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CLEMSON
CHEMICAL AND BIOMOLECULAR ENGINEERING

Department Newsletter

Mark Blenner honored with Presidential Early Career Award

The White House Office of Science and Technology Policy Director, Dr. Kelvin Droegemeier, presented Dr. Blenner with the PECASE Award in Washington DC.

Mark Blenner, the McQueen-Quattlebaum Associate Professor in the Department of Chemical and Biomolecular Engineering, recently received the Presidential Early Career Award for Scientists and Engineers, also called PECASE. Dr. Blenner's research has the potential to enable long-term space missions and provide new tools to aid in the search for some of the globe's most destructive weapons. Blenner was among 311 researchers nationwide, including two from South Carolina, honored with the award, according to the White House.

"The PECASE is the highest honor bestowed by the United States government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in science and technology," it stated. Blenner is the fifth Clemson University researcher to win the award since it was commissioned in 1996 by the cabinet-level National Science and Technology Council. He joins Dr. Scott Husson as the second winner from Clemson's Chemical and Biomolecular Engineering Department.

Blenner works with bacteria and yeast to make new enzymes that are able to do things nature has not yet figured out. The research gives the students in his lab a chance to work on the cutting edge of synthetic biology. In one project, Blenner and his team are working to engineer yeast to convert respiration carbon dioxide, algae biomass and urine into 3D printable plastics and nutritional omega-3 fats. Astronauts on missions to Mars could, for example, use the plastics to make new tools and use the omega-3 fatty acids for maintaining health. Some of Blenner's other research has focused on developing sensors. One would pick up signatures of tributyl phosphate, a solvent used to enrich uranium, for energy and nuclear weapons applications. Another sensor he is helping develop could determine if radiation is from natural or man-made sources and whether the enriched nuclear materials are for power generation or weapons applications. Further, Blenner is leading a program aimed at increasing diversity in engineering. He and his team are recruiting students who are from groups underrepresented in engineering and helping them work toward doctoral degrees in chemical engineering so they can then pursue careers in education and research. The idea behind the program is to create a new generation of professors to serve as role models for underrepresented groups.

The White House announcement marked the first time that a new group of PECASE awardees has been announced since January 2017 when 102 scientists and researchers were honored. In February 2016, 105 researchers received the award. David Bruce, Chair of Chemical and Biomolecular Engineering, congratulated Blenner on the honor. "The PECASE is a highly competitive national award," he said. "I am excited that his exceptional work has received the attention it richly deserves and greatly appreciate how his efforts are strengthening Clemson's reputation in the broader scientific community." The nominating agency for Blenner's award was NASA, and he was one of 18 from the agency to win. "These PECASE winners represent some of the brightest early career researchers that NASA supports," said James Green, NASA chief scientist. "They were selected for what they have already accomplished, but more importantly, we expect they will reach even higher goals in the future. They are shining stars."

Anand Gramopadhye, Dean of the College of Engineering, Computing and Applied Sciences, said the award underscores that Blenner is working at the frontiers of engineering. "This is truly fantastic news — a testament to Dr. Blenner and his research team," he said. "I congratulate them on this richly deserved honor."

Dr. Blenner also received the Junior Researcher of the Year Award, which was presented by President Clements in May. This Fall, Blenner was appointed visiting scientist at NASA Ames Research Center, where he is working towards waste and in situ biomanufacturing to support life in space and mass-less bioprocessing.

From left: Timothy Fulford of Trident Technical College, Joe Santaniello of Spartanburg Community College, Christopher Kitchens of Clemson University and Shawn Masto of Spartanburg Community College meet in Clemson University's Earle Hall to plan SPECTRA.

NSF SPECTRA Grant provides Scholarships to Hundreds of Transfer Students

Hundreds of students who transfer from South Carolina technical colleges to Clemson University will soon be eligible for scholarships as part of a new program backed by nearly $5 million from the National Science Foundation.

The plan calls for more than 300 transfer students to receive $3 million in need-based scholarships over the five-year life of the grant, said Christopher Kitchens, the program's principal investigator and associate professor of chemical and biomolecular engineering at Clemson.

The scholarships will be open to students who plan to pursue Bachelor of Science degrees in engineering or computing in Clemson University's College of Engineering, Computing and Applied Sciences. The rest of the funding will pay for an assortment of programs, many aimed at helping transfer students form a community to support each through some of higher education's most challenging majors. Researchers will also study the results of the program to learn what leads to success and share their findings with the nation. Researchers are calling the program Student Pathways in Engineering and Computing for Transfers Program, or SPECTRA. To apply, go to clemson.edu/cecas/spectra. The idea behind SPECTRA is to help recruit, retain and graduate transfer students as they begin to make up a bigger share of the Clemson student body, largely because starting at technical colleges can reduce higher education costs.

Some transfer students, though, may unknowingly be putting themselves at a disadvantage, Kitchens said. "For many, it's due to financial restrictions," he said. "Others just don't know how to make that transition from technical colleges to the university, and they get lost in the system. What this program provides are pathways for the students so they can see the road map that will help them succeed." At stake is who will be eligible for some of the nation's most lucrative jobs. Fourteen of the 20 bachelor's degrees that led to the highest pay were in engineering and computer science, all with mid-career salaries at $117,000 or more, according to PayScale's College Salary Report.

The application process for the scholarships are now open, and the first SPECTRA students started at Clemson this Fall semester. Scholarship amounts vary depending on students' individual needs and range from $5,000 to $10,000 per year. For most students, the scholarships will cover costs at Clemson only. Students who start out at Trident Technical College in Charleston and Spartanburg Community College are also eligible for two years of scholarships before they transfer. Those scholarships will be worth up to $3,000.

Targeting Trident Technical College and Spartanburg Community College for additional scholarships will allow researchers to see what happens when they build a community of students and expose them to special programs before they transfer. These colleges were chosen in part for their locations on opposite ends of the state and for demographic reasons. Trident Technical College has the greatest number of students who are underrepresented in engineering and computing, while Spartanburg Community College leads in first-generation college students.

When transfer students arrive at Clemson, they will find several new programs that researchers are creating for them as part of SPECTRA. The programs will be open to all transfer students, whether they receive scholarships or not, and will include access to advisers, special events during move-in and talks by industry representatives. The collection of programs is being packaged as Clemson Assistance for Transfer Students in Engineering, or CATS. Also as part of SPECTRA, researchers will establish the Advisors for Communities of Engineers program. Ten Ph.D. students who aspire to become educators will be designated as ACE Fellows. They will shadow a Clemson instructor in a freshman-level course then help teach and mentor students at technical colleges. After two semesters, the graduate students will return to Clemson with the transfer students.

Even as SPECTRA is just getting started, researchers are laying plans to keep it going after the federal funding runs out. The hope is to continue providing $1 million per year in scholarships, with funding coming from industry, Kitchens said. The SPECTRA principal investigator from Trident Technical College is Dr. Timothy Fulford and the principal investigator from Spartanburg Community College is Joe Santaniello. Co-principal investigators from Clemson include Drs. Matt Boyer, Joshua Summers and Anand Gramopadhye. Dr. Tim Hardee, President of the South Carolina Technical College System, said that SPECTRA has the potential to benefit students at all of the state's 16 technical colleges.

"Through SPECTRA, we will enhance the opportunities available for our students across the state enabling them to reach their goals and enrich their college experience," Hardee said. "Accessibility and affordability are key tenets of the System. To this end, we are excited about the new doors that SPECTRA could open for our students." Dr. Gramopadhye, Dean of the College of Engineering, Computing and Applied Sciences, said that "SPECTRA will help the college recruit and retain some of the South Carolina Technical College System's top students." "SPECTRA will provide some of the crucial tools transfer students need for success," he said. "We look forward to deepening our collaboration with the state's technical colleges through this program so that we can work together to help students achieve their dreams."

FOCUS ON TEACHING

Dr. Christopher Norfolk awarded the Byars Prize for Excellence in Teaching Engineering Fundamentals

Dr. Christopher Norfolk (center) is shown receiving the Byars Prize for Excellence in Teaching from Dean Anand Gramopadhye and Dr. David Bruce.

Dr. Christopher Norfolk was recently presented the Byars Prize for Excellence in Teaching Engineering Fundamentals from the College of Engineering, Computing and Applied Sciences. This award honors Dr. Norfolk's skills as a teacher, mentor, and one who is respected by students and faculty alike. It also acknowledges the many accolades he receives from our students each year.

Dr. Norfolk, who was promoted to Senior Lecturer this year, teaches Introduction to Chemical Engineering (ChE 1300) and Unit Operations Lab courses (ChE 3070 and ChE 4070). Below you will find Dr. Norfolk's teaching philosophy in his own words:

"My approach to teaching is likely different from many of the excellent lecturers and professors that practice the trade at Clemson. I find the traditional role of 'teacher' to be too confining to capture all of the things I am trying to do in my position. Instead, I consider myself to be the leader of a group of students, and I try to apply principals of good leadership to my interactions with my team. I find this paradigm to be very helpful.

The first thing any team requires is a clearly defined goal. The implicit goal for every class is that every student master the course material. However, I also spend a lot of time clearly communicating expectations, including allowing all students access to years' worth of old exams, so that the final expectations are clear.

Another characteristic of a good leader is the realization that the success of the leader lies in maximizing the potential of the team. My greatest possible success is not in being a popular instructor, or in handling a large number of students, but in the extent to which my students master the course material. This philosophy suggests several tactical choices that I tend to use with my students. The first is to strive to meet each student 'where they are,' rather than where I think they should be. This means that the methods that I employ in the classroom are continually changing to accommodate learning styles of students, including hybrid in-person/online classes, in class exercises, providing opportunities for individual and group practice, etc.

I have also revised our Unit Ops Lab Manual, which more closely follows the current structure of the lab courses and gives students explicit instruction on the proper methods to estimate experimental uncertainty, based on the methods used by NIST. The manual also provides examples of the type and level of technical reports we expect from them. It is a critical resource to support our most important courses.

I view the task of learning as primarily belonging to the students; they are doing the hard work, and I am merely guiding them along the path. Part of my role is to remove, where possible, impediments to their work, so that they can progress as efficiently as possible. In this, timely communication is key, and so I make myself as available as possible to all students, both in-person and on-line; my students all have my cell phone number to facilitate this. I find this to be one of the most appreciated aspects of my teaching style. I also make it clear to students that I will support them through the learning process, doing whatever it takes to reinforce their efforts. With the knowledge that they have virtually limitless resources available to them, the responsibility for their progress in the course vests with the them. I find that forcing students to face this responsibility encourages more professional behaviors.

Since the students are doing all of the hard work of learning, part of my role as a leader is to keep them motivated. The students will get out of the course in proportion to the effort they put into the course, and so if I can keep them dedicated to the material, they will achieve the goal of mastery to a greater extent. This requires me to answer the 'why' question, rather than the 'how' question, keeping the purpose of the course as a central aspect. But in motivating students, as in motivating any team, I find that personal connection is most effective. As the saying goes (attributed to Theodore Roosevelt), 'Nobody cares how much you know until they know how much you care.'

Finally, I do what I can to model leadership and dedication for my students. I am continually encouraging them to give more to the class, to press through their limits, and to reach the next level of understanding of the material. So I strive never to falter when they ask me for more, either in class or out, and I do my best to put none of my other activities above the needs of any student. I want to inspire loyalty in my team, the idea being that students can see my dedication to them in our everyday interactions. I want them to tirelessly work for me because they know I will tirelessly work for them."

ChBE Graduate Students research makes front cover of Chemical Science Journal

Like so many great projects, the research that earned ChBE PhD students, **Ryan DeFever and Steven Hall,** three awards and a spot in a respected academic journal was fueled in part by coffee. "Steven and I had probably 25 walks to Starbucks and back– at least–during the course of this research," DeFever said. "There was a lot of chatting and bouncing ideas off each other."

DeFever and Hall were part of a team that had its research highlighted this year in the journal **Chemical Science**. Their experience underscores how interdisciplinary research, sometimes enhanced by caffeine, energizes the educational experience that creates the next generation of engineers. The team showed that the same machine-learning techniques that allow self-driving cars to see obstacles can be used to identify nano-sized structures of atoms and molecules, enabling advances in a wide range of research.

The students involved in the recently published research were guided by two faculty members, Sapna Sarupria and Melissa Smith. **Dr. Sarupria, an Associate Professor in Chemical and Biomolecular Engineering, was the project leader.** Sarupria said that she was lucky to have DeFever and Hall working in her lab. "Students, especially those who are creative and brave, are important to research," she said. "They do the work, but they're also the ones who come up with ideas and motivate you," Sarupria said. "These are my research collaborators– they are my true science collaborators, and they keep my energy going."

Sarupria, DeFever and Hall collaborated on the research with Smith, Associate Professor of Electrical and Computer Engineering, and her former student, Colin Targonski. Smith said that she and Targonski contributed their machine-learning techniques and experience in applying them appropriately. Just as important as the scientific discoveries, she said, is teaching students to collaborate across disciplines. "I come from a national laboratory background where that is everyday practice," said Smith, a former research associate at Oak Ridge National Laboratory. "That is why they make these big discoveries and extend science in big leaps and bounds. They work in an interdisciplinary team, rather than working with their own kind all the time."

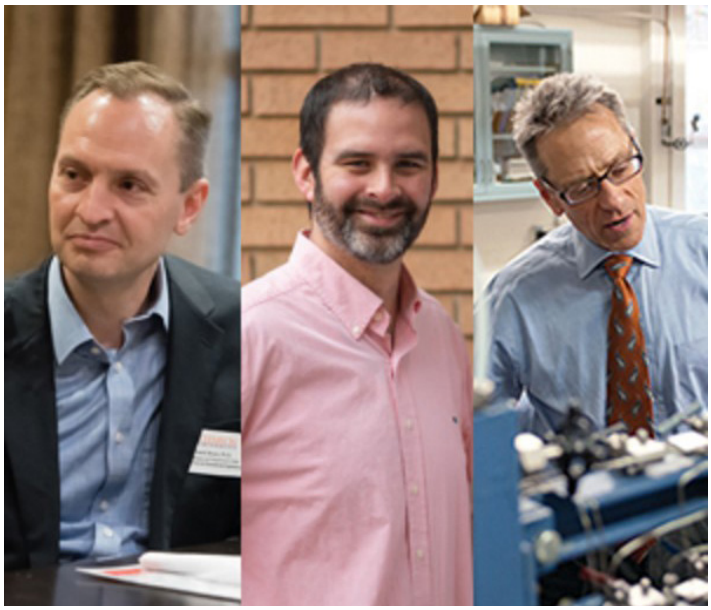
Targonski graduated in May with a master's degree in computer engineering and now lives in New York, where he works as a machine-learning engineer at JP Morgan Chase & Co. "This work was exciting because it offered an entirely new domain to work in– applying machine learning algorithms to molecular dynamics," Targonski said of his work at Clemson. "We are especially excited about the state-of-the-art results we were able to achieve by using algorithms developed for the computer vision domain and adapting them to the computational chemistry domain."

The research also helped DeFever earn a Ph.D. DeFever, who is from Greenville, graduated in August with his doctoral degree in chemical engineering. When he crossed the stage at the hooding ceremony, he had two prominent awards under his belt, again thanks in part to the research. He received Clemson University's Outstanding Graduate Researcher Award, and the Chemical Computing Group Excellence Award from the American Chemical Society's Division of Computers in Chemistry. DeFever plans to continue in academia as a post-doctoral researcher at the University of Notre Dame. Hall, who is from Anderson, began the research as an undergraduate and is now a second-year Ph.D. student in chemical engineering. He also took home an honor based on the research, winning a best poster competition at July's Rare Events Workshop at the Indian Institute of Science, Bengaluru, India.

Part of what made the research stand out is how fast it went. The team went from idea to published paper in about a year, with most of the work occurring in the final six months. DeFever said one of his favorite parts of the research was that it involved lots of coding. Most of the time, he said, was spent debugging code. "**The idea always is quick, but the implementation is long and tedious," he said. "You get that moment where it all falls into place, and it clicks and it works. And that brings you back for more because it's thrilling when that happens. It's worth a lot."**

FACULTY HIGHLIGHTS

Three ChBE Professors Honored for Securing Patents



Chemical and Biomolecular Department researchers D**rs. David Bruce, Christopher Kitchens, and Mark Thies** were among those honored this year for securing patents in 2018. Faculty from Automotive Engineering, Bioengineering, and Environmental Engineering were also honored. Among the 16 patents issued to Clemson University researchers in 2018 were technologies for improving on-site building construction with a sustainable building system, purifying lignins, and self-healing polymer coatings that inhibit corrosion of metal substrates.

Drs. Thies and Bruce received a patent on a **"Solvent and Recovery Process for Lignin."** The technology developed by Profs. Thies and Bruce in conjunction with Dr. Adam Klett, a doctoral graduate of the ChBE department, enables renewable lignin, the most abundant aromatic polymer produced in nature, to be recovered at high purities and with low metals content from process fluids that are routinely generated during the conversion of trees into pulp and paper products. These purified lignin products are finding uses as polyurethane foams, building materials, and carbon fiber precursors, to name just a few.

Dr. Kitchens was recently awarded a patent on technology to build **Micro-Electromechanical Systems (MEMS)** devices from nanocrystals derived from renewable cellulose biomass, including cotton or trees. This technology was developed in collaboration with Profs. Virginia Davis and Robert Ashurst at Auburn University and funded by the National Science Foundation. The MEMS industry is a $20 Billion industry that has enabled the miniaturization of technology that we have become reliant upon. MEMS devices are currently fabricated from silicon by an energy intensive process that uses large quantities of hazardous chemicals. This technology enables the production of entirely new materials with similar performance characteristics to existing MEMS but is renewable, more sustainable, non-toxic, and biocompatible. These attributes have the potential to revolutionize the MEMS industry and open the doors to new applications, especially in the biomedical field. The title of this patent is **"Microdevices and Methods of Manufacture."**

The patent recipients were honored at the annual Patent Award Ceremony hosted by the Clemson University Research Foundation (CURF), which facilitates technology transfer at Clemson University.

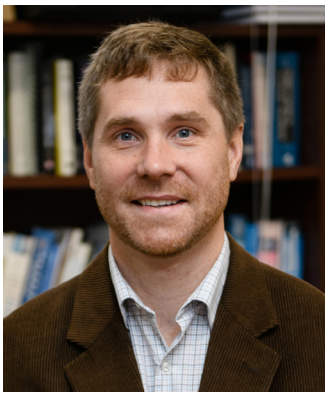
Dr. Amod Ogale Honored with Award

Prof. Amod Ogale received the prestigious University Research, Scholarship, and Artistic Achievement Award (URSAA) from President James Clements.

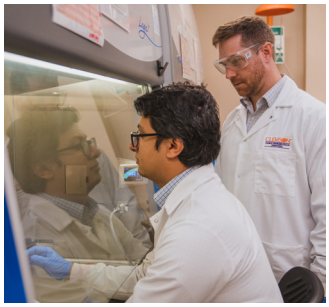
The award recognizes Clemson University faculty whose work has been acknowledged at the highest levels nationally and internationally.

URSAAA winning faculty are lifetime appointees and participate in a yearly celebration of faculty achievements.

FACULTY HIGHLIGHTS



Dr. Marc Birtwistle receives Tenure



The department would like to congratulate Associate Professor, Dr. Marc Birtwistle, who received tenure this year. Dr. Birtwistle transferred here from the Icahn School of Medicine at Mount Sinai in 2017. He received his B.S. degree from Georgia Institute of Technology and his PhD from the University of Delaware. At Clemson, Dr. Birtwistle currently teaches Introduction to Biomolecular Engineering (BMOL 4250/6250) and Bioprocess Engineering (BMOL 4290/6290), and the main focus of his research lab is cancer research. The Birtwistle Research Group has research grants with the National Institute of Health (NIH) and is working on three interacting research areas: Systems Biology: Reconstructing Noisy Biochemical Networks; Systems Pharmacology: Mechanistic Modeling of Drug and Drug Combination Responses; and Technology: Increasing Quantitative Multiplexing and Computational Efficiency. Currently, cancer precision medicine is based on matching genomic data to targeted drugs. This has revolutionized cancer care, but is not always successful. Their overall vision is to use a patient's genomic data to tailor models of relevant biochemical networks. These models would then be analyzed to make more precise predictions for personalized treatment strategies. This would include important features of drug action, such as on-and off-target effects, potential toxicity, dosing, dynamics and sequence.

The EFRC (DOE Energy Frontier Research Center for Inorganometallic Catalyst Design) research group that **Dr. Rachel Getman** works with won **"Best Interviewing"** for their video submission at the EFRC's PI meeting. The video titled **"Collaborating for a Better Future"** highlights the importance of collaboration between computational and experimental chemists, chemical engineers, and material scientists in the study of metal organic frameworks, catalysts, and chemical reactions relevant to natural gas liquefaction. To view the video, please go to this link: https://www.energyfrontier.us/content/collaborating-better-future. In addition, Dr. Getman's research group has submitted and published seven papers over this past year. One of those has 320 views and 7 citations and is titled **"Free Energies of Catalytic Species Adsorbed to Pt(111) Surfaces under Liquid Solvent Calculated Using Classical and Quantum Approaches"** and can be found at this site: https://pubs.acs.org/doi/10.1021/acs.jcim.9b00089. The other is an excellent collaboration on machine learning with Heather Kulik's group at MIT, and it is titled **"Machine Learning Accelerates the Discovery of Design Rules and Exceptions in Stable Metal–Oxo Intermediate Formation."** This publication can be found at ACS Catalysis: https://pubs.acs.org/doi/10.1021/acscatal.9b02165. It has been viewed over 2,025 times with 2 citations.

For the second year in a row, **Dr. Jessica Larsen was selected as a "Late Breaking" speaker at the International Nanomedicine and Drug Delivery Symposium**. This year the symposium was held at MIT, and she was able to speak on the same stage as Dr. Robert S. Langer. In September, Dr. Larsen's **Science on Tap talk entitled, "Using Brain Disease to Treat Brain Disease,"** was the most attended Science on Tap talk since the beginning of the program. Dr. Larsen also is an assistant track coach at Seneca High School, and her girls' track team became the **Class AAA Cross Country State Champions in November!**

Life Outside the Classroom and Lab

In November, **Dr. Scott Husson ran the Moab Trail Marathon**! The marathon was held in Moab, Utah and is listed as a Trail Runner Magazine "Bucket List" Race. The Moab Trail is described as unique and wild. The canyons around Moab are unlike anywhere in the world, and this course conquers some of the most spectacular. Runners travel through narrow canyons with spectacular vertical walls on both sides and along the rim-tops of deep canyons with spectacular vistas every direction. The terrain changes frequently to keep the miles clicking and includes narrow single-track, rugged jeep trails, sandy washes, 'Moab-style slickrock', a short section of dirt road, a few sections of no-track, a very old mining trail and a couple sections of fixed line traverse. Views will take your breath away, and include the spectacular red rocks of "Behind the Rocks Wilderness" and "Amasa Back" area, also view the sheer vertical walls of Pritchett, Hunter and Kane Creek Canyons and views into Canyonlands National Park. Dr. Husson trained for 5 months in preparation for the marathon, mostly running trails at Paris Mountain State Park in Greenville. Even then, he described the course as really challenging. He was thankful for every rest station along the course! Dr. Husson ran the race with four friends and everyone in their group was able to finish the course. Dr. Husson says that now he's taking things easy and thinking about what's next!

MESSAGE FROM THE CHAIR

Dear Alumni and Friends,

Holiday Greetings from the Chemical and Biomolecular Engineering Department at Clemson University! I am delighted to have the opportunity to share news about the accolades that our faculty and students have recently received as well as the impact they are having on future students and the world through their research, teaching, and outreach. Their efforts are helping to raise the quality of our programs and the prestige of the department.

Our outstanding faculty and students were recognized for several achievements. Dr. Mark Blenner was honored with the Presidential Early Career Award, which is the highest honor bestowed by the United States government to outstanding early career scientists and engineers. Additionally, the research of Dr. Sapna Sarupria's group was highlighted on the cover of the Chemical Science journal, and her graduate student Dr. Ryan DeFever received the Outstanding Graduate Research Award, which is given to a single graduate each year. The college recognized Dr. Chris Norfolk with the Byars Prize for Excellence in Teaching Engineering Fundamentals, and two of ChBE's alumni, Dr. Allison Godwin and Dr. Amol Janorkar, received Outstanding Young Alumni awards. Three of our exceptional undergraduates also received Graduate Research Fellowships from the National Science Foundation and are attending prestigious graduate schools this fall. Finally, Dr. Marc Birtwistle was awarded tenure in the department, and we look forward to many achievements from his group in the future.

In closing, I want to thank the many alumni and friends of the ChBE department that have donated their time and treasure over the past year to ensure that we continue to graduate exceptional engineers and create future leaders in education and the chemical industry.

Best Wishes and Go Tigers!
David

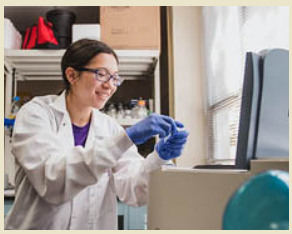
2019 Outstanding Young Alumni

Some of Clemson University's top alumni gathered in Memorial Stadium on the night of April 25th for the annual showcase gala of the College of Engineering, Computing and Applied Sciences. Three of the college's alumni were inducted into the Thomas Green Clemson Academy of Engineers and Scientists, while three others were celebrated as Outstanding Young Alumni. **Two of the Outstanding Young Alumni recipients are alumni from the Department of Chemical and Biomolecular Engineering: Dr. Allison Godwin and Dr. Amol Janorkar.**

Allison (Foreman) Godwin received her Bachelor of Science in chemical engineering in 2011 and her Ph.D. in engineering and science education in 2014 from Clemson. Her degrees launched her into a tenure-track position as an assistant professor in Purdue's School of Engineering Education. Godwin captured the attention of her more senior colleagues when she was awarded a National Science Foundation CAREER grant, one of the foundation's most prestigious awards for junior faculty. In addition to the CAREER grant, she has garnered more than $4 million in funding since she joined the faculty in the fall of 2014. Godwin's research accomplishments have received national and international media attention. She has won several best paper awards from engineering and science education societies. She has made an extraordinary mark on the world through her distinguished faculty career and has remained involved with her alma mater as a donor, an unofficial mentor for our current students, and a member of the advisory board for the Department of Engineering and Science Education. **Amol Janorkar** received his PhD in chemical engineering in 2005. His research prowess and skill in the classroom as a graduate student at Clemson made it obvious that he was well suited for the university environment as a professor. After completing a two-year postdoctoral fellowship at Harvard Medical School in the Center for Engineering in Medicine, Janorkar joined the faculty at the University of Mississippi Medical Center in 2007. He is now a full professor in the Biomedical Materials Science Department. Janorkar has been very successful in securing funding for his research in cell-biomaterials interactions, tissue engineering, and drug delivery. Grants from governmental and corporate partners exceed $2.2 million in extramural funding. Over his career Janorkar has published 45 peer-reviewed journal articles, one of which has been cited 1,400 times. He received the TEACH Prize for 2018, the highest honor bestowed upon a faculty member at the University of Mississippi Medical Center. The honor generated an article in the Society for Biomaterials Forum. **Congratulations to both Allison and Amol for being Outstanding Young Alumni!**

STUDENT HIGHLIGHTS

Undergraduates in the Department of Chemical and Biomolecular Engineering, who are rising seniors, are invited each summer to participate in our **Study Abroad program in Denmark.** This program allows them to take their required senior Unit Operations Lab course near Copenhagen, Denmark, while giving them a valuable international experience. This summer, **20 ChBE undergraduates had the opportunity of completing their Unit Operations Lab study at the highly ranked Technical University of Denmark, DTU**, which is one of the prestigious Nordic 5 universities. The course takes place in the university's cutting-edge pilot plant facilities and combines detailed theoretical and practical engineering experiences. The summer study program is designed specifically for international students. During their lab and classroom studies, the students completed multiple experiments related to chemical separations and reaction processes. In addition, students traveled with hosts from DTU and fellow students from other universities to nearby cities and historical sites.



Undergraduate, **Sarah Baum**, was awarded the **Robert W. Snelsire Diversity Prize** at the College's Awards Day this year. This award recognizes a student who has been of service to PEER, Programs for Educational Enrichment and Retention, or WISE, the Women in Science and Engineering Program.

ChBE students, J**oshua Osuofa and Kenetra Johnson, attended the NOBCChE National Conference** in St. Louis, Missouri, in November with Dr. Eric Davis, where they were able to meet the President of NOBCChE, Dr. Emanuel Waddell. They also met up with Clemson Alumnus, Roneisha Haney (pictured left).

ChBE is proud to highlight all of our graduate students who have received Fellowships: (L-R) **Mark Pitman** (GAANN), **Bobby Emmett** (SMART)**, Calep Arp** (NRT)**, Allison Domhoff** (NSF/Hitachi)**, Abena Williams** (GAANN)**, Allison Yaguchi** (GAANN)**, Stephen Vicchio** (GAANN)**, Abe Darge** (GAANN), **Zach Pittman** (USDA). Not pictured: **Anna Malakian, Keturah Bethel, and Dyllan Rives** who are all GAANN recipients.

The Fellowships are prestigious awards that distribute generous stipends and tuition allowances, and can afford the students many research, teaching and internship opportunities.

Several undergrads are able to have research experiences each year in our labs. **Josh Chong, Evan Miyasato, and Noah Dammers** of the Thies Research Group are shown preparing the continuous ALPHA (Aqueous Lignin Purfication via Hot Agents) unit for operation. This unit produces renewable precursors for carbon fibers and polyurethane resins.

Three of the department's seniors who graduated in May have headed to graduate school this Fall and received one of the nation's top honors for graduate students:

- **Hansen Mou, chemical engineering, Columbia University**
- **Sallye Rose Gathmann, chemical engineering, University of Minnesota**
- **Sarah Elizabeth Sandler, materials engineering, University of California San Diego**

The students have been offered **Graduate Research Fellowships from the National Science Foundation**, an honor that puts them in the same club as several Nobel laureates and Google founder Sergey Brin. Fellowships consist of three years of support during a five-year fellowship period. Each Fellow receives a $34,000 annual stipend and a $12,000 cost-of-education allowance that is paid to the institution that will be granting the graduate degree.

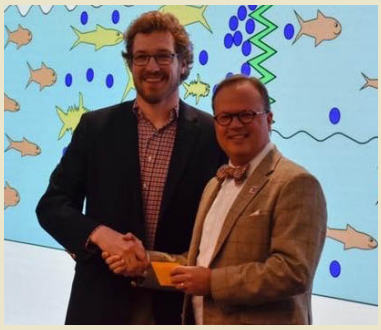
STUDENT RESEARCH

ChBE Ph.D. student Allison Domhoff received a $25,000 Hitachi High Technologies Electron Microscopy Fellowship to support research aimed at making energy grid-scale batteries more efficient and cost-effective. Domhoff is working to develop nanocomposite materials for batteries that support energy generation at large wind and solar farms. The technology could reduce the cost of renewable energy, thus making it more prevalent in utility portfolios. "These are like extremely large car batteries, 15 or 20 feet tall. They would store energy produced by wind and solar farms so that during the night or when winds aren't blowing, you could still provide energy," said Eric Davis, Domhoff's faculty adviser and an Assistant Professor of Chemical and Biomolecular Engineering. Electron microscopy allows Domhoff to research nanometer-sized particles in the battery's membrane so she can manipulate its surface chemistries to improve battery life and performance. Domhoff has presented nationally at meetings of the American Chemistry Society (ACS) and the American Institute of Chemical Engineers (AIChE). **She received a prestigious Graduate Research Fellowship from the National Science Foundation and was one of 10 finalists for the national AIChE Excellence in Graduate Polymer Research Award, where she placed 3rd.** Domhoff, who expects to graduate in May, hopes to continue her research in the private sector. She earned her undergraduate degree at Duquesne University in Pittsburgh before attending Clemson for Ph.D. studies. "Clemson has all of the big-school funding and resources, but it's a relatively small department so you get the one-on-one mentoring and collaboration," she said.

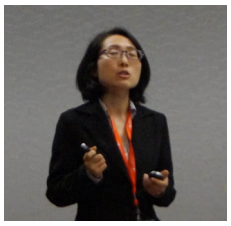
Graduate student, **Allison Yaguchi, received a DOE SCGSR** (Department of Energy Office of Science Graduate Student Research) award, which funded a summer long internship at DOE's National Renewable Energy Lab in Colorado, which contributed greatly to her doctoral research.

Graduate student, **Tianjun Xie, won first place at the Southeastern Catalysis Society poster session.** His poster was titled "Multi-Scale Simulations with Linear Scaling Relations and Microkinetic Models of Aqueous Phase Reactions". TJ also won the CRE Travel Award from Catalysis and Reaction Engineering Division at the 2019 AIChE Annual Meeting. He was one of 20 awardees this year. His advisor is Dr. Rachel Getman.

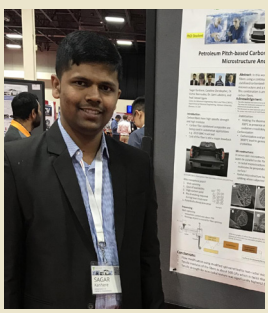
This past summer:
--Graduate **Joshua Osuofa** received a NAMS Elias Klein Founders' Travel Supplement.
--Undergrad **Michael Lemelin** received a NAMS Student Travel Award.
--Undergrad **Matt Brabender** won a SC Space Grant Consortium Undergraduate Research Fellowship.
--Undergrads **Will Burnette and Sarah Dorsey** won Palmetto Academy research funding from the SC Space Grant Consortium.



Nicholas Gregorich won first place at Clemson University's Three Minute Thesis (3MT) competition in November. Nicholas won the PhD candidate category for his presentation, **"Green Filtration for Cleaner Water."** He is advised by Dr. Eric Davis. Nick will go on to represent Clemson at the March 2020 Conference of Southern Graduate Schools (CSGS) 3MT competition in Birmingham, Alabama. 3MT is a research communication competition that challenges research higher degree students to present a compelling oration on their thesis and its significance in just three minutes in language appropriate to a non-specialist audience. Graduate students from all colleges at Clemson competed in preliminary rounds before all coming together for the finalist competition.



PhD students **Xiaohong Zhang and Ryan Defever**, along with their advisors, Dr. Rachel Getman and Dr. Sapna Sarupria, published an article this year with ACS Publications titled **"Free Energies of Catalytic Species Adsorbed to Pt(111) Surfaces under Liquid Solvent Calculated Using Classical and Quantum Approaches."** It has been downloaded over 320 times and has been cited 7 times.



PhD Student Sagar Kanhere won the Best Poster Award at the Society of Plastics Engineers ACCE Automotive Composites Conference, Novi, MI, September 2019 for research entitled, "Petroleum Pitch-based Carbon Fibers With Modified Transverse Microstructure And Enhanced Properties," co-authored by Dr. Victor Bermudez, Caroline Christopher, Dr. Sam Lukubira, and Professor Amod Ogale. The Defense Advanced Research Projects Agency (DARPA), through University of Delaware, has awarded Clemson University's Center for Advanced Engineering Fibers and Films (CAEFF) $2 million for carbon fiber research. The project, led by Professor Ogale, is developing high-performance, cost-competitive carbon fibers for composite feedstock/manufacturing processes.

GRADUATION

Congratulations to the Senior Class of 2019!

The Department of Chemical and Biomolecular Engineering wishes all of our graduates the best of luck in their future endeavors.

Ryan Alawar
Cody Allen
Marie Amurao
Natalia Arbelaez
Matthew Artman
Juan Avila
Ross Bovarnick
Erza Baghdady
Meredith Bailey
Logan Ballard
Candace Balletine
Darbie Barr
Adam Beitz
Lucas Bohn
Jeremy Bouknight
Annalise Bowers
Jonathan Bowman

De'Janique Bradshaw
Collin Burchette
Logan Burton
Bradley Cauble
Nicholas Chor
Michael Christofaro
Mikhala Cooper
Racheal Dalpiaz
Matthew Dayton
Nicholas Desoiza
James Erskine IV
Savanah Ferguson
Joseph Gagnon III
Sallye Gathmann
Thomas Gonzales, Jr.
Mikaela Grady
Claudia Grancho

Ashleigh Helms
Grant Henriksen
William Interiano
Ross Jasper
James Jenkins
Navpreet Kaur
Charles Kessler
Carson King
Rachel Kluesener
Michael Kowalske
Gunner Kral
Graham Lambrecht
Paige Leighton
Julie Little
Alexander Luzzatti
Riley Major
Rachella Mariano

James Martzin
Connor McCormick
Evan McDonell
Christopher Meyer
Samuel Michelich
Hansen Mou
Owen Nelis
Ricky Netherton
Johnathan O'Neil
Leo Ou
Nicholas Pagley
Mary Pakes
Anna Pavnica
Himendra Perera
Brandon Pratt
Jasmine Pringle
Amber Purcell

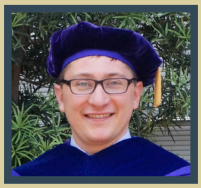
Trevor Rajopa
DJ Rawls
Natalie Rogers
Austin Saracina
Ellie Sears
Scott Sheriff
Sarah Smith
Camilo Suescum
Josh Tedder
Donald Titherington Jr.
Matthew Van Grouw
Paul Wakim
Deidra Ward
Sierra Williams
Abel Wilson
Kala Windham
Matthew Wright

PhD Graduates

Dr. Victor Bermudez..... Advisor: Dr. Ogale

Anomalous Effect Of Spinning Conditions On The Mechanical And Transport Properties Of Mesophase-Pitch Based Carbon Fibers

Post Doc - CAEFF - Clemson University



Dr. Cameron Bodenschatz.... Advisor: Dr. Getman

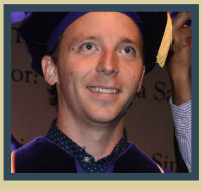
A Combined Molecular Dynamics and Density Functional Theory Approach for Generating Liquid Water Configurations for Aqueous-Phase Heterogeneous Catalysis Studies

Research Physicist - NASA Glenn Research Center

Dr. Siva Dasetty..... Advisor: Dr. Sarupria

Towards computer aided engineering of proteins and protein-surface complexes

Founder - theo2prac Solutions LLC - Virginia



Dr. Ryan Defever.....Advisor: Dr. Sarupria

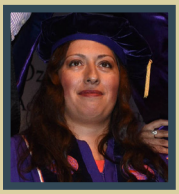
Advancing molecular simulations of crystal nucleation: Applications to clathrate hydrates

Post Doc - Chemical Engineering - Notre Dame

Dr. Robert Emmett.....Advisor: Dr. Roberts

Power and Capacity Enhancement of Energy Storage Devices via Faradaic Doping of Carbon Electrodes

High Power Energy Storage Specialist - U.S. Army Power Division



Dr. Ozgun Guzdemir.....Advisor: Dr. Ogale

Melt-Spinning and Properties of Soy-filled Polyethylene, Polypropylene, and Polylactic Acid Fibers

Professor - Adnan Menderes University - Aydin, Turkey

Dr. Alphonse Hakizimana.....Advisor: Dr. Scott

Novel Optimization Approaches for Integrated Design and Operation of Smart Manufacturing and Energy Systems

Operations Research Analyst - Eastman Chemical-Kingsport TN

Dr. Kai Shen.....Advisor: Dr. Scott

Advances in Reachability Analysis for Nonlinear Dynamic Systems

Senior Engineer - Aspen Technology

AWARDS

Western SC Section AIChE Scholarship Achievement Award
Sallye Gathmann

ChBE Senior of the Year
Darbie Barr
Charles Kessler

ChBE Junior of the Year
Kathleen Arevalo
Ross Jenkins

Undergraduate Researcher of the Year
Adam Beitz - 1st Place
Sallye Gathmann (Honorable Mention Senior)
Hansen Mou (Honorable Mention Senior)
Michael Lemelin (Honorable Mention Junior)

Outstanding Graduate Research Assistant of the Year
Jaime Idarraga-Mora

Outstanding Graduate Teaching Assistant of the Year
Mark Pitman

GRADUATE SYMPOSIUM WINNERS

Oral Presentations
1st Place - Apoorv Balwani
2nd Place - Jaime Idarraga-Mora
3rd Place - Allison Domhoff

Poster Presentations
1st Place - Jesse Westfall
2nd Place - Jiarun Zhou
3rd Place - Molly Wintenberg

Student Choice Awards
1st Place Oral Presentation - Jaime Idarraga Mora
2nd Place Oral Presentation - Michael Spagnuolo

Dr. Tianjun Xie.....Advisor: Dr. Getman

Multiscale Assessment of Binding Geometries and Energetics of Aqueous Phase Reforming of Glycerol and Methanol: Towards Realistic, Accurate, and Computationally Tractable Strategies

Dr. Jiazhou Zhu.....Advisor: Dr. Getman

Computationally Driven Design of Advanced Materials: Expanding Methods from Computational Catalysis to Designing Substituted Metal Ferrites with Precise Magnetic Properties

Masters Graduates

Nithya Krishnan.....Advisor: Dr. Roberts
Non-thesis

Shubham Thoke.....Advisor: Dr. Roberts
Non-thesis

Charles Wang.....Advisor: Dr. Birtwistle
Mammalian Artificial Chromosomes As a Synthetic Biology Tool for Transgene Expression

Jesse Westfall.....Advisor: Dr. Larsen
Connecting Polymeric Nanomedicine and Systems Biology: An Innovative Approach to Glioblastoma Treatment

Orrod Zadeh.....Advisor: Dr. Birtwistle
Mesowestern Blot: Simultaneous Quantitative Analysis Of Hundreds Of Sub-Microliter Cell Or Tissue Lysate Samples

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