SPRING/
SUMMER
2016

CLEMSON

CHEMICAL AND BIOMOLECULAR ENGINEERING

Dr. Amod Ogale receives $2 Million DARPA Grant

Dr. Amod Ogale has received a $2 million grant and will work with a group of researchers across the country to lower the cost of high-tech materials that have helped make airplanes and luxury cars more fuel efficient but remain too expensive for price-sensitive products. Falling prices for composite materials would mean they could be used in more automobile and airplane parts to help make them lighter. When it comes to fuel efficiency, every ounce counts.

Ogale's latest round of funding comes as part of a collaboration with the **Center for Composite Materials at University of Delaware. The center, which is leading the research, has received $14.9 million from the Defense Advanced Research Project Agency for the Tailorable Feedstock and Forming Program.** Jack Gillespie, the director of the center, is leading the team. Researchers from Drexel University and Virginia Tech are also collaborating. "It's an honor to be part of such a talented team," Ogale said. "Carbon fibers are commercially used in high-performance aircraft applications, including some in the Boeing 787 Dreamliner. However, such fibers are also very expensive, so there is significant interest in reducing their cost."

Tanju Karanfil, vice president of research at Clemson, congratulated Ogale and his team on taking part in the project. "The collaboration will help further Clemson's reputation for excellence in advanced materials research," Karanfil said. "Dr. Ogale has worked with composite materials for more than 30 years. That he and his team were selected are testament to his leadership in the field."

Composite materials are made up of strands of carbon fibers that look as unremarkable as string when wrapped on a spool. But when they are glued together with special polymers, they form super-strong materials that can be fashioned into a wide range of products, ranging from car and airplane parts to helmets and golf clubs. The objective of the research is to make a low-cost feedstock–which is the raw material that goes into composite materials– and a manufacturing process. **Researchers hope to create a new type of composite material they will call TuFF, which stands for tailorable universal feedstock for forming.**

Ogale plans to use his expertise in working with carbon fibers on a microscopic level. The diameter of each carbon fiber is one-tenth that of a human hair, yet the fiber is three times stronger than steel. Ogale and his group plan to generate a novel microtexture in carbon fibers. "We will help the team understand how the molecular structure and processing conditions will influence the microstructure and strength of the resulting carbon fibers," Ogale said. **The new material could revolutionize the use of composite materials worldwide, providing a cost-effective replacement for small metal parts meeting aerospace performance requirements.**

(Excerpts of article written by Paul Alongi, COES)

Award Winning Faculty

With over $10 million in active research grants from DARPA (Defense Advanced Research Project Agency), DTRA (Defense Threat Reduction Agency), DOE (Department of Energy), DOD (Department of Defense), plus prestigious junior faculty awards from the National Science Foundation, Air Force Office of Scientific Research, NASA, and the American Chemical Society, the faculty of the Department of Chemical & Biomolecular Engineering have had an outstanding year! In addition to the research grants, our faculty have also recently received patent awards and many College awards, which included the McQueen Quattlebaum Award for Outstanding Achievement, Collaboration Award, COES Dean's Professorship Awards, and Faculty Fellow Awards. All of these recognitions, plus student awards, are outlined in the following pages of this newsletter. *"This was a banner year for the Department of Chemical & Biomolecular Engineering . . ." - Dean Anand Gramopadhye.*

RON LINDSAY INDUCTED into THOMAS GREEN CLEMSON ACADEMY

ChBE alumnus, Ronald C. Lindsay, received the College of Engineering and Science's highest honor, being inducted into the **Thomas Green Clemson Academy**. He graduated magna cum laude with a bachelor of science in chemical engineering in 1980. Shortly thereafter he accepted a position with the Eastman Chemical Company.

Lindsay began his career as an entry-level process improvement engineer and has risen to the highest levels of the company. Throughout his career, Lindsay has shown great adaptability by serving, leading, and excelling in a very broad range of roles. For example, he has been a director of three different manufacturing divisions, had P&L responsibility for several business organizations, and has been the chief technology officer for the company. His latest position was the inaugural chief operating officer for Eastman Chemical Company, a Fortune 500 company with $10 billion in annual revenue.

Lindsay has been instrumental in leading the company through a transformation from a mostly commodities company to a specialty company, realizing six continuous years of earnings growth in very challenging times, and achieving this in the right way – ethically and safely. Eastman recently received the inaugural "top company" designation in the Specialty segment for "Advancing Excellence in Process Safety." For the last three years Eastman has also received recognition as one of the "World's Most Ethical Companies" by Ethisphere and Glassdoor's "Best Place to Work."

Lindsay is a member of the American Institute of Chemical Engineers and served as chair of the Advisory Board for the College of Engineering and Science at Clemson University.

He is a very active supporter of the United Way in Kingsport, Tennessee, and he has also served on the boards of the local American Red Cross and a local private school, Tri-Cities Christian School.

(Excerpts of article written by Paul Alongi, COES)

MESSAGE FROM THE CHAIR

For roughly two decades, our Department of Chemical Engineering (and then Chemical and Biomolecular Engineering) has been housed administratively in the College of Engineering and Science (CES). About two years ago the university initiated an evaluation of the College structure. Through this process CES has been re-structured and effective July 1 we are now under the umbrella of the College of Engineering, Computing, and Applied Sciences (CECAS). The major change is the transition of Chemistry, Mathematical Sciences, and Physics from CES to a newly formed College of Science, which also includes Biological Sciences and Genetics and Biochemistry.

We have also undergone some personnel changes. I am now serving as Interim Associate Dean for Research and Graduate Studies and Prof. David Bruce is serving as Interim Associate Department Chair. I will continue to serve the department in a select-few areas, while David manages the day-to-day operation of the department.

Earlier this Spring, we celebrated the 20-year employee service of Bill Coburn, our Lab Technologist, and Prof. David Bruce (pictured below). We would like to thank them again for their years of service and dedication to our department.

Alumni, thank you for all that you do for the department, through your gifts of time and money. We appreciate your support!

Best regards,
Doug Hirt

Dr. Scott Husson receives McQueen Quattlebaum Faculty Achievement Award and Collaboration Award

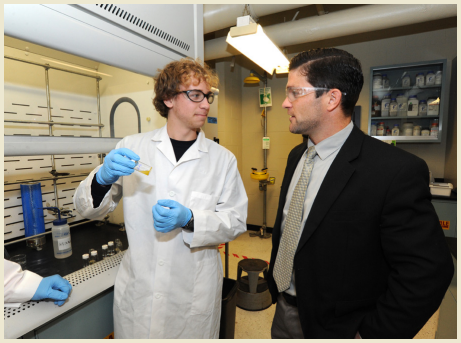
Dr. Scott Husson was honored May 4th by the College of Engineering and Science at a faculty awards dinner attended by honorees, their families, colleagues and top college officials. **Dr. Husson received the McQueen Quattlebaum Faculty Achievement Award,** which was based on his success over the past three years. And he also received the **Collaboration Award** that he shares with Tim DeVol, a fellow professor in Environmental Engineering and Earth Sciences (EEES). Dr. Husson was the only one in 2016 to win two College of Engineering and Science faculty awards. Since then, he has received the COES Dean's Professorship Award in Chemical & Biomolecular Engineering, which came with annual discretionary funds.

In 2015-16, Husson advised eight Ph.D. students, sponsored two Creative Inquiry teams and worked with 15 undergraduate researchers. His students won 11 research awards, including seven national awards, the GRADS College of Engineering and Science Best Poster Award, and a People's Choice Award in the Focus on Creative Inquiry symposium. Husson has a high level of funded research that puts him in the top 10 in the college. He is also consistently rated as one of the university's top teachers. In past years, he won the college's Byars Prize and Murray Stokely Award and the University's Prince Award for Innovation in Teaching. Husson is a member of the Faculty Senate and the 2016 Chair of the Separations Division of the American Institute of Chemical Engineers. He serves on the Executive Committee of the Board of Directors for the North American Membrane Society. He also is associate editor for the journal Separation Science and Technology.

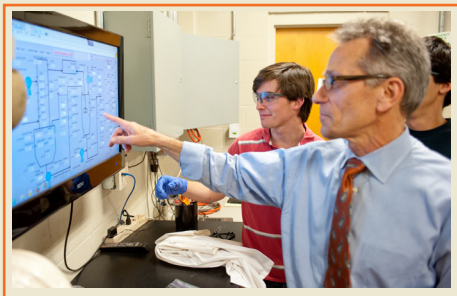
Dr. Husson has also recently received two very significant grants. The first one is titled, **"Reactive Membranes for Rapid Isotopic Analyses of Waterborne Special Nuclear Material" for $1,694,061 from the Defense Threat Reduction Agency (DTRA).** Dr. Husson is the PI and Dr. Tim DeVol (EEES) is the Co-PI. The overall goal of this basic research program is to advance scientific understanding by developing new materials and methods for the rapid identification and quantification of waterborne radioisotopes. The ultimate outcome of this project will be a fast and reliable method to conduct forensics of debris from a nuclear event by integrating the science of reactive membranes for radionuclide isolation and concentration with accurate nuclear spectroscopy for activity and isotope quantification. Such a forensics tool currently is not available, even for laboratory analyses.

The second recent grant is titled **"Robust Extractive Scintillating Resin and Adsorptive Membranes for Plutonium Isotopic Analyses of Aqueous Media" from the Department of Energy – National Nuclear Security Administration Stewardship Science Academic Alliances, for $750,000.** Dr. Husson is the Co-PI and Dr. Tim DeVol is the PI. The goal of this research is to advance scientific understanding in the development of high-selectivity sensor materials and high-sensitivity sensors for ultra-trace-level quantification of plutonium in aqueous matrices. Under the regulatory provisions of the Safe Drinking Water Act, radionuclide monitoring of drinking water sources can be very infrequent, leaving this infrastructure vulnerable. The on-line system developed in this project for ultra-low-level detection of plutonium radionuclides in environmental media (particularly water) will be a powerful nuclear forensics tool. Currently, no such system exists.

In addition to the scientific impacts and providing new knowledge and tools to the nuclear forensics community, these two collaborative research programs will educate and train graduate students, undergraduate students, and postdoctoral researchers and provide them with the necessary skills to pursue careers in nuclear forensics, environmental radiochemistry, environmental health physics, chemical engineering, and materials science. Thus, this research program will contribute to developing a workforce of educated, motivated students, with nuclear detection experience and expertise.

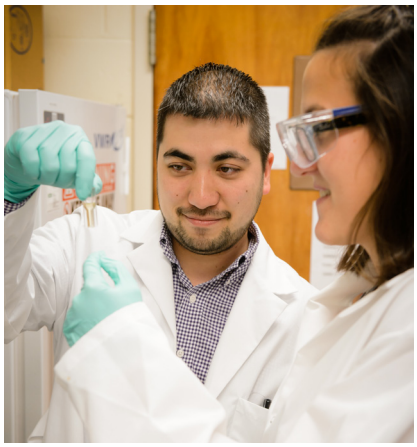


Professor Mark Roberts was promoted to the rank of Associate Professor with tenure. This promotion with tenure is the culmination of hard work over the last six years and is representative of excellence in teaching, research, and service. Congratulations to Mark!



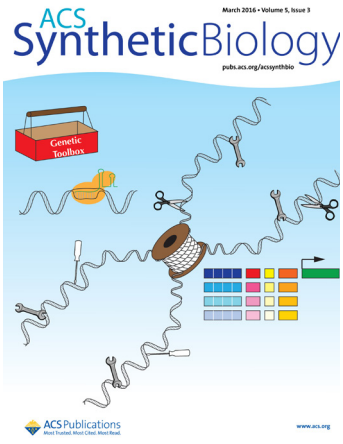
Professor Mark Thies was inducted into the Clemson Inventors Club in April at a special recognition award event that honored patent recipients through the Clemson University Research Foundation. He was inducted based on his seven invention disclosures and more than $500,000 of sponsored research funding at Clemson.

OUTSTANDING JUNIOR FACULTY . . .



Prof. Mark Blenner recently received the College of Engineering and Science Dean's Professorship Award in Chemical and Biomolecular Engineering. This award comes with three years of annual discretionary funds and honors him for his research and teaching.

Blenner has received numerous grants since starting in 2012, including funding from the National Science Foundation, Air Force, NASA, industrial sponsors, and the Defense Threat Reduction Agency. **This level of funding places him amongst the highest funded assistant professors.** Dr. Blenner's focus is on synthetic biology and engineering bacteria and yeast to produce fuels and chemicals more sustainably, and to produce therapeutics and enzymes that can do things nature has not yet figured out.



Prof. Blenner won two of the nation's top awards for young researchers within months of each other. One came through the **Air Force Office of Scientific Research Young Investigator Program, and one was the NASA Early Career Faculty Award**, which was highlighted in the last newsletter. His CRISPR-Cas9 Paper made the cover of the ACS Synthetic Biology journal in March and, in the April issue, it was the 4th Most Read Paper of the past 12 months.

Dr. Blenner's most recent grant is titled **"Predictive Structure-Function Relationships for Enzymes Immobilized on Complex Surfaces"** sponsored by the Defense Threat Reduction Agency (DTRA) for $487,983. This is a collaborative project with Dr. Sarupria (Co-PI) to study fundamental mechanisms governing the interaction between enzymes and polymeric surfaces. The impact of this work will help develop biosensors with longer lifetime and more predictable behavior for detecting indicators of nuclear weapons activity. Drs. Blenner and Sarupria are working to create a reliable, longer lifetime sensor that would pick up signatures of tributyl phosphate, a solvent used to enrich uranium for use in a nuclear weapon - a sensor that would help searches for potentially destructive weapons and keep them out of the hands of terrorists and rogue nations.

Other recent grants include "**Optimization and Initial Bioprocess Scale Up of Omega-3 Production from Rendered Fat**" sponsored by the Animal Coproducts Research & Education Center (ACREC) for $38,500, which is a third year of support toward the development of omega-3 production from rendered animal fat. Another is the **"Fluorescence Activated Cell Sorter"** sponsored by the Defense University Research Instrumentation Program (DURIP) for $175,100. The funds are to purchase a fluorescence activated cell sorter.

Prof. Rachel Getman recently received the College of Engineering and Science Dean's Faculty Fellow Award in Chemical and Biomolecular Engineering. This three-year award recognizes her excellent record in teaching and research and comes with annual discretionary funds.

In addition, the **National Science Foundation awarded Dr. Getman the prestigious "Early CAREER Faculty Award" in the amount of $500,000 for her project entitled, "CAREER: Hierarchical Modeling for Rational Catalyst Design in Aqueous Conditions."**

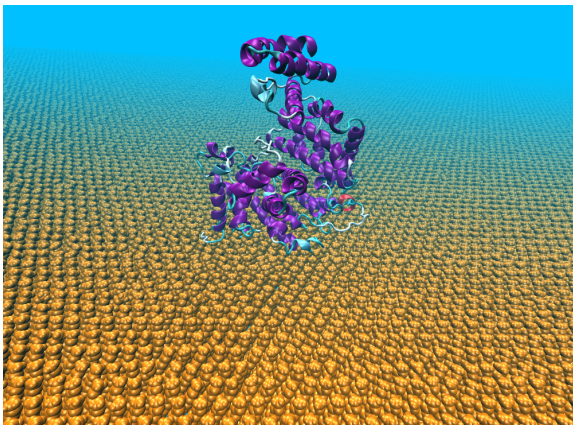
The proposed research will refine molecular simulation models for catalytic reactions in the presence of liquid water and apply the calculations to an electrochemical process for ammonia synthesis that could potentially replace the long-standing Haber-Bosch gas phase process. The current process was developed in 1909 and involves two gases, nitrogen and hydrogen, at high temperature and pressure, which is very energy intensive and expensive. It relies on hydrogen gas, a chemical that is nonideal for many reasons. Dr. Getman's research team will be working on finding a new way to make ammonia using water instead of hydrogen gas. Ammonia is used in commercial fertilizers to improve crop yields and is crucial in sustaining the world's population boom over the last century. Poorer regions of the world cannot afford the current gas phase process using hydrogen, therefore, a water method would help bring crucial ammonia to help sustain crops in these areas. The research is integrated with an educational plan that introduces molecular level simulation concepts to students across levels ranging from high school to graduate research.

Prof. Getman served as mentor for 23 undergraduates and high school students wanting experience in performing research, and several of those have either authored or been acknowledged in journal articles about their research in peer-reviewed, scientific literature. She also co-taught with three different graduate student instructors, including two who won the college's "Outstanding Graduate TA" award. Getman also organized the Southeastern Catalysis Society Annual Meeting in 2015 and the session on Liquid Phase Catalysis for the Spring 2016 American Chemical Society meeting. She is presently serving as the Area Chair for the Catalysis Division of the American Institute of Chemical Engineers, where she is responsible for organizing 43 oral presentation sessions and one poster session for the annual meeting to be held in San Francisco this fall.

. . . INNOVATIVE RESEARCH

Prof. Sapna Sarupria recently received an **American Chemical Society OpenEye Outstanding Junior Faculty Award.** The award recognizes her outstanding work in the area of computational chemistry and is a testament to the fact that she is quickly gathering acclaim for her research. Sarupria and her research team use Clemson's supercomputer to build molecular models and perform computer simulations that help researchers better understand how materials work at the molecular level. This will enable researchers to engineer materials tailored for desired applications. In 2014, the society awarded her the **Petroleum Research Fund Doctoral New Investigator Award** for **"Tackling the "Fire-In-Ice" Problem in the Petroleum Industry: A Molecular Approach."**

Prof. Sarurpria was also awarded the College of Engineering and Science Dean's Faculty Fellow Award in Chemical and Biomolecular Engineering this past month. In addition to research, this award recognizes her record of excellence in teaching and mentoring.



Among her several active research grants that total over **$1.8 million**, is one from the **National Science Foundation** that focuses on developing computational models for membranes used in water purification. These models will accelerate the discovery of membranes that are less likely to clog as they filter impurities out of water, helping lower the cost of water treatment around the world. As part of another NSF grant, Sarupria is studying ice nucleation on mica surfaces. She also has a **Department of Energy** grant to develop novel computational techniques that will enable the study of processes that are currently inaccessible to simulations.

Most recently she received a **$487,000 Defense Threat Reduction Agency (DTRA)** grant as co-PI with Dr. Blenner (PI). The goal of this grant is to create a reliable, long lasting sensor that can detect nuclear weapons activity. The sensor would pick up signatures of tributyl phosphate, a solvent used to enrich uranium used in nuclear weapons. Enzymes can detect this chemical, but researchers must find a way to lengthen the enzymes' lifespans to make them more practical for sensors. Blenner and Sarupria are aiming to do so over the next three years on this DTRA project.

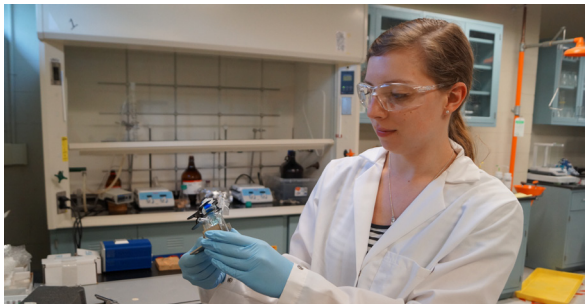
Prof. Joseph Scott was awarded a prestigious Young Investigator Program Award (YIP) in the amount of $330,000 from the Air Force Office of Scientific Research (AFOSR) for his research project entitled, **"Rapid and Accurate Uncertainty Propagation for Nonlinear Dynamic Systems by Exploiting Model Redundancy."** The YIP is open to scientists and engineers who have received PhD's or equivalent within the last five years, and Dr. Scott's proposal was one of only 56 that were selected.

Dr. Scott's project addresses the U.S. Air Force's goal of engineering techniques that could help autonomous aircraft calculate what trajectory to take to avoid danger without having to play it too safe. The Scott team believes the techniques could also be used for other applications, such as biochemical networks.

Scott and his team plan to develop new ways of quickly calculating how to deal with the myriad of uncertainties that come from operating in complex, unpredictable environment. In flight, for example, wind speed and direction can constantly shift, which would cause problems for an unmanned aircraft trying to avoid an obstacle. His research team hopes to develop techniques that would replace current methods that are too slow, expensive, or conservative to be of practical use. "You can write the flight dynamics of an airplane, and you can write the kinetics of a chemical reaction. It's a very general class of model. Our techniques are useful for anything that has uncertainties in the model, which is pretty much all models."

To address this issue, Dr. Scott's research team is developing new simulation techniques capable of accurately and efficiently quantifying the level of uncertainty in the simulation results. Rather than provide a single solution, these methods compute a rigorous enclosure of all possible solutions given a specified level of uncertainty in the model equations. Although this has been possible for decades, existing algorithms are either too slow to aid in real-time decision-making, or provide enclosures that are too conservative to be of practical use. This project aims to develop a novel enclosure strategy based on the key idea of using model redundancy to substantially improve the accuracy of existing methods without sacrificing their efficiency. This work is expected to enable the use of rigorous uncertainty quantification in real-time algorithms for robust control, verification, and fault detection tasks.

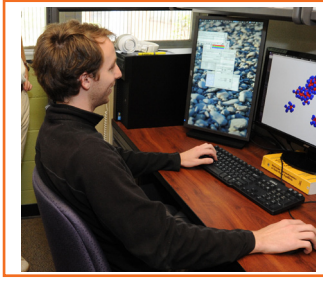
STUDENT HIGHLIGHTS



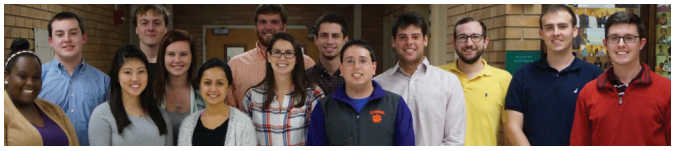
Allison Jansto recently received the prestigious **National Science Foundation (NSF) Graduate Research Fellowship**. Her research proposal entitled, **"Characterizing Transport and Mechanics of Nanophase-Segregatrd Polymers for Energy Storage and Delivery Applications"**, seeks to deepen our understanding of the role of nanostructure on the transport properties of phase-segregated block copolymers. Allison is a graduate student in Prof. Eric Davis's Polymer Membranes Group.

Dr. Husson's Research Group traveled to the **North American Membrane Society** annual meeting in Bellevue Washington in May. **Juan Wang** gave a talk and also received the **2016 NAMS Student Fellowship Award,** which is the most prestigious award given by NAMS to graduate students. **Nikki Chitpong also won 1st Place for her research poster**. ChBE Professional Advisory Board Member, **Uwe Beuscher**, also attended the conference.

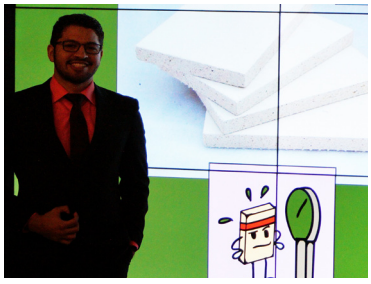
Senior Matt McMillan won **2nd Place in the Paper Competition** at the AIChE Southern Regional Conference at the University of Alabama. His research was titled "Nanocrystalline Cellulose Device Platforms"



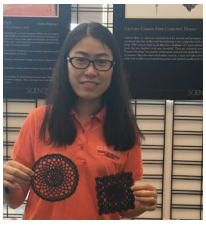
Ryan DeFever, received a **NSF Graduate Research Fellowship Honorable Mention.** His advisor is Prof. Sapna Sarupria



The Creative Inquiry undergrad group **"Membrane Separations for Clean Water and Energy" won 2nd Place People's Choice Award at the Focus on Creative Inquiry Poster Event. Christine Duval and Steven Weinman** are the graduate student mentors.



ChBE graduate students Roque Gochez and Adam Klett tied for 3rd Place in the Graduate School's Three Minute Thesis Competition. 3MT is a research communication competition that challenges graduate students to present a compelling oration on their research in just 3 minutes. Their advisors are Dr. Kitchens and Dr. Thies.



The People's Choice Award went to graduate student **Meng Zhang** at the annual **Science as Art** competition. She crocheted doilies out of carbon fibers. Her advisor is Dr. Amod Ogale.

Departmental Awards

Mark Payne - Western S.C. Section AIChE Scholastic Achievement Award

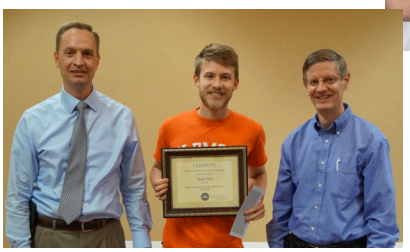
David Barton - ChBE Senior of the Year Award

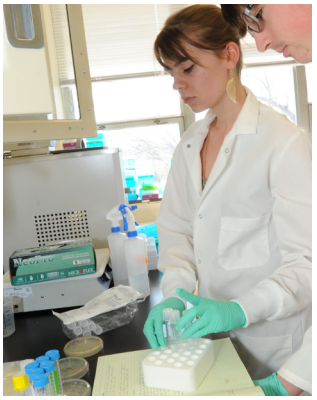
Townsend Reeves - ChBE Junior of the Year Award

Sean Dix - ChBE Undergraduate Researcher of the Year Award

Adam Klett - ChBE Graduate Researcher of the Year Award

Robert Emmett - ChBE & COES Graduate Teaching Assistant of the Year Award





Erika Arvay, an undergraduate working in Dr. Blenner's research group, is the recipient of a **NASA SC Space Grant Undergraduate Research Fellowship, an ACCIAC Creativity & Innovation Fellowship, and a Calhoun Honors College Award.** Undergraduate, **Spencer Smith,** also won an ACCIAC Fellowship.

CLASS OF 2016

The Chemical & Biomolecular Engineering Department would like to congratulate the Senior Class of 2016. The students were honored at a Senior Reception on April 21st at the Madren Center, and the department hosted an Open House for the graduates and their families on graduation day, May 7th. The faculty and staff of ChBE wish all of our graduates the best of luck in their future endeavors!

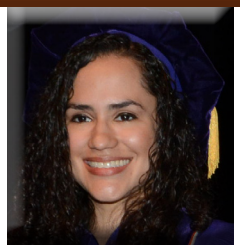
2016 Graduation Candidates ~ Bachelor of Science Degree in Chemical Engineering

Sukhwinder S. Banga	Seth T. Elliott	Justin R. James	Landen M. Nevergoll	Perry R. Spinelli
David G. Barton	Matthiew V. Filanova	Breann L. Janvier	Joshua D. Parks	Katherine M. Stahel
Eric C. Bickford	Jamce C. Foster	Megan A. Leaders	Vinay Y. Patel	Shelby R. Thies
Sabra P. Buckaloo	Benjamin H. Gaines	Nikki L. Lewis	Allen M. Payne	Katherine G. Toth
Bejamin Calle	David W. Griffith	Phillip O. Marchant	Philip M. Pstrak	Mary K. Truitt
Andrew P. Carlin	Shaelyn N. Hammond	Natalie J. Matthias	Collin F. Ray	Adam J. Wambaugh
Payton V. Chappell	Bradley C. Hatch	Andrew W. McCartney	Troy M. Riddle	Baxter M. Ward
Stephanie R. Chiu	Mattie M. Hinz	Stephen B. McJunkin	Hitomi Saito	Cole J. Weinberger
Sean T. Dix	Timothy R. Howard	Matthew F. McMillan	Taylor L. Schaeffer	Joseph C. West
Jacob C. Dworkin	Parker R. Hume	Timothy R. Mescher	Thomas A. Solon	William D. Wiseman
Anthony M. Edwards	Austin J. Hurst			

CLASS OF 1966 - 50th REUNION

We were honored to host our Chemical Engineering Class of 1966 for their 50th Class Reunion on June 10th! They were given a chance to visit, reminisce, and tour Earle Hall. Pictured are Bob Smith, Bill Price, Leonard Boyd, Victor Lopez, and Bud Bell. Happy 50th - Class of 1966!! We hope you come back soon!!

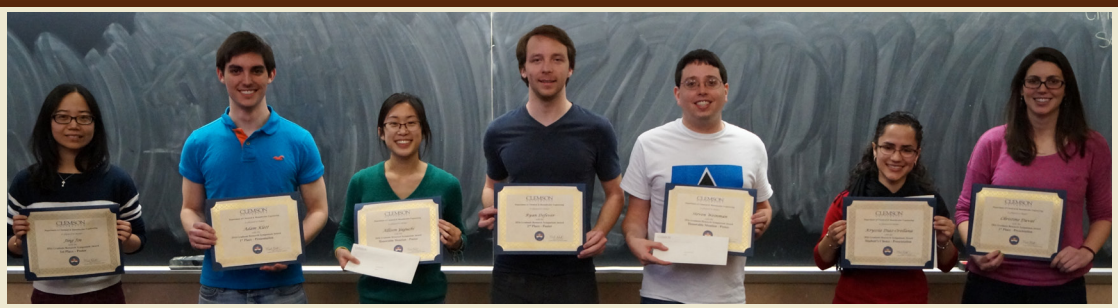
PhD GRADUATES



Dr. Kryssia Diaz-Orellana
Dissertation: **"Low Cost, Carbon-Based Micro- and Nano-Structured Electrodes for High Performance Supercapacitors"**
Advisor: Dr. Mark Roberts
Current Position: **Process Technology Development Engineer Intel Corporation, Oregon**

Dr. Meng Zhang
Dissertation: **"Carbon Fibers Derived from Dry-Spinning of Modified Lignin Precursors"**
Advisor: Dr. Amod Ogale
Current Position: **Compound Engineer GITI Tire Richburg, South Carolina**

ChBE GRADUATE RESEARCH SYMPOSIUM



In February, ChBE held its annual **Graduate Research Symposium** at the Madren Center. We were honored to have members of our Professional Advisory Board in attendance. Our graduate students were able to share their research with their peers through poster sessions and oral presentations. Winners this year were (L-R): **Jing Jin** (1st Place-Poster), **Adam Klett** (1st Place-Presentation), **Allison Yaguchi** (Honorable Mention-Poster), **Ryan Defever** (2nd Place-Poster), **Steven Weinman** (Honorable Mention-Poster), **Kryssia Diaz-Orellana** (Student's Choice-Poster) and **Christine Duval** (1st Place-Presentation).

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Computational Chemical Engineering




ChBE COMMUNITY OUTREACH



This past academic year, the Chemical & Biomolecular Department has been participating in many community activities, reaching out to students from elementary to high school levels. **The goal is to expose students, who wouldn't normally have the opportunity, to math and engineering problems and experiments.** This, in turn, may spark an interest at a young age for professions in engineering or science. Along with **Assistant Professor, Dr. Eric Davis,** many of our graduate and undergraduate students have participated in judging math and science projects at **Tamassee-Salem High School,** help run the **First Lego League (FLL) robot qualifying competition** at Tri-County Technical College with kids age 9-14, as well as running science experiments with many girls scouts during **WISE (Women in Science & Engineering) Girl Scout Day.** In addition, **Dr. Scott Husson** visited **Stone Academy** earlier this year and helped the 5th grade class create water filtration systems on their Science Fun Day. Most recently, our department took part in the **2016 Navy STEAM Camp** program on June 24th. The program gives high school students with parents serving in the Navy the opportunity to spend a week at Clemson University and the surrounding area exploring engineering and biotechnology activities. For our activity, the students were tasked with designing and building a water filtration device using only a plastic bottle and their choice of sand, rice, cotton balls, and activated carbon. They then used the filters to clarify unpurified apple juice. We had four graduate students and two undergraduates who helped with this event.