

FALL 2016

# CLEMSON<sup>®</sup>

## CHEMICAL AND BIOMOLECULAR ENGINEERING

### Dr. Douglas Hirt Named Associate Dean for Research and Graduate Studies



Dr. Douglas Hirt has been named Associate Dean for Research and Graduate Studies in the College of Engineering, Computing and Applied Sciences. With his experience as a faculty member, researcher and administrator, Dr. Hirt is well positioned to advance the research enterprise of the college. He has been a member of the faculty in the Department of Chemical and Biomolecular Engineering for more than 25 years

and served as department chair from 2009 until he assumed the interim associate dean's role in February of this year. Prior to that, he was also director of the Clemson-based NSF Engineering Research Center for Advanced Engineering Fibers and Films.

Dr. Hirt's research focuses on the surface modification of polymer films and fibers. He is a fellow of the Society of Plastics Engineers. As associate dean Dr. Hirt's two primary areas of responsibility are supporting faculty as they seek and receive extramural funding and supporting the work of graduate students and postdoctoral researchers.



Dr. David Bruce was selected as Interim Chair for the Department of Chemical & Biomolecular Engineering, assuming Dr. Hirt's chair duties since February. Dr. Bruce has been with the department for over 21 years, and his research focuses on catalysis, kinetics, mass transfer, and molecular modeling. His experience will serve the department well.

Congratulations to both of them in their new positions!

### Dr. Ogale Receives Awards



Prof. Amod Ogale received the plaque for The George D. Graffin Lecturership Award at the 2016 World Carbon Conference from Dr. Rodney Taylor, Chairman of the American Carbon Society. Sponsored by Asbury Graphite Inc., the award is given by the American Carbon Society to an individual who has made distinguished contributions to carbon science and

engineering. Prof. Ogale delivered six seminars, "The Versatile Carbon: Fibers for Composites", at various universities and companies as part of the 2013 lecture series. His current research involves studies of mesophase pitch and bio-mass precursors for high-performance and cost-competitive carbon fibers and their composites. He has served as the principal investigator on more than 50 individual research grants worth over \$8 million, has been one of the founding members of the Center for Advanced Engineering Fibers and Films (CAEFF), and serves as the Director of CAEFF. He has published four book chapters and more than 100 research papers.

Prof. Ogale also won the SABIC-sponsored Composites Educator of the Year award from the Composites Division of the Society of Plastics Engineers, given each year to a professor who has made a significant contribution to training students in composites materials. He has developed and



taught numerous courses ranging from the freshman to graduate level. The award was based on the recent "Polymer Composite Engineering" course that addresses rheology and processing issues for polymeric matrices, reinforcing fibers, and composites, and thermo-mechanical properties of composites. Laboratory experiments are an important feature of the course. Prof. Ogale is a Fellow of the Society of Plastics Engineers, and has served as education chairman for the Carolinas Section, and Chair of Electrical and Electronics Division. Dr. Ogale, the Dow Chemical Professor of Chemical Engineering, and his group specialize in carbon fiber research with a focus on how these fibers behave in polymeric composites. Such composite materials are stronger than steel but much lighter, making them ideal for aircraft and light-weighting applications. But the materials are expensive, so the Ogale group is looking to make lower-cost composites.

# Dr. Mark Roberts

## Promoted to Associate Professor



Congratulations to Dr. Roberts on his recent appointment to Associate Professor! 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. Dr. Roberts joined the ChBE Department in 2010, where he now studies functional polymers and carbon nanomaterials for high-power energy storage and sustainable systems. He received his B.S. from Montana State University and his M.S. and Ph.D. from Stanford University, all in Chemical Engineering. He also served as a postdoctoral researcher at Sandia National Laboratories before beginning his teaching career at Clemson.

Dr. Roberts has received multiple awards, including a 3M Non-tenured Faculty Grant Award and a National Science Foundation Scalable NanoManufacturing Award. He has published over 50 journal articles with 15 of those published in the last five years, many of them in highly-ranked journals, such as *Advanced Materials* and *Chemical Communications*. Professor Roberts has also served faithfully on numerous committees at the departmental, college, and university levels. He has graduated three Ph.D. students and two Honors students.

### Teaching in Chemical and Biomolecular Engineering:

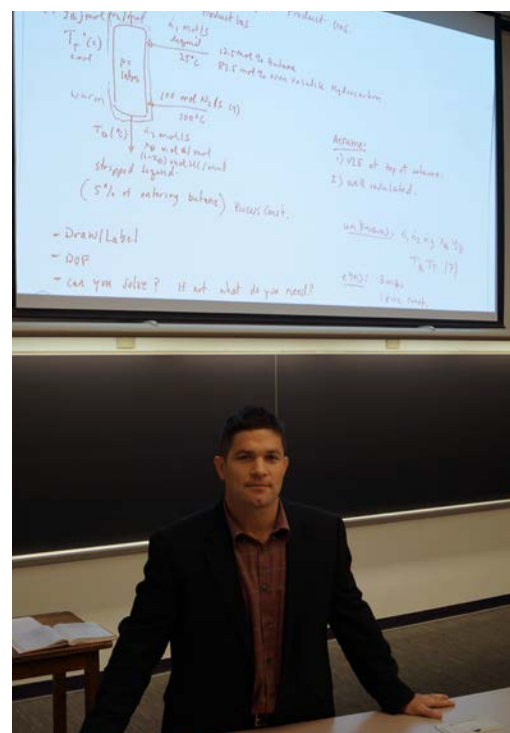
Dr. Roberts has contributed to various aspects of graduate and undergraduate education in the department. As the graduate coordinator, he oversees the Introduction to Graduate Research course for all new ChBE graduate students, and he has previously taught graduate courses in Reaction Kinetics and Energy Storage in Carbon Materials. In these courses, students learn to derive meaningful relationships between measurable quantities starting with fundamental mass, energy and momentum balances by applying reasonable simplifications. His teaching focus is placed on relating coursework to research and how to apply chemical engineering principles to experiments in a way that guides the creation of new knowledge. His graduate courses emphasize communication with assignments ranging from written proposals to oral presentations that integrate relevant course principles with students' research interests.

In 2016, Dr. Roberts had an impact on nearly 200 students as the lead instructor for two core undergraduate courses, *Process Dynamics and Control* and *Material and Energy Balances*! In these courses, Dr. Roberts' primary goal was to train students to think about problems as physical systems and to use principles, relationships and equations as tools to relate measurable quantities for designing systems that create value.

In *Process Dynamics and Controls*, Dr. Roberts focuses on two important questions about chemical processes: what happens when you change something and how to implement practical control schemes to keep processes safely doing what they're supposed to do. The often dreaded Laplace transform is only used as a tool to help students think about how process inputs affect output variables, and the course focuses more on training students to think about which direction and how fast process outputs change rather than simply solving complex math problems. Students are trained for industrial practice with experience on feed-forward, PID feedback control, and override-select decisions with the primary goal of conserving life, but also to improve process economics and accommodate for changing process demands.

In *Material and Energy Balances*, Dr. Roberts focuses on solving chemical engineering problems and preparing students for a rigorous major. Students are challenged daily with computer-based assignments to keep them on track, and they also learn the essential skill of teamwork. The importance of being able to solve material and energy balances is exemplified using high-profile case studies, which include accidents in Pasadena (1989), Texas City (2005), and Jacksonville (2007). Overall, students are trained to think about problems as real systems with an emphasis on avoiding potentially hazardous scenarios in chemical processes.

Dr. Roberts devotion to his teaching and to the success of his students, as well as his research, is an asset to our department. Congratulations to Professor Roberts for all of his achievements in the first segment of his career!!



## FACULTY HIGHLIGHTS



**Prof. Mark Blenner** received a second DTRA grant this Fall, with Dr. Nicole Martinez from EEES. The grant is titled: **Discriminatory Transcriptional Response of Environmental Microorganisms and Microbial Communities to Low-Dose Ionizing Radiation**. The grant is for 3 years with 2 option years, valued at \$866,884 (and potentially \$1,480,460 over 5 years). In this project, he and his students will study how microorganisms respond to low-doses of ionizing radiation that would be found at some distance away from nuclear activities. This dose rate of radiation is known to affect microbial physiology but is poorly understood. They hope to uncover transcriptional signatures that can discriminate between different types of radiation sources and use this knowledge to create microbial sensors that can be covertly deployed and passively monitor illicit nuclear activities.

**The W. David Smith, Jr. Graduate Publication Award** was given to **Professor Joseph Scott**. This award is given by the AIChE Computing and Systems Technology (CAST) Division to recognize a PhD publication that has had a lasting impact on the field.

The award is typically given less than five years after the candidate has received his or her PhD. It recognizes an individual for published work on the application of computing and systems technology to chemical engineering. The work must have been done by the individual while pursuing graduate or undergraduate studies. It was awarded to Dr. Scott for his paper titled **“Generalized McCormick Relaxations”** in the Journal of Global Optimization. This paper also won the inaugural Best Paper Award for the Journal of Global Optimization in 2012.



## DR. KITCHENS IS DEVELOPING ORGANIC FERTILIZERS



**Project Title: Enhancing the nutrient use efficiency in crop plants by tailoring the nitrogen and phosphorous release rates from rendered animal byproducts**

Prof. Kitchen has teamed up with Prof. Nishanth Tharayil in the Department of Plant and Environmental Sciences and Dr. Chris Ray, Director of the Clemson Experiment Station to develop new fertilizers derived from organic materials, specifically animal byproducts from the food industry. Current agriculture relies heavily on inorganic fertilizers to meet the ever burgeoning demand for food production from a cropping area that is steady dwindling. Despite scrupulous attempts to increase the nutrient use efficiency of cropping systems through the use of slow release forms, band-placements and split application of fertilizers, less than 40% of the applied nitrogen is converted to plant biomass, and phosphorous use efficiencies in most

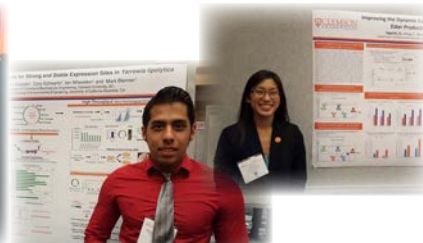
croplands are less than 20%. The high application rates and subsequent leaching and erosion of chemical fertilizers degrades the native soil biological processes and leads to environmental pollution.

This 4-year, \$500,000 project is sponsored by the United States Department of Agriculture. The proposed research will develop new formulations of fertilizers, focusing on maximizing the nutrient use efficiency while employing economically feasible source materials. The proposed approach will utilize rendered animal proteins that are unsuitable for feed applications as a base matrix for supplying nitrogen and phosphorous to crops, thus recapturing and reusing the nutrients from a resource which otherwise would be land-filled. The project will employ various natural plant-based amendments that are spent-waste, to tailor the nutrient release rate from these RM so as to match the nutrient uptake rate of the crops, thereby facilitating higher nutrient use efficiency. The project team proposes to produce a pelletized material of varying formulations of RM and amendments and test the nitrogen and phosphorous use efficiency on food crops in greenhouse and field conditions. The proposed recycling of reactive forms of nutrients in animal and plant byproducts will enhance the long-term sustainability of crop production systems by promoting the biological health of soils that is diminished by long-term, exclusive use of inorganic fertilizers. Motivation for this work originated with seed research from the Animal Co-Products Research and Education Center (ACREC) at Clemson University.



# AICHE ANNUAL MEETING HIGHLIGHTS

The American Institute of Chemical Engineers held its annual meeting November 12-19th in San Francisco. Academic and industry experts attend, as well as research students from every university imaginable around the country, presenting their cutting edge research, new technologies, and emerging growth areas in chemical engineering. The majority of our faculty and grad students attended, as it provides a premier educational forum for chemical engineers. We are proud of the awards that undergrad Zach McGill and graduate student, Christine Duval, received during this important week, which are highlighted on this page. In addition, the department hosted a reception during the conference that honored all the awards that our faculty and students received during the past year, which was attended by many alumni and others in academia. The reception featured a video commercial of our department, as well as the university, and we proudly showed our Clemson orange and purple colors! It was a great opportunity to advertise our department and College, and we have received lots of positive feedback from other universities and attendees. We are proud of all the hard work that our students and faculty have done over the past year and are proud of the presentations they gave during this conference.



Christine Duval was awarded the AIChE Separations Division Graduate Student Research Award. The award was presented to Christine alongside her advisor Dr. Scott Husson at the AIChE Annual Meeting. The Separations Division Award honors

outstanding graduate students who are the primary authors of a research paper that has contributed to separations. Christine's research has focused on the development of uranium-selective polymers for use in portable radiation detection devices. Thus far, she has contributed to 5 publications (3 in print, 2 under review) and has given more than 20 conference presentations. Christine has won multiple poster competitions locally and on the national level. Throughout graduate school, Christine has been active in outreach activities with the Girl Scouts of America as well as teaching undergraduate courses. In 2015, she received the Outstanding Graduate Teaching Assistant award for both Chemical Engineering and the College of Engineering and Science.



Senior Zach McGill was selected as a winner of the Donald F. & Mildred Topp Othmer Scholarship Award by the American Institute of Chemical Engineers (AIChE) for his outstanding academic achievement and involvement in student chapter activities. He received his award at the AIChE conference in San Francisco in November. Only fifteen AIChE student members nationwide are chosen to receive this award each year.

## PHD GRADUATE



**Dr. Nikki Chitpong**  
Dissertation: "Functionalized Cellulose Nanofiber Membranes for Heavy Metals Removal from Impaired Waters"  
Advisor: Dr. Scott Husson  
Current Position: Faculty Member  
Rajamangala University of Technology  
Textile Engineering Department  
Thanyaburi, Pathum Thani  
Thailand

## COMMUNITY OUTREACH

Our students and faculty worked with the APO fraternity during their Merit Badge University Day to enable boy scouts to earn their chemistry badge. We also held a three-event series workshop for girl scouts to earn their "Getting to Know Nuclear" badge. Our last event was volunteering with FIRST Lego League. We also have several events planned for the Spring.



# HOMECOMING ALUMNI REUNION



**Class of 1966:** (above) Victor Lopez and George Newcomb; (right) Bill Hall; (below) Victor Lopez and his son Victor.



ChBE hosted its Annual Homecoming Alumni Drop-In tailgate before the football game on October 15th. A special thank you to all of our alumni and their families that took the time to attend our tailgate. We had classes represented from 1959 through 2016. During the tailgate, the Class of 1976 celebrated their 40th Class Reunion, and the Class of 1966 celebrated their 50th!! It was a pleasure meeting with everyone and their families. We hope everyone comes back again next year!!

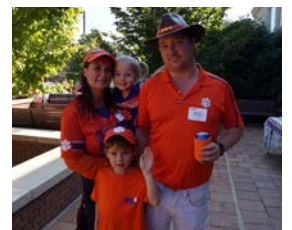
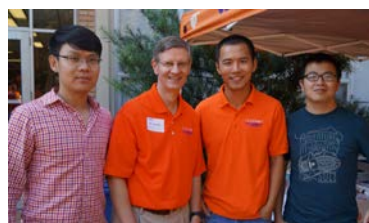
Go Tigers!!



We were honored to have **Dr. Charles Barron** (Class of 1959) as one of our guests at Homecoming. He was our Department Chair from 1987-1994 and retired in 2002.



**Class of 1976** (above L-R): 1st Row: Brad Peacock, Bill Jackson, Rick Wolfe, Tom Smith, John Frazer, and Danny Henderson. 2nd Row: Jeff Watkins, Tom Ford, Jerry Galloway, Steven Douglas, and John Stony. Pictured Below: The Class of 1976 takes a look at the membrane separation equipment in the Unit Operations Lab that their class funded. Thanks for your support!!





Department of Chemical and Biomolecular Engineering  
 127 Earle Hall, Box 340909  
 Clemson, SC 29634-0909

[www.clemson.edu/chbe](http://www.clemson.edu/chbe)

Like Us on Facebook:

[www.facebook.com/clemsonuniversitychbe](http://www.facebook.com/clemsonuniversitychbe)



Advanced Materials  
 Energy, Water & Sustainability  
 Advanced Separations  
 Biotechnology & Biomolecular Engineering  
 Computational Chemical Engineering

## DONORS - FISCAL YEAR 2016

### Corporations, Foundations, & Trusts

Aiken-Barnwell Genealogical Society  
 Albemarle Corporation  
 American Association of Tissue Banks  
 BASF Corporation  
 BP Amoco  
 Business Mens Club  
 Cambridge Oaks Consulting  
 Chevron Texaco  
 Citgo Petroleum Corporation  
 Comerica Charitable Trust  
 Cryovac Division of Sealed Air Corporation  
 Dabo's All In Team Foundation  
 DJO Surgical  
 Dow Chemical Company (Match)  
 Dow Chemical Foundation  
 Eastman Chemical Company  
 Exxon Mobil Corporation  
 Exxon Mobil Foundation  
 Fluor Corporation  
 Fluor Foundation  
 Greenville Health System  
 Hutson-Etheredge Companies  
 Jacobs Engineering Foundation  
 Jet Products  
 L.B. Bowen Inc.  
 Nexvac Inc.  
 Pfizer Incorporated  
 R E and M Solutions Inc.  
 Sara De Coursey Ruth Trust  
 Science & Technology Corporation  
 Scoliosis Research Society  
 Shell Oil Company Foundation  
 South Carolina Biotechnology Industry Assoc  
 Trust  
 Vanguard Charitable Endowment  
 VentureWell  
 WestRock MWV, LL  
 Wyatt Family Revocable Living Trust

The Department of Chemical and Biomolecular Engineering would like to honor the following donors to our department from FY2016 (07/01/15- 06/30/16). Financial support is always critical to the operation of the department - without it we would not be able to fund our initiatives that help us attract the best students and faculty. Thank you so much to the donors listed below. Your generosity is sincerely appreciated!

### Individuals

Wayne F. Addy	John B. Frazer	Jamie L. Keller	Noelle R. Norfolk	Lori G. Stayton
Kenneth K. Aniunoh	Kenneth D. Frick	Lawson S. Kendrick	Theodore M. Northrop	William D. Stephens
Donald W. Baxter	Toshita Fujisato	Doreen C. Keptner	Amod A. Ogale	Bryan E. Summers
Harry E. Beasley	Steven C. Gailbreath	Jane W. Kiekhaefer	Robert J Pappas	Carmen C. Sutherland
Patricia A. Bernat	Robert R. Gatling	Terence R. Kinard	Bonnie W. Pattie	Henry W. Theiling
Anne R. Boudreaux	Matthew W. Gissendanner	Walter H. Knox	Patrick C. Philipp	Brian W. Thompson
Joshua M. Branham	David B. Grubbs	Cynthia S. Komsa	Wade H. Ponder	Christine M. Tilton
William S. Brant	John R. Grubbs	Wesley L. Kosin	James W. Price	Alfred D. Tolson
Oliver A. Brevton	John M. Haas	Michale A. Lake	Ralph S. Radford	William L. Trapp
Gayle S. Bumgarner	Joseph E. Hale	Frank H. Lamson-Scribner	Gary S. Ragan	Jane W. Trinkley
Paul & Vicki Campbell	Susan M. Hamm	Clifton J. Lewis	Benjamin D. Rainey	John C. Troutman
Andrew K. Charles	M. N. Hanano	William C. Lewis	Philip R. Ramsey	Christine M. Turner
Kelly U. Cloyd	John K. Hane	Michael J. Liebman	Deborah A. Reeves	Richard D. Vernon
John W. Coyle	Christopher P. Harbeck	Jack L. Linder	David B. Robbins	Johnnie J. Walters
John N. Cromer	Fitz L. Hardin	Mark J. Mahoney	Susan M. Roberts	Lex D. Walters
John B. Crostic	Jeffrey S. Harding	Wellington M. Manning	Grant A. Robertson	Daniel Wandera
George M. Daugherty	Hunter S. Harris	Ellyn B. McNair	Julie R. Robinson	Robert M. Ward
Austin D. Devaney	Gary J. Hayes	Betty F. Meadows	James D. Rushton	Andreas Westergaard
J. W. Douglas	Edward C. Henne	Stephen S. Melsheimer	Crescent C. Salvador	Debra A. Williams
Charles D. Dukes	Priscilla J. Hill	Marcia B. Mia	George F. Schladensky	Gloria J. Williams
Carrie E. Dunton	Francis G. Hinnant	Gary N. Mock	John W. Schrader	Marian C. Wilroy
Mark A. Edling	Joel W. Hoard	William C. Mostertz	Brandon T. Scruggs	Timothy N. Wolf
James L. Edwards	Lyman L. Holland	Jacklyn D. Moxham	Matthew J. Shealy	Frederick G. Wolfe
Ron N. Eissmann	James R. Hunter	Jordan Mueller	Donald R. Sheeley	Silas & Sofia Wong
Noel E. Eldridge	Mark D. Ingram	Lawrence B. Murdoch	Charles M. Shuler	Daniel A. Wurst
John I. Elsey	William L. Jackson	Christine C. Murphy	Robin L. Smith	Delly Young
Stephen Q. Ferguson	James K. Jennings	Kenneth M. Nelson	Dyan M. Spinnato	James C. Young
Benjamin F. Ford	James R. Jones	George W. Newcomb	William H. Spitzer	Siqiang Zhu
Edward E. Ford	Leigh M. Joye	Michael D. Newman	Joseph C. Stanfill	