Carolina
Crichigno, Jorge	Rising STAR Award	University of South Carolina Office of Research
Wang, Guoan	Research Progress Award	University of South Carolina College of Engineering and Computing
Sadati, Sanaz	NSF CAREER	National Science Foundation
Matolak, David	Russell Research Award - Science/Math/Engineering	USC Ed Foundation
Ali, Mohammod	2021 National Science Foundation Director's Award	National Science Foundation

Faculty Awards Received

Service Awards

Recipient(s)	Award	Organization
Huynh, Nathan	2021 Section Leadership Award	South Carolina Section of the American Society of Civil Engineers
Uline, Mark	Biedenbach Service Award	University of South Carolina College of Engineering and Computing
Crichigno, Jorge	Samuel Litman Distinguished Professor Award	University of South Carolina College of Engineering and Computing
Crichigno, Jorge	Demonstrating Leadership and Making a Positive Impact in Communities	VMware IT Academy Academic Center of Excellence

Faculty Awards Received

Teaching Awards

Recipient(s)	Award	Organization
Pierce, Charles	2021 Educator of the Year	South Carolina Section of the American Society of Civil Engineers
Moss, Melissa	Mungo Undergraduate Teaching Award	University of South Carolina
Khan, Jamil	2021 Carolina Trustees Professorship Award	University of South Carolina
Khan, Jamil	2021 Carolina Trustees Professorship Award	University of South Carolina

Faculty Awards Received

Faculty Other Awards Nominations
No Awards have been entered for this section.

Alumni Engagement & Fundraising

Alumni
Substantial activities, engagements, and initiatives with alumni, focusing on relationships and activities with alumni.
We have not had any face to face events. We did launch the CEC Linked In Page which currently has over 2,000 followers. Also launched an Alumni/Student Platform called CEC Connect via Graduway which enables our alumni to post jobs and internships and mentor our current students. This also has over 1,000 followers and is growing. In the Spring 2021, the College was awarded the National Graduway Impact Award Winner 2021 for its launch and implementation of the platform. Overall, the College's alumni presence on web/social media nearly doubled.The Alumni Office also assisted in the creation of video presentations of the school highlighting the College and the Departments. These video's will be used strategically for development and student recruitment efforts.

Development, Fundraising and Gifts
Substantial development initiatives and outcomes, including Fundraising and Gifts.
- $25M naming gift for CEC (w/ 3:1 match of the income) currently being reviewed by the donor and President elect.
- $14M gifts/commitments; $1M for scholarships and fellowships; $20M from industry
- $250K for a two-year pilot of First Scholars Program
- $628M in-kind (Siemens; OEE was the main driver)
- SRNL undergraduate scholarships (24 at $8,000 each)
- Multiple outstanding proposals including $1M professorship and $400K Carolina Scholars

Community Engagement

Community Engagements and Community - Based Activities

Community engagement and community based research, scholarship, outreach, service or volunteerism conducted, including activities at the local, state, regional national and international levels.

Personnel

- Senior Associate Dean for Academic Affairs
- Assistant Dean for Student Services
- Director of Precollege Education
- Director of Enrollment Mangement
- Inclusive Programs Coordinator
- Graduate Recruitment Coordinaotr

Outreach

- Searched (internal) and appointed the second Associate Dean for Diversity, Equity and Inclusion.
- 2+2 articulation agreement with Midlands Tech into our programs (many of our 200+ transfers).
- 4+1 with SCSU in Nuclear Engineering: BS/SCSU and MS/USC
- 3+2 with Claflin University: BS-Chem/Claflin and BS-ChE/USC.
- 3+2 with Columbia College: BS-Chem/Cola and BS-ChE/USC.
- $1M from NSF for Bridges to Doctorate for URM students (joint w/ CAS).
- Fund-raised $250K and started a 3-week summer bridge program (including 4 years of $1K scholarship for each participant) for two years of 20+ first-generation students.

Community Perceptions

How unit assesses community perceptions of engagement, as well as impact of community engagement on students, faculty, community and the institution.

The Engineering and Computing Open House is a great community event that draws close to 1000 visitors to our College campus in February. Unfortunately we have not been able to offer it for two years.

Incentivizing Faculty Engagement

Policies and practices for incentivizing and recognizing community engagement in teaching and learning, research, and creative activity.

There are many different ways that the faculty of CEC engages with the community. As such we do not have a uniform policy to address all possible means of interaction and engagement. For engagements that are substantial and impactful, we will count it as a substantial element for the service that each faculty member needs to do. For more significant levels of engagement, we can consider other incentives. We will address on a case by case basis.

Collaborations

Internal Collaborations

Our most significant academic collaborations and multidisciplinary efforts characterized as internal to the University.

- Arnold School of Public Health (Environmental Health Sciences; Exercise Science; Health Promotions, Education and Behavior; Health Service Policy and Management; Epidemiology and Biostatistics; Prevention Research Center; and Rural and Minority Research; Applied Research & Evaluation (CARE); Communication Science and Disorders)
- Big Data Health Science Center
- Center for Child and Family Studies
- College of Arts and Sciences (Biological Sciences; Baruch Institute; School of Earth, Ocean and Environment; Linguistics Program; English; Biological Sciences; Chemistry and Biochemistry; History; Mathematics; Physics & Astronomy; Geography; Psychology; Political Science; Military Science – ROTC; Statistics)
- College of Education (Child Development Research Center; Educational Studies; Physical Education)
- College of Hospitality, Retail and Sports Management (Hotel, Restaurant & Tour Management)
- College of Information and Communication (Journalism and Mass Communication)
- College of Nursing
- College of Pharmacy (Drug Discovery & Biomedical Sciences; Clinical Pharmacy and
- Outcomes Sciences)
- College of Social Work
- Darla Moore School of Business (Division of Research; Dean's Office)
- Office of Economic Engagement
- School of Medicine (Cell Biology & Anatomy; Pathology, Microbiology & Immunology; Pharm., Physiology & Neuroscience; Basic Science Research; Obstetrics and Gynecology; Pediatrics; Neurology; Neuropsychiatry and Behavior Sciences; Internal Medicine; Family & Preventive Medicine; Surgery)
- President
- University Libraries
- Division of Information Technology (High Performance Computing; Research Computing)
- USC Aiken
- USC Upstate

External Collaborations

Our most significant academic collaborations and multidisciplinary efforts characterized as external to the University.

Other Collaborations

Our most significant academic collaborations and multidisciplinary efforts that are not otherwise accounted for as Internal or External Collaborations.

- Aalborg University
- Advanced Composites Consortium
- Advent Innovations

Collaborations

- Alfred University
- Alliance for Sustainable Energy, LLC
- Amazon
- American Institute of Chemical Engineers
- Ames Laboratory
- Applied Hypersonics
- Argonne National Laboratory
- Arkansas State University
- Arizona State University
- Association of Environmental Engineering and Science Professors (AEESP) Foundation
- Atlantic Current Energy
- Atomic-6
- Auburn University
- BASF Corporation
- Battelle Energy Alliance, LLC
- Baylor University
- Benedict College
- Blue Origin
- BMW
- Boeing
- Boise State University
- Boston University
- Brown University
- Cabrillo College
- California State University, Bakersfield
- Capgemini
- Carbon Conversions, Inc.
- Carnegie Mellon University
- Catholic University of America
- CDF Research Corporation
- CEATI International Inc
- Chalmers University, Goteborg, Sweden
- Chemtronergy
- Cisco Systems
- Citadel
- Claflin University
- Clemson University
- Coastal Carolina University
- College of Charleston
- Collins Aerospace
- Coldstream Energy, LLC
- Columbia University
- Compact Membrane Systems, Inc
- Concurrent Technology Corporation
- Culpeper Wood Preservers
- DOCOMO Innovations, Inc
- Duracell
- EaglePicher Medical Power, LLC
- E2H2Nano, LLC

Collaborations

- Electric Power Research Institute
- Environmental Research and Education Foundation
- ERDC (Engineering Research and Development Center)
- Eurecat
- Florence-Darlington Technical College
- Florida State University
- Fort Hays State University
- Francis Marion University
- Fraunhofer USA
- General Atomics
- General Motors
- General Electric Research
- George Mason University
- Georgia Institute of Technology
- Georgia Southern University
- Geosynthetic Institute
- Global Engineering Research and Technology, LLC
- Golder Associates Ltd.
- Good AI
- Gulfstream
- Gwangju Institute of Science and Technology
- Harper Engineering
- Hawkins Foundation
- HIMSS
- Hitron Technologies
- Holtec International
- Howard University
- Intelligent Automations, Inc
- Idaho National Laboratory
- Idaho State University
- Integer Technologies, Inc.
- Iowa State University
- Johns Hopkins University
- L3 Harris
- Lawrence Berkeley National Laboratory
- Lehigh University
- Lincoln Memorial University
- Lockheed Martin Corporation
- Lordstown EV Corporation
- Los Alamos National Security, LLC
- Maher Advanced Manufacturing
- Massachusetts Institute of Technology
- Mayo Clinic
- Medical University of South Carolina
- Michigan State University
- Michigan Technological University
- MicroVide
- Mississippi State University
- Moraine Valley Community College

Collaborations

- NanoMEMS Research, Inc
- NanoSonic, Inc
- National Aeronautics and Space Administration
- National Energy Technology Laboratory
- National Renewable Energy Laboratory
- National Technical University, Iraq
- National University of Science and Tech, Muscat, Oman
- Navatek, LLC
- Naval Information Warfare Center
- Neo-H2
- Nephron Pharmaceuticals Corporation
- Network Development Group
- North Carolina State University
- Northern New Mexico College
- Nuclear Regulatory Commission
- Nuvera Fuel Cells, LLC
- Oak Ridge National Laboratory
- Ohio State University
- Oklahoma State University
- Old Dominion University
- Pacific Northwest National Laboratory
- Palmetto Tech Bridge
- Palo Alto Networks
- Pennsylvania State University
- Piasecki Aircraft Corp.
- Power Coops of SC
- Princeton University
- Prisma Health
- Purdue University
- RedShred
- SAVIC Global Technologies, B.V.
- Samsung Electronics America, Inc.
- San Francisco State University
- Savannah River National Laboratory
- SC Research Authority
- SC Revenue & Fiscal Affairs Office
- SC Space Grant Consortium
- Siemens Energy, Inc.
- Sony Electronics, Inc
- South Carolina State University
- South Dakota School of Mines & Technology
- Special Aerospace Services, LLC
- Special Power Service
- Spintech
- Spirit AeroSystems
- Stanford University
- Stanly Community College
- Stony Brook University
- Structured Material Industries

Collaborations

- Tantiv4, Inc
- Temple University
- Tennessee Technical University
- Texas A&M University
- Texas Research Institute-Austin
- TIGHITCO
- TNE Global/Xidian University, China
- Trident Technical College
- Toray
- Transportation Technology Center, Inc
- Trulite, Inc.
- Universal Technology Corporation
- University of Alabama, Tuscaloosa, AL
- University of Arkansas
- University of Buffalo
- University of California, Berkley
- University of California, Davis
- University of California, Irvine
- University of California, Los Angeles
- University of California, Riverside
- University of Colorado, Boulder
- University of Connecticut
- University of Central Florida
- University of Florida
- University of Georgia
- University of Illinois, Urbana-Champaign
- University of Kentucky
- University of Maryland
- University of Massachusetts at Lowell
- University of Missouri
- University of Nevada at Las Vegas
- University of New Mexico
- University of North Carolina
- University of North Carolina, Charlotte
- University of North Texas
- University of Oulu
- University of Puerto Rico
- University of Rhode Island
- University of South Florida
- University of Tasmania
- University of Tennessee, Chattanooga
- University of Texas
- University of Texas at Austin
- University of Texas at Dallas
- University of Texas at San Antonio
- University of Utah
- University of Virginia
- University of Wyoming
- UOP LLC

Collaborations

- US Army Corps of Engineers
- UT- Battelle, LLC
- Virginia Commonwealth University
- Virginia Tech
- VMware IT Academy
- Washington University
- W.L. Gore & Associates
- West Virginia University
- Western Academy Support and Training Center
- Westinghouse Electric Company LLC
- Wichita State University
- Wipro Limited
- Worchester Polytechnic Institute
- Wright State University
- Yunnan University, China
- 3 Rivers Analytics, LLC

Supplemental Info - Collaborations

Any additional information on Collaborations appears as 'Appendix 2. Collaborations' (bottom).

Equity and Diversity Plan

Improve Under-Represented Minority (URM) Student Enrollment

Undergraduate outreach and recruitment activities aim to 1) increase participation of URM and female K-12 students in college-level outreach and recruitment initiatives, 2) increase applications to CEC programs from URM and female population, and 3) convert "admitted URM and female" students to "enrolled URM and female" students. Related activities include:

- Develop and maintain partnerships with K-12 educational organizations, such as K-12 schools, Department of Education, Midlands Education and Business Alliance (MEBA).
- Facilitate on-campus educational programs for K-12 students, such as Lead Academy, Duke TIPs, Carolina Master Scholars camps, and Partners for Minorities in Engineering and Computer Science.
- Promote engineering and computing through community outreach events, such as eWeek Open House, career fairs, and engineering competitions, and volunteer work with organizations such as Boys and Girls Club.
- Engage Students, Faculty, and Staff in recruitment efforts, such as daily college tours, and other regional recruitment events.
- Identify targeted high schools with high percentage of minority students and high average SAT scores for recruitment.
- Offer scholarships and incentives for admitted students. CEC recently received nearly $1 million in funding through a grant from the National Science Foundation Scholarships in Science, Technology, Engineering and Mathematics Program (S-STEM) to support academically-talented engineering and computing students based on financial need.
- Promote Engineering and Computing to transfer students, including regional technical colleges and historically black colleges and universities (HBCUs).
- Adopt diversity-aware faculty search practices to increase hiring of minority and female faculty; thus appeal to URM and female students.

Graduate outreach and recruitment efforts aim to attract URM and female graduate students to apply to CEC.

- Promote Graduate Education for Minorities (GEM) opportunities for CEC undergraduate and graduate students. Actively participate in GEM events. In 2019, CEC hosted GEM Lab.
- Visit and conduct recruitment events in regional HBCUs and minority serving universities.
- Hold recruiting events at diversity conferences, such as National Society for Black Engineers (NSBE), Grace Hopper Celebration (GHC) conference, Society of Hispanic Professional Engineers (SHPE) National Convention, Society of Women Engineers (SWE) conference, and Richard Tapia Celebration of Diversity in Computing conference.
- Facilitate access to research scholarships and awards. UofSC has recently received $1 million grant from the National Science Foundation (NSF) to establish a Bridge to Doctorate (G2D) fellowship program. The program is funded through the NSF Louis Stokes Alliance for Minority Participation (NSF-LSAMP). The B2D fellowship program, will be administered through UofSC's College of Engineering and Computing (CEC) and the College of Arts and Sciences (CAS).
- Adopt diversity-aware faculty search practices to increase hiring of minority and female faculty; thus appeal to URM and female students.

Equity and Diversity Plan

Improve The Number Of Full-Time URM Faculty Across Academic Units

The College of Engineering and Computing aims to increase diversity of faculty candidate pools; thus increase the potential of recruiting URM and female faculty. Related activities include:Recruitment

- College-level oversight of faculty position posting for diversity-conscious job description and placement.
- Adopt and require university-level diversity training for search committees and the designation of a diversity advocate for each search committee.
- Establish metrics in the hiring process for diversity contribution and standard questions for each candidate.
- Make active recruitment a requirement for each CEC department and require diversity statement from faculty candidates.
- Develop diversity-aware information booklet for CEC/UofSC and provide this information to each faculty candidate.
- Facilitate meeting between Associate Dean for Diversity, Engagement, and Inclusion and faculty candidates with questions regarding diversity climate of CEC.

Retention

- Establish multi-level faculty mentoring for academic success.
- Establish measurement for diversity contribution within the tenure and promotion process.
- Identify and support unique research support needs of URM and women faculty.
- Reduce service load for URM and women faculty at all rank.
- Provide mentoring and promotion guidance/training for post-tenure URM and women faculty.

Enhance Outcomes For URM Undergraduate and Graduate/Professional Students

Undergraduate retention is built on three pillars: 1) <u>Academically</u>: provide education resources to the students to make the path to graduation as smooth as possible, 2) <u>Socially</u>: help students feel connected to UofSC and CEC, and 3) <u>Professionally</u>: offer development opportunities to the students via the Career Center.

- Improve academic advising by focusing on individual student's needs and establishing a positive relationship with the academic advisors.
- Ensuring faculty and staff knowledge of course curricula and special needs, such as transfer credits and inclusive classroom resources.
- Focus staff advising on transitional issues and faculty advising on career planning and professional development.
- Promote student success center, supplemental instructions and tutorial for students. Identify academically at-risk students to develop appropriate intervention.
- Develop peer-mentoring for undergraduate students to help with both academic and social progress. Monitor success of students through academic applications.
- Develop onboarding programs for new freshman, such as summer bridge program to prepare students for the academic work at the college.

Equity and Diversity Plan

- Build support structures, such as Engineering and Computing Living and Learning Community. Develop programs and events to connect students with faculty and each other.
- Provide resources for URM and women student chapters, such as NSBE, SPHE, SWE, Women in Computing (WiC), Minorities in Computing (MIC), and Alpha Omega Epsilon (AOE).

 Graduate retention addresses progress towards M.S. and Ph.D. graduations.

- Department-level academic oversight of progress towards graduation.
- Financial support in forms of fellowship and scholarships, graduate teaching and research assistantship.
- Unit and university-level support for scholarship applications, such as NSF graduate scholarship and GEM support.
- Provide support to participate in diversity conferences, such as NSBE, GHC, Richard Tapia, etc.
- Organize social events to facilitate meeting with faculty and other graduate students.

Improve Post-Graduate Outcomes For URM Undergraduate and Graduate/Professional Students

The Career Center of CEC provides support for students, faculty, alumni, and potential employers. Special workshops on these services are provided at URM student chapter meetings. The following services are available for CEC students from the Career Center:

- support career planning: career coaching, assessment tools, online career management platform (Handshake).
- Facilitate internship, co-op, and job shadowing opportunities.
- Provide resume writing and interview preparation workshop.
- Support job searching activities, including interviewing skills, salary negotiation, and preparation of "elevator pitch."
- Provide information about graduate education and scholarship information.
- Support preparation for Career Fair and successful job negotiation.

Increase the engagement of students, faculty, staff, administrators in Equity and Inclusion

 CEC aims to increase engagement of students, faculty, staff, administrators in equity and inclusion activities. The current activities focus on overcoming the following challenges: 1) limited engagement between faculty and URM/female students, 2) limited diversity and cultural awareness of faculty and instructors, 3) lack of motivation/know how of tenure-track and tenured faculty to support gender and ethnic diversity initiatives. The current and planned activities include:

- Require diversity commitment by each department and make is part of the annual evaluation for the departments.
- Generate diversity support materials for research funding, including broader impact write up and broadening participation. Distribute these resources for all CEC researchers and administrators.
- Connect student chapters and faculty by organizing joint events, such as CEC women power lunch, leadership forum, and invited speakers series.

Equity and Diversity Plan

- Engage alumni of CEC to serve as mentors for organizations and individual students.
- Increase faculty awareness about the benefit of diverse work environment. Promote diversity seminars organized by the UofSC Center for Teaching Excellence.
- Host workshops/presentations/meetings with minority universities and colleges.
- Improve visibility of diversity activities and their impact on improved educational and research productivity.

Improve The Sense Of Inclusion Amongst All University Community Members

CEC aims to develop an inclusive academic environment where discrimination and bias against any of the members of our community are not tolerated. Related activities include:

- Assessment of the diversity knowledge and perception of CEC students, faculty, and employees. This leads to the understanding of key challenges faced by faculty, staff, and students with respect to diversity and inclusiveness. Assessment is performed via 1) discussions with student chapters/students, 2) discussions with departments/faculty/staff, 3) feedback on accessibility and usage of diversity training resources, such inclusive classroom environment, cultural awareness, hidden bias.
- Increase the knowledge about discrimination and bias of CEC students, faculty, and staff by 1) promoting training programs, 2) facilitating access to resources to report inclusive academic environment.
- Organize college-wide events to provide interaction between all students, faculty and staff.

Dashboard Metrics and Narrative

Metrics

Student Information Narrative

CEC student enrollment numbers dropped due to the pandemic, but are recovering. CEC is the third largest college on campus with about 10% of total students.

CEC students have the most favorable salary to debt ratio upon graduation. 81% are placed at the average salary of $71K ($75K with internship). 58% of the students carry an average debt of $34.5K, resulting in a debt to salary ratio of 49% for those with debt, and a ratio of 28% overall.

The college offers the highest number of BS degrees to African American students of all its peers and peer aspirants (59 in 2020, up from 40 in 2018).

Contribution (Per Student) Narrative

Tuition revenue and costs are stable. The heretofore increases in support unit allocations have made it difficult to plan strategically. The fixing fo the subvention is a positive step, if it accompanies a stabilization of support unit allocations.

Model Allocations (Per Student) Narrative

Subvention is needed in engineering. Much more expensive than other colleges: every hire requires significant startup (a measure of the expensive cost of equipment), and significant footprint (a measure of the size of the equipment and number of students working on experiments). The latter specifically necessitates subvention when compared with other colleges. The norming should be against similar colleges in peers and peer aspirant universities.

Faculty Information Narrative

The ability to increase faculty count is the result of increased student fees, as was the original intent. The onset of the budget model and the excellence initiatives have slowed down the ability of the college to hire at a rate which is necessary for growth, and for replacement of retirements or other departures. Additional resources are needed as noted in the faculty portion fo the blueprint.

Credit Hours Taught Narrative

We have worked to decrease the student-faculty ratio to improve teaching and learning.

Engineering and computing are very high-touch majors involving laboratories, design courses, or computer labs. The ideal average class size is 20 students, or 60 credit hours per section. A fully loaded average faculty member would then be teaching 360 hours (equivalent of 6 sections per year), which is exactly where CEC is today. Of course, the average is not representative of all the faculty. Given that our research awards have more than doubled

Dashboard Metrics and Narrative

from 5 years ago, a great deal of the faculty time goes to research and education of graduate students.

College/School Financial Information Narrative

The average indirect to direct ratio for the university is 60%, but it is 72% for CEC. Today this imbalance is addressed (and appreciated) through significant subvention. There are ways that the model can be improved. The ideal model would have rolled out with minimal need for subvention, pointing out transparently how each college can be strategic and improve its standing.

Student Outcomes Narrative

CEC graduates are gainfully employed or admitted to graduate schools at a high rate.

81% of the students are placed at $71K ($13K higher than 5 years ago). For the many who do internships, the starting salary is closer to $75K. The 6 year graduation rate has increased from 44% to 57% from CEC, and to 72% from the University. The College gives the largest number of BS degrees to African American students from among all its peers and peer aspirants, many of whom are larger than CEC. Yet, our absolute number of graduates (59 in 2020, as compared with 40 in 2018) is larger than all of them.

HERD Research Expenditures Narrative

CEC since 2016 has been in an unprecedented period of growth in all its facets, but especially in research activity.

CEC received $18.1M of sponsored awards in FY16. YTD in FY22 it has close to $36M. We expect to be close to $60M in FY24. The DoD awards alone have increased from $3M to over $16M (and will be around $40M in FY24). Mechanical, Chemical and Electrical engineering are competitive with, or superior to, some of their peer aspirants.

Other Information Narrative

Concluding Remarks

Quantitative Outcomes

Explain any surprises regarding data provided in the quantitative outcomes modules throughout this report.

Cool Stuff

Describe innovations, happy accidents, good news, etc. that occurred within your unit not noted elsewhere in your reporting.

One of the largest aerospace programs in the US!

Highest number of BS degrees awarded to African American students as compared with all our peers and peer aspirants

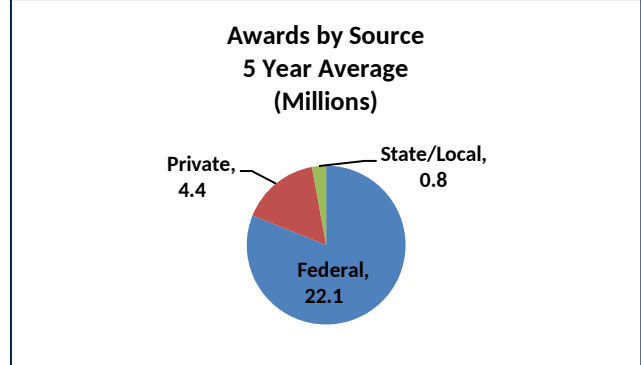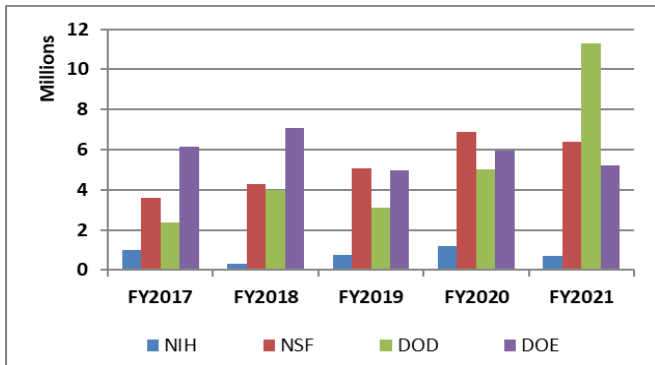Successful rollout of First-generation scholars program.

Sponsored research awards have more than doubled from Fy16.

Appendix A. Research & Scholarly Activity

College of Engineering and Computing
Summary of Awards

SAM ACTIVITY	FY2017	FY2018	FY2019	FY2020	FY2021	% Change Avg. (17-20) & 2021
Division Award Totals	*24,769,514*	*27,055,385*	*22,398,581*	*30,229,806*	*32,030,764*	**27.7**
Unit Totals						
Chemical Engineering	5,859,555	5,336,003	4,746,264	7,298,070	5,646,864	**(2.8)**
Civil & Environmental Engineering	3,377,993	1,727,180	2,526,009	5,138,916	3,519,953	**10.3**
Computer Science & Engineering	2,453,729	831,752	1,796,625	2,839,355	4,898,582	**147.4**
Electrical Engineering	3,495,582	7,625,747	3,628,483	5,129,756	5,786,221	**16.4**
Dean's Office	4,557	0	0	0	0	**(100.0)**
IIT – Engineering	137,989	593,589	1,223,824	725,309	339,380	**(49.4)**
Mechanical Engineering	9,440,109	10,941,114	8,447,376	9,098,400	11,839,764	**24.8**
Source						
Federal	20,159,582	19,522,796	17,156,506	25,342,880	28,461,117	**38.5**
Private	4,191,085	6,913,808	4,051,176	3,734,174	3,020,561	**(36.0)**
State/Local	418,847	618,781	1,190,899	1,152,752	549,086	**(35.0)**
Proposals						
Submissions	244	282	353	324	346	**15.0**
Dollars Requested	37,636,384	34,942,599	52,800,444	43,663,273	73,303,802	**73.5**

Awards by Department 5 Year Average (Millions)

Awards by Source 5 Year Average (Millions)
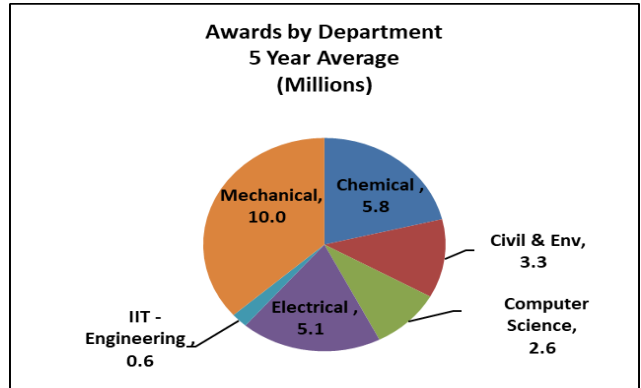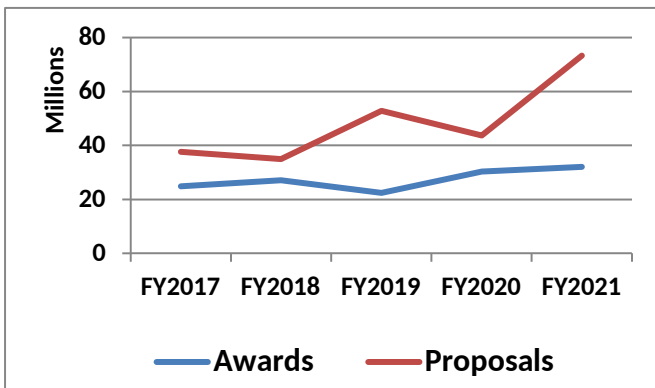
COLLEGE OF ENGINEERING & COMPUTING				
	Invention Disclosures	**Provisional Patent Applications**	**Non-Provisional Patent Applications**	**Issued Patents**
TOTALS:	**35**	**36**	**40**	**21**
Department Breakdown				
Chemical Engineering	**4** (ID no. 1511, 1515, 1522, 1539)	**6** (ID no. 1380 *(shared with CEC/Mechanical Engineering)*, 1451 *(shared with CAS/Chemistry & Biochemistry)*, 1470, 1511, 1522, 1539)	**10** (ID no. 1088, 1255, 1267, 1280, 1423, 1436 *(shared with CEC/Biomedical Engineering)*, 1440, 1442, 1469, 1471 *(shared with CAS/Chemistry & Biochemistry)*)	**7** (ID no. 944 *(shared with SOM/Surgery)*, 1160, 1212 *(shared with CEC/Electrical Engineering)*, 1216, 1250, 1280, 1309)
Civil & Environmental Engineering	**1** (ID no. 1504)	**0**	**8** (ID no. 1180, 1303 (Europe), 1303 (USA), 1353, 1383, 1437 *(shared with CEC/Mechanical Engineering)*, 1467, 1473)	**5** (ID no. 1153, 1163 *(shared with CEC/Mechanical Engineering)*, 1180, 1184, 1353)
Computer Science & Engineering	**8** (ID no. 1490, 1523, 1526, 1530 *(shared with CEC/Artificial Intelligence)*, 1532, 1533, 1537, 1540)	**7** (ID no. 1359, 1477, 1490, 1523, 1526, 1534, 1537)	**3** (ID no. 1431 *(shared with CEC/Electrical Engineering)*, 1477 (Utility), 1477 (TM))	**0**
Electrical Engineering	**10** (ID no. 1489, 1492, 1493, 1494, 1502 *(shared with CAS/Chemistry & Biochemistry)*, 1527, 1529, 1538, 1541, 1542)	**12** (ID no. 1385, 1434, 1435, 1480, 1489, 1492, 1493, 1502 *(shared with CAS/Chemistry & Biochemistry)*, 1512, 1538, 1541, 1542)	**7** (ID no. 1431 *(shared with CEC/Computer Science & Engineering)*, 1433, 1439, 1441, 1445, 1476, 1492)	**4** (ID no. 1118, 1212 *(shared with CEC/Chemical Engineering)*, 1220, 1249)

Mechanical Engineering	**10** (ID no. 1488, 1491, 1496, 1497, 1501, 1508, 1509, 1518, 1520, 1528)	**10** (ID no. 1380 *(shared with CEC/Chemical Engineering)*, 1450 *(shared with SOM/Cell Biology & Anatomy, CEC/Biomedical Engineering)*, 1464, 1468, 1474, 1488, 1491, 1501, 1509, 1536)	**12** (ID no. 1157, 1199, 1227, 1272, 1312, 1349, 1382, 1437 *(shared with CEC/Civil & Environmental Engineering)*, 1443, 1446, 1447, 1448)	**8** (ID no. 1147 *(shared with CEC/Biomedical Engineering, SOM/Pharmacology, Physiology, Neuroscience, SOM/Cell Biology and Anatomy)*, 1156, 1157, 1162, 1163 *(shared with CEC/Civil & Environmental Engineering)*, 1199, 1268, 1324)
Biomedical Engineering	**0**	**1** (ID no. 1450 *(shared with SOM/Cell Biology & Anatomy, CEC/Mechanical Engineering)*)	**2** (ID no. 1201, 1436 *(shared with CEC/Chemical Engineering)*)	**2** (ID no. 1147 *(shared with CEC/Mechanical Engineering, SOM/Pharmacology, Physiology, Neuroscience, SOM/Cell Biology and Anatomy)*, 1201)

Appendix 1. Academic Analytics Report

ACADEMIC ANALYTICS STUDY

Peers for the College of Engineering and Computing

We examined the Full-Field "Engineering" database within Academic Analyics (AA), which contains 231 listings. Of these we excluded programs that are not ranked by US News and World Report (USNWR) in their "Top Engineering Graduate Schools" listing. We also excluded schools that are not Carnegie Very High Research or that have a USNWR ranking below UofSC CEC. We also excluded UNC-Chapel Hill (no engineering college, only an environmental engineering program); Emory University (AAU, but only an UG program offered by transfer to Georgia Tech), University of Oregon (no engineering college), and the University of Southern Mississippi (ocean engineering only). There remain 33 public AAU institutions and 24 private AAU institutions having traditional engineering colleges; all AAU universities are Very High Research. Of the non-AAU universities, the AA database has an additional 44 public engineering colleges and 8 private universities that are Carnegie Very High Research and ranked equal to or above the 2019 USNWR ranking for CEC. These 119 universities comprise the global set of schools from which UofSC CEC should select its peers and aspirants.

Academic Analytics Broadfield Gauge

This tool compares UofSC CEC to all 231 institutions in the AA database. As explained above, many of these institutions are less than Carnegie Very High; others are specialty "one major" institutions or otherwise not considered peers or peer aspirants. So this particular AA tool actually sets a fairly low bar for comparison. Nevertheless we can learn something from the Broadfield Gauge.

Figure 1 presents the Z scores from the Broadfield Gauge for several metrics. A positive Z score means UofSC CEC is above the national mean. CEC faculty score well on the percentage of faculty with a citation, article, or grant; this means a higher-than-national average fraction of the faculty are research active. CEC scores low on the size of federal grants (dollars per grant), federal grant dollars per faculty member, and on number of honorifics (awards) such as Fellow of a society or Academy membership. CEC is near the national average on the other metrics such as citations per publication and citations per faculty member.

Peers and Near-Peers, including AAU Institutions

Based on input from our departments, suggestions from the VPR, and geographic and cultural considerations we selected 26 programs as peers or aspirants from the list of 119 universities described above. The list of peers and aspirants is shown in **Table 1** and includes AAU and non-AAU institutions and a mix from EPSCoR and non-EPSCoR states. Table 1 covers a broad range of faculty sizes. The table also shows the most recent USN & WR ranking; the ranking is dated 2019 but it is based on data submitted by colleges as of Fall 2018. We are interested in how the USNWR rankings correlate with actual quantitative performance data.

Table 1. UofSC CEC PEERS AND ASPIRANTS						
University	**USNWR Rank (2019)**	**ASEE Fac Count**	**Private**	**Land Grant**	**AAU**	**EPSCoR State**
NC State U	24	384		Y		
U Cal-Santa Barbara	24	131			Y	

Ohio State U	27	371		Y	Y	
U Washington	27	339			Y	
Rice Y	27	112	Y		Y	
U Virginia	41	161			Y	
Arizona State U	44	412				
U Florida	45	312		Y	Y	
U Mass-Amherst	58	152		Y		
U Tennessee	58	231		Y		
U Connecticut	67	146		Y		
Clemson	69	203		Y		Y
Oregon State U	73	191		Y		
U Central Florida	75	149				
U New Mexico	85	141				Y
U Cal-Santa Cruz	87	79			Y	
U South Florida	89	123				
UofSC CEC	**95**	124				Y
U Kentucky	95	135		Y		Y
U Nebraska	95	192		Y		Y
U Missouri	95	106		Y	Y	
U Kansas	95	113			Y	Y
U Oklahoma	106	132				Y
Oklahoma State U	106	165		Y		Y
LSU	106	116		Y		Y
Tulane U	106	22	Y		Y	Y

For the following analyses we consulted the following recent sources of data:

- Academic Analytics: data on articles published and citations to articles, and metrics related to publications and citations. Database AAD2018.04.01458.
- ASEE and USNWR: ASEE data tables are self-reported by colleges, the latest available data are for Fall 2018. These data include doctoral, masters, and bachelors enrollments and degrees granted; total research expenditures, and percentage of NAE members. The USNWR rankings employ ASEE data as well as reputational surveys of peers (other engineering administrators) and employers (people in industry).
- NSF HERD survey: Data on total federal R&D expenditures for 2018, the latest AY available.

Table 2: EPSCoR + AAU Comparison

There are only four AAU universities in EPSCoR states that have engineering schools. Two of these were chosen for comparison: Tulane/Louisiana and the U of Kansas/Kansas. (The other two EPSCoR/AAU engineering schools are Dartmouth and Brown, private Ivy League schools in small states that are not comparable in any sense to UofSC). **Table 2** shows the performance of UofSC CEC to these EPSCoR/AAU schools and to Clemson University School of Engineering and Applied Sciences. Some data come from

the ASEE F 2018 data set and other data from Academic Analytics. Table 2 also shows the USNWR ranking for 2019 (based on Fall 2018 data). We include the faculty count as a point of reference; note that the ASEE and AA have different methodology for faculty counts thus do not match. We report the totals in each category (the total impact of a college) as well as the per-faculty metric (a measure of faculty productivity).

The shaded entries in Table 2 are those quantitative metrics where UofSC CEC is NOT the top performer. Clemson tops all metrics in total size (impact), with a faculty nearly twice the size of UofSC CEC. CEC far outperforms the AAU+ EPSCOR schools Kansas and Tulane in almost every category. Tulane outperforms UofSC in the per-faculty productivity of PhD students, research expenditures, and articles published. Tulane has only three programs in its engineering college (Biomedical, Chemical, and Materials Engineering) and has much lower teaching loads.

A discussion of USNWR rankings is in order. Table 2 includes eight of the USNWR metrics, indicated by an asterisk *. Clemson is ranked 69 by USNWR, UofSC 95. The primary reason for this disparity is the USNWR peer score (given by a survey of academics) and recruiter score (given by a survey of companies that hire advanced degree candidates). The Peer and Recruiter scores are subjective. Note that the USNWR rankings do not include any measure of scholarly output/impact such as publications and citations.

Conclusions and Actions-Table 2

- On a total performance basis and on most per-faculty metrics, UofSC CEC outperforms the two AAU+EPSCOR Engineering colleges, while supporting higher enrollments and per-faculty teaching loads. On all per-faculty metrics, with the exception of Master's student teaching, UofSC CEC outperforms Clemson.
- USNWR peer and recruiter scores do not reflect the overall better performance of UofSC in the "countable" metrics. The USNWR graduate ranking methodology does not take into account support of teaching undergraduate students.
- CEC must continue to find ways to promote its identity and the actual performance of its faculty in research and teaching. CEC has built up its internal communications staff significantly in an effort to get out the "good news" about the college and its programs. CEC needs to continue seeking strategic communications opportunities, and it needs the support of UofSC central communications.

Table 2. Peers that are (EPSCoR + AAU) , plus Clemson University				
Metric	**UofSC CEC**	**Tulane**	**Kansas**	**Clemson**
# ASEE FT Fac	121	36	128	227
# Acad Analytics Fac	124	22	113	203
USNWR rankings and selected metrics				
Rank 2019	95	106	95	69
Peer score*	2.4	2.4	2.5	3.0
Recruiter score*	2.8	3	3.33.4	
Percent NAE members*	0.8	0	0.8	0.4
Total Size (Impact)				
PhD enrolled	300	91	231	533
PhD graduated*	57	11	32	91

Tot Res Expenditures*	$24.1M	$8.6M	$14.0M	$40.2M
Total Articles	1415	262	1012	2071
Total Citations	24,474	2,561	16,540	26,597
MS Enrolled	167	14	167	591
BS Enrolled	3,085	526	2,217	5,331
Per Faculty (Productivity)				
PhD enrolled/FT Fac*	2.48	2.53	1.80	2.35
PhD degrees/FT Fac	0.47	0.31	0.25	0.40
Res Expend/FT Fac*	$199,363	$238,039	$109,583	$176,963
Articles/FT Fac	11	12	9	10
Citations/Article	14	8	13	10
MS enrolled/FT Fac*	1.38	0.39	1.30	2.60
BS enrolled/FT Fac	25.5	14.61	17.32	23.48
* Indicates USNWR ranking metric				

Table 3. Scholarly Metrics from Academic Analytics

Table 3. Relative Rankings for Selected Academic Analytics Scholarly Metrics	
Metric	**UofSC CEC Outranks These Schools**
Articles published per faculty member	**UC Santa Cruz**, Clemson, Kentucky, U Mass-Amherst, **Missouri**, Nebraska, Oklahoma State, South Florida, **Kansas**
Total Citations	Kentucky, LSU, **Missouri**, Oklahoma State, South Florida, Tulane, **Kansas**
Citations per faculty member	Clemson, Kentucky, LSU, **Missouri**, Nebraska, Oklahoma State, South Florida, **Tulane, Kansas**
Citations per article published	Central Florida, Clemson, **Florida**, Kentucky, LSU, **Missouri**, Nebraska, Oklahoma State, South Florida, **Tulane, Kansas**

Table 4: USNWR most recent rankings

UofSC CEC is ranked #102 by USNWR. Its individual departmental and program rankings are as follows: Biomedical Engineering, 93; Chemical Engineering, 66; Civil Engineering, 75. Computer Entineering, 97; Electrical Engineering, 97; Mechanical Engineering, 94; Nuclear Engineering, 21.

The US News & World Report 2021 graduate (PhD-granting) program ranking for the College as a whole is #102 (tie). Graduate rankings are based on data quantitative submitted in Spring 2020. There are 23 private engineering colleges ranked above us by U.S. News. The two most important metrics that bring down the college is the low ratings given by Peers (other academic engineering deans and associate deans) and by Recruiters (non-academic leaders who hire advanced degree candidates).These two metrics together account for 40% of the total USNWR ranking score.

The US News & World Report 2021 undergraduate program ranking for the College as a whole is also #102 (tie). Undergraduate rankings are based solely on a reputation survey conducte in Spring 2020.

US News also conducts a reputational survey of individual graduate programs (See Appendix 1 for the engineering programs/departments). The highest-ranked programs in the College are nuclear engineering (21), chemical engineering (66th) and civil engineering (75th). Each program is ranked higher than 100, and so the overall college ranking is lower than the individual ranking of any program. Our lowest-ranked graduate programs (Electrical Engineering and Mechanical Engineering) were actually two of the highest-ranked programs in the 2010 National Research Council rankings: Electrical Engineering at # 10 and Mechanical Engineering at # 34. While NRC data are quite dated now, the fact remains that the USNWR rankings are unreasonably skewed by the reputational rankings.

Appendix 2. Collaborations

Kaiming Ye, PhD
Professor and Chair
Department of Biomedical Engineering
Thomas J. Watson School of
Engineering and Applied Sciences
Director, Center of Biomanufacturing for Regenerative Medicine

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February 16, 2020

Mark J. Uline, Ph.D.
Associate Professor
Department of Chemical Engineering
Undergraduate Director, Biomedical Engineering Program
University of South Carolina
301 Main Street Room 3C17
Columbia, SC 29208

Dear Dr. Uline,

I am very pleased to write this letter to support your plan of launching a new Department of Biomedical Engineering.

As Chair-Elect of the Council of Chairs of Bioengineering and Biomedical Engineering, I am leading a team to plan for the 2022 Biomedical Engineering Summit focused on developing a national strategy for biomedical engineering education and workforce training. We realize that Biomedical Engineering is a field at the interface of engineering, medicine and biological sciences. It combines the practical problem-solving ability of engineering to diagnostic, monitoring, and therapy needs of medical sciences. The evolution of academic disciplines often follows the sequence of first being a multi-disciplinary program evolving into an interdisciplinary program and then becoming a discipline in itself with a variety of sub-disciplines. Biomedical Engineering has followed that path and is now widely recognized as a separate discipline within engineering. We witnessed more and more universities launched a new department of biomedical engineering in the last several years.

This is certainly true based on my own experience. In 2012, I helped launch a new Department of Biomedical Engineering from a program homed at the Department of Biological and Agriculture Engineering at University of Arkansas. The launching of the new department was very successful. The enrollment of the first class reached 100 when we launched the new department. The department kept growing in both enrollment and faculty numbers. After joining Binghamton University, State University of New York (SUNY), I renamed our department from Bioengineering to Biomedical Engineering. The name change led to 75% increase in student enrollment in the first year. It also made easier for ABET accreditation, due to a clear and simple administration in curriculum development and student outcome assessment.

I had a chance to visit your program in April 2019. I observed your rapid growth and expansion. I also felt your pain in growth. The designation as a program limits your ability to grow, your

ability to recruit talent students who consider BME as the one of the fast-growing professional choices, and your ability to recruit top faculty members to help further grow and expand your program. The establishment of a new department will remove these burdens and streamline your administration and curriculum development. It will eliminate competing interests between two programs within one department, which will fundamentally streamline faculty hiring and tenure and promotion processes. It will help faculty to compete for NIH funding which views a favor for biomedical engineering faculty due to a consideration of research environment.

Finally, I would like to offer my assistance in helping you to plan for and eventually to launch a new department if needed.

I strongly support your plan of establishing a new Department of Biomedical Engineering.

Yours faithfully,

Kaiming Ye, Ph.D.
Professor and Department Chair
Director, Center of Biomanufacturing for Regenerative Medicine

Noshir A. Langrana,
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February 24, 2020

Dr. Tayloe Harding
Interim Executive Vice President for Academic Affairs and Provost
Office of the Provost
University of South Carolina
102 Osborne Admin Building
Columbia, SC 29208

Dear Dr. Harding,

At the request of Dr. Mark Uline, I am submitting my support for the establishment of a Biomedical Engineering Department at your university. I have been at Rutgers, The State University of New Jersey, for over 40 years. In my tenure at Rutgers, I have observed a tremendous growth in Biomedical Engineering (BME) at Rutgers as well as many other universities. I am an ABET (Accreditation Board for Engineering and Technology) program evaluator and team leader; in this capacity, I have observed the advantages of being in a "department" compared to "program". I am very familiar with the process of going from a program to a department and what it takes to make a department successful. Let me first state what we went through in our development and then I will comment on Mark's proposal.

The Biomedical Engineering program at Rutgers University was initially established in 1965 as a track within Electrical Engineering, offering M.S. degrees with a Biomedical Engineering emphasis. In 1986, the State of New Jersey formally chartered the Rutgers Department of Biomedical Engineering as an independent entity within the School of Engineering (SoE) with exclusive responsibility for granting M.S. and Ph.D. degrees in biomedical engineering.

The undergraduate program in Biomedical Engineering was inaugurated in 1991 under the "Applied Sciences" option within the School of Engineering; a formal undergraduate B.S. degree in BME was approved by the University in 1997. In Fall 1999, our BME department started an official undergraduate degree program. In order to qualify for a BME leadership award (which was instrumental in getting a new BME-dedicated building), Former SoE Dean, Michael Klein, requested six SoE faculty from other established departments to have a joint appointment in BME and their home department. The department faculty grew over the next few years from eight to fourteen. In addition, ten new faculty members were hired in a span of seven years. The first BS degree class was four (4) students in May 2000. The class of 2020 is one-hundred twenty-two (122). Our BME undergraduate program initially received ABET accreditation in 2005 and has been successfully renewed since.

A BME building was dedicated on April 18, 2007. The 80,000-square-foot education and research facility featuring state-of-the art micro fabrication, tissue culture, and microscopy laboratories, including small animal facilities. The 2nd and 3rd floors are "open lab space" concept with no walls. We have seen tremendous advantages of collaborative research work and sharing of resources because of the environment that has been created. Currently, we are 25 BME core and 71 graduate faculty, over 300 undergraduate students (4th largest in the country) and over 100 graduate students. I strongly believe this type of growth cannot occur with a "program" alone; it has to be through a "department".

RUTGERS
School of Engineering

Having said that here are my comments on the proposal by the College of Engineering and Computing (CEC) at the University of South Carolina (UofSC):

1. Biomedical Engineering at the University of South Carolina should be administered as a department. They have been functioning as a program, but now this step is necessary to have an impact on the program as well to the university. Currently, there are 13 faculty members, 3 instructors, and 2 administrative staff members who are supporting the BME program. There is a need to strengthen the activity of BME by creating a department and developing a critical "core" faculty size. The department will get firm commitments from the residing faculty and they will share the resources and develop collaborative research programs.

2. The hiring proposal is modest, and it is developed with the consideration of three existing research centers: The Artificial Intelligence Institute, the Research Center for Transforming Health, plus the Cardiovascular Translational Research Center. With the addition of five faculty members, the department will be a decent size of eighteen faculty members. This will make BME comparable to existing departments at other universities. One of the Accreditation criteria is faculty size and expertise. The current hiring plan will avoid the concern about the small faculty size. The department of 18 faculty members will be able to handle advising, teaching, research and mentoring all BME undergraduate students.

3. The faculty hiring plan is designed by your internal functioning and expertise to acquire. It is a fact that that hiring plan will be severely hampered if a BME department is not established. Based on experience, we can state that we have been able to attract excellent faculty because we are a full BME department and we have built an environment with a collaborative culture. I am certain that you will observe a significant amount of collaborative activities which will result into successful funding, research growth and the ability to attract new junior, as well as senior, faculty members.

4. In the UofSC College of Engineering and Computing (CEC), Biomedical Engineering exists as a program, rather than a department. Once the program becomes a department, it should become a nationally respected academic unit. Clemson University is the only other university in South Carolina with a similar yet distinct academic unit, a Bioengineering Department. The University of South Carolina's Biomedical Engineering Program has reached the stage now to become a department to its own identity and build a unified autonomous entity. This will allow BME to create a research direction and make a name for their own challenges. The next set of hiring in Cardiovascular Mechanics & Modeling; Cardiotoxicity; Big Data; Biomaterials for Localized Delivery; Regenerative Medicine; Protein Science; Diagnostics; and Biomanufacturing will enhance the current strength, plus the teaching, training and clinical practice should address relevant health care issues affecting SC citizens.

5. The department will be able to further outreach the local universities and build partnerships in biomedical engineering related devices.

6. The undergraduate and graduate student population will have a home; they will be your assets and ambassadors of your department and they will become part of your complete endearment as they provide valuable services to the department. It is possible that Biomedical Engineering may become the largest degree granted program in the CEC. All faculty will be in close vicinity which will enhance faculty collaboration. All-in-all, it will be a win/win situation.

I wish you all best of luck in the formulation of the department and look forward to constructive progress in Biomedical Engineering at the University of South Carolina.

Warm regards,

Noshir A. Langrana, Ph.D, .P.E.
Distinguished Professor
Interim Undergraduate Program Director
Former Chairman of BME Department, 2005-2017

Samir N. Ghadiali, Ph.D.
Professor and Department Chair

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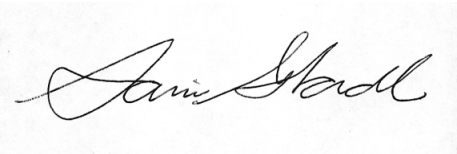
February 24, 2020

Dear Dr. Uline:

I am writing regarding the pending formation of a Biomedical Engineering department at the University of South Carolina. As you can see from my comments below, I am very supportive of this effort and know first-hand how important the formation of a BME department can be to the growth of our discipline. To provide some context, let me first describe my background. After completing my PhD in Biomedical Engineering from Tulane University and post-doctoral training at the University of Pittsburgh, I was recruited to Lehigh University in 2003 as an Assistant Professor in Mechanical Engineering and part of my job description was to co-develop a Bioengineering program at the undergraduate level. I helped develop the curriculum and structure for this program, which rapidly became a very popular undergraduate major. However, there were several limitations as a program, the primary of which was that tenure-line faculty needed to be hired in other engineering departments and that limited our ability to specifically hire the faculty needed for the Bioengineering undergraduate program. The lack of a department also hindered the development of a Bioengineering graduate program. Although I moved to Ohio State University in 2007, I am happy note that Lehigh now has a strong Bioengineering department with tenure-line faculty.

I am currently, Chair of the Biomedical Engineering (BME) department at the Ohio State University (OSU) and the history of BME at OSU is typical of many BME programs. It was initially a research center that offered graduate degrees (MS and PhD) for many years before becoming a full department in ~2006 with an undergraduate program. Simply stated, become a department has been transformational for BME at OSU. In the past 14 years, we have grown to be a large department (~550 undergraduates, ~100 graduate students and 30+ faculty members) that offers a large range of services to our students. The most critical aspect of becoming a department was the ability to directly hire tenure-line faculty in areas where we wanted to grow. Specifically, our department has very strong ties to the OSU Medical Center and particularly strong ties with several hospitals and research institutes on campus (e.g. James Cancer Center, Davis Heart & Lung Research Institute, Spine Research Institute, etc.). As an independent department, we were able to target our faculty recruitments in these areas and cost-share these lines with Institutes and Divisions in the Medical Center. As a result, we have recruited outstanding faculty members who are making significant impacts on both engineering research and clinical care. The department has also been able to provide outstanding resources to our students which have allowed them to excel in many areas as evidence by the recent winning of "chapter of the year" award to our undergraduate student society at BMES. Being a full department has also helped us enhance our graduate programs, obtain better access to larger scale funding resources and develop the resources needed to deliver high quality teaching, research and service in BME. It has allowed BME to be a full partner with other departments in the college of engineering and this can be most visibly seen in our new state-of-the-art building that will go online this summer (https://engineering.osu.edu/bmec). This building will house two departments, BME and Material Science and Engineering, and will foster new collaborative efforts in the area of biomaterials development and significantly enhanced resources for our undergraduate and graduate students. Development of this type of collaborative facility would not have been possible if Biomedical Engineering did not have full departmental status.

Samir N. Ghadiali, Ph.D.
Professor and Department Chair

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THE OHIO STATE UNIVERSITY

In summary, although I recognize the significant effort and resources that are required to form a new BME department, the benefits of this effort will be significant and likely out-weigh the costs. BME is now a very mature discipline and in my opinion, Universities and Colleges that do not have a department structure are at a significant disadvantage when it comes to national recognition, the ability to recruit faculty members/students and provide the collaborative resources required by our discipline. It sounds like a very exciting time at the University of South Carolina and I am excited to hear about your plans for forming a department. I wish you the best in this endeavor and would be happy to answer any questions you have about our department at Ohio State or this letter.

Sincerely,

Dr. Samir N. Ghadiali, PhD
Professor and Department Chair
Department of Biomedical Engineering
The Ohio State University

Professor (Joint Appointment)
Department of Internal Medicine
Division of Pulmonary, Allergy and Critical Care Medicine
Dorothy M. Davis Heart & Lung Research Institute
Ohio State University Wexner Medical Center

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Paul and Allene Russell Professor
Director, Center for Molecular Regeneration Therapeutics

Friday, February 28, 2020

Dr. Tayloe Harding
Interim Executive Vice President for Academic Affairs and Provost
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University of South Carolina
102 Osborne Admin Building
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RE: <u>USC DEPARTMENT OF BIOMEDICAL ENGINEERING</u>

Dear Provost Harding,

I am delighted to learn that the University of South Carolina's College of Engineering is proposing the establishment of a Department of Biomedical Engineering. While there are several structural advantages of establishing a departmental structure around biomedical engineering, there are even more important scientific and academic reasons to do so. Thus, I am writing to strongly encourage in the strongest terms the University of South Carolina to create a department of biomedical engineering, especially one that links the School of Medicine with the College of Engineering.

Decades ago when I was a graduate student in engineering, there was general skepticism regarding the concept of biomedical engineering as a distinct intellectual discipline. At that time there was no unique intellectual skillset that either defined biomedical engineering pedagogy or justified biomedical engineering as a distinct academic discipline. Now the situation has completely changed.

Today, the application of engineering systems science to biology and medical research is resulting in the discovery of new engineering design principals for self-organizing, and even living, materials that have performance capabilities not achievable with other materials. These new biomaterials are robust and adaptive. They self-repair and manifest emergent behaviors that define structure-function-property relationships which are new to engineering science. It seems most likely that the future of engineering science and pedagogy will be heavily influenced by investigating and learning the rules of biological systems. Increasingly public and private engineering research dollars are being directed toward biomedical engineering research. Today, biomedical engineering is rapidly becoming the flagship engineering department within colleges of engineering.
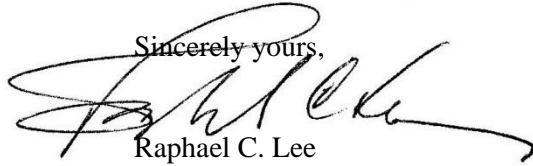
It is also becoming clear that engineering science is of fundamental importance to the advancement of biology and medicine. The scientific questions being addressed by biologists today are increasing about how cellular systems behave. In medicine a patient is seen as a robust and adaptive complex feedback-controlled closed-loop homeostatic system, and disease is a malfunction resulting from a disorder in that system. The goal of medical research now is to move away from population-based validation of drugs and

devices and move towards personalized therapies based on the genetics and regulating epigenetic factors for each patient..

Success in accomplishing personalized medicine inexorably requires a working knowledge of how to accomplish a steady-state beneficial change in the behavior of closed-loop control systems which is a skillset unique to engineering. Thus there is a fundamental need to converge engineering and medical pedagogies to train tomorrow's physicians.

I wish to congratulate the USC College of Engineering on increasing the investment in biomedical engineering. I am totally confident that this will prove to be a wise investment that will not only benefit future students, but the future of both engineering and medicine as well.

Sincerely yours,

Raphael C. Lee