

SPRING 2014

# CLEMSON<sup>®</sup>

## CHEMICAL AND BIOMOLECULAR ENGINEERING

### Dr. Keisha Walters Receives Outstanding Young Alumni Award



ChBE alumnus, **Keisha B. Walters**, was honored at the 19th Annual College of Engineering and Science banquet in April with the **Outstanding Young Alumni Award**. The award was presented to her by Dean Anand Gramopadhye and department chair, Dr. Doug Hirt. Prof. Walters received her M.S. in Chemical Engineering in 2001 and her Ph.D. in Chemical Engineering in 2005, both from Clemson.

Prof. Walters is currently an Associate Professor at Mississippi State University where her research is in nanoparticles and stimuli-responsive materials. She has authored or co-authored 23 publications or book chapters and has generated over \$1.7 million in research support. At MSU, she has graduated 3 Ph.D. and 5 M.S. students in the Swalm School of Chemical Engineering, along with mentoring over 50 undergraduates and high school students in her labs. She has also served as Interim Associate Dean for Strategic Initiatives in MSU's College of Engineering.

Prof. Walters has also received numerous teaching and research awards. She was selected by the National Academy of Engineering to participate in their Frontiers of Engineering Education Symposium Program. She also won the 2012 Raymond W. Fahien Award from ASEE, a national award that recognizes the outstanding chemical engineering educator under the age of 40. Recently, she was selected to serve on Clemson University's Alumni Council.

The Department of Chemical & Biomolecular Engineering congratulates Dr. Keisha Walters on a well-deserved award!!

### New Faculty Member Dr. Chris Norfolk



We are pleased to announce that Dr. Christopher Norfolk has joined the Department of Chemical & Biomolecular Engineering as a Lecturer with joint responsibilities with General Engineering. Dr. Norfolk is returning to Earle Hall, having earned his B.S. from Clemson, and his M.S. and Ph.D. from Notre Dame. Prior to joining the faculty full-time, Dr. Norfolk served our department as an adjunct assistant professor for eight years. During this time, he also managed the implementation of advanced materials into defense applications as a Program Manager for SCRA Applied R&D in the Advanced Materials Division.

Highlights of Dr. Norfolk's previous work include his research with prosthetic technologies. These include advanced manufacturing techniques, which reduce the cost and increase the strength of custom composite sockets for amputees, and prototype systems for addressing overheating of amputated limbs. These projects have been honored nationally. Further, Dr. Norfolk provided the main technical resource for entry into a new market, the use of composite materials for architectural applications.

Dr. Norfolk was motivated to join the faculty full time by his passion for mentoring students. His experiences as an adjunct were extremely rewarding, and he looks forward to building relationships and helping students realize their aspirations.



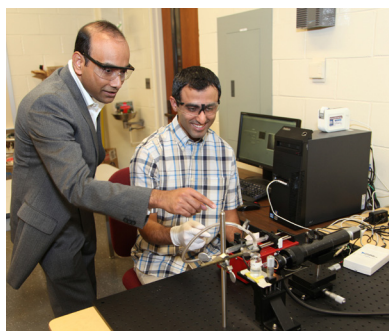
Dr. Norfolk will take a major role in the Unit Operations labs, and will teach the Chemical Engineering Tools course. He will also serve the General Engineering Program by teaching Introduction to Engineering and Problem Solving with MatLab.

## Dr. Santanu Kundu



**Dr. Santanu Kundu** (Ph.D. 2006, ChE) received the prestigious **NSF Career Award** in March 2014 to study 'Large-Strain Deformation of Polymeric Gels: Non-linearity, Instability, and Fracture' (\$533k over 5 years). He has been an Assistant Professor in the Dave C Swalm School of Chemical Engineering Department at Mississippi State University since January 2012. His current research focuses on the large-strain deformation behavior of various polymer gels as a function of their microstructure.

Before starting his academic career, Dr. Kundu was a post-doctoral research associate at the National Institute of Standards and Technology (NIST) and at the University of Massachusetts at Amherst. Santanu's Ph.D. dissertation on the rheology and microstructure of discotic liquid crystalline pitch materials received the Best Dissertation award from the Elsevier Carbon Journal (2007). He completed his Ph.D. under the advisement of Dr. Amod Ogale, Dow Chemical Professor.



## Dr. Parag Diwan



**Dr. Parag Diwan** graduated with his Masters from Clemson in Chemical Engineering in 1985, working with Dr. Dan Edie on carbon-fiber research. Dr. Diwan returned to CU in May with his wife, Shalini, so they could attend their son's (Prateek) graduation from Clemson.

Since his days in Chemical Engineering, Dr. Diwan obtained his doctorate in Business Administration from Panjab University and has held various management and consulting positions over the years. In June of 2003, he became the **Founder Vice Chancellor of the University of Petroleum and Energy Studies** in Gurgaon, India, which is the only Energy Domain specific university in India. He is the principal academic and executive officer responsible for the overall development of the institution. He also is the Chief Operating Officer of the Indian School of Petroleum.

He has more than 200 papers to his credit and has authored and edited over 40 books on management and energy.



## MESSAGE FROM THE CHAIR

*Dear Alumni and Friends of the Department:*

*Hello from Clemson and we hope you are doing well. My message in this Spring 2014 newsletter focuses on planning for the future. We have a very active and supportive Professional Advisory Board. Two years ago the Board challenged us to develop a new strategic plan for the department. After much discussion and feedback, not to mention extensive revisions, we produced a plan last year that will guide us over the next decade. Key elements are given below.*

### Mission

*The mission of our department is to prepare students for highly competitive employment, life-long learning, and societal and professional service by:*

- *Providing high-quality, student-centered educational opportunities through flexible yet rigorous curricula and cutting-edge research programs;*
- *Motivating engagement and leadership in areas that include co-op/internships, Creative Inquiry, research, study abroad, and student and professional organizations;*
- *Leading the future of chemical and biomolecular engineering through excellence in research, scholarship, and professional service;*
- *Fostering a collegial, collaborative, and productive environment for all students, faculty, and staff.*

### Vision

*The ChBE Department at Clemson University will be a top 25 department among public universities by 2025.*

### Strategic Goals

- Goal 1. Expand and further develop our faculty, staff, and facilities*
- Goal 2. Enhance our national stature in educational programs*
- Goal 3. Enhance our national recognition in research and scholarship*

*These elements are backed up by action items and metrics that we will monitor over the years. We are collaborating with the Dean and the upper administration to work toward our goals, and we'll continue to report on our progress.*

*Have a great summer.*

*Best regards,  
Doug Hirt  
Professor and Chair*



# FACULTY HIGHLIGHTS



**Prof. Mark Blenner** and colleagues from the **University of California –Riverside** were awarded a collaborative research grant from the **National Science Foundation** to study novel mechanisms for improving biocatalysis of dicarboxylic acids from renewable resources. Dr. Blenner's group will design novel and well-defined gene regulation tools for metabolic engineering of a non-conventional industrial yeast, *Yarrowia lipolytica*. This work is aimed at creating metabolic pathways that are self-regulating in order to improve the efficiency of bioproduction strategies. Dr. Blenner's collaborators at Riverside will develop novel methods to localize enzymatic pathways to fat droplets accumulated in cells. Together, these technologies will be combined to produce high yields of biosynthetic dicarboxylic acids. The three-year award to Dr. Blenner is for \$300,000.

**Prof. Rachel Getman** in collaboration with **Northwestern University** received a grant from the **National Science Foundation**. They are designing catalysts that are encapsulated by metal-organic frameworks, or MOFs, which are porous crystalline materials comprised of metal or metal oxide "nodes" connected by organic "linker" compounds. MOFs are highly tunable and thus can be designed for certain purposes. In this work, they are designing the MOFs and the catalyst for superior selectivity and regioselectivity. Their initial objective is to design the MOF and catalyst to oxidize butane to 1-butanol. The MOF pore structure will restrict butane interaction with the catalyst to the terminal carbon, and the catalyst composition will be designed to properly balance C-H bond activation and C-O bond formation. The total grant amount is \$1.2 million.



**Prof. Amod Ogale**, Dow Chemical Professor, was the Guest of Honor at the **2014 Advanced Manufacturing and Materials Engineering (AMME 2014)** Conference organized by the National Institute of Technology, Surathkal, India. He was invited to deliver a keynote lecture on his advanced carbon fibers research, which

was recognized earlier by the American Carbon Society as the 2013 Graffin Award for distinguished contributions to carbon science and engineering.

The Greenville News featured a research achievement of **Dr. Mark Roberts** and **Dr. Apparao Rao** (Physics). The article highlighted their breakthrough in carbon nanomaterial synthesis, where they demonstrated a roll-to-roll process for manufacturing aligned carbon nanotube electrodes for high-power density energy storage. Low-cost and high-power systems are important for various applications, from storing energy generated by wind and solar to prolonging the lifetime of batteries in portable electronics or large format systems. The research carried out in the Clemson Nanomaterials Center (CNC) overcomes a key limitation in manufacturing of materials with dimensions on the order of 1 billionth of a meter and is expected to have a significant impact on commercialization efforts.



## ChBE PROFESSIONAL ADVISORY BOARD

The Department of Chemical and Biomolecular Engineering is proud to recognize the following members of our department's Professional Advisory Board. We would like to acknowledge and thank them for their time, efforts, and expertise in helping us define and refine our future goals and objectives. Thanks again!

### Susan Bailey

Sales/Development Manager  
formerly of Elk Corp of Texas  
Ennis, TX  
B.S. Clemson - 1986

### Richard Baud

Solution Improve Supervisor  
Singapore Metallocene  
Elastomers  
ExxonMobil  
M.S. Clemson - 1988

### Uwe Beuscher

Global Separations  
Technology Leader  
W. L. Gore & Associates Inc.  
Elkton, MD  
Ph.D. Clemson - 1997

### Gary Hayes (Chair)

Global Process Platform Leader  
Sealed Air  
Technology & Innovation  
Duncan, SC  
B.S. Missouri-Rolla - 1983  
M.S. Clemson - 1989  
Ph.D. Clemson - 1993

### Patrick Hickey

President and COO  
Merichem Company  
Houston, TX  
B.S. Manhattan College - 1989  
Ph.D. Clemson - 1993

### Mark Ingram

Director, Program and  
Performance Management  
Global Infrastructure Operations  
Merck  
Whitehouse Station, NJ  
B.S. Clemson - 1987

### Deborah Savage

Independent Environment  
Consultant  
Arlington, MA  
B.S. Clemson - 1984  
Ph.D. MIT - 1992

### Mark Todd

Director Americas  
Manufacturing & Supply Chain  
BASF Corporation  
Huntsville, AL  
B.S. Clemson - 1986

### Bill Trapp

Director, Chemicals Develop.  
Eastman Chemical Company  
Kingsport, TN  
B.S. Clemson - 1980

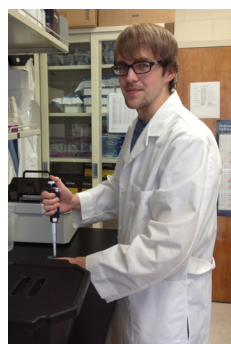
### Andrew Zydney

Department Head and  
Walter L. Robb Family Chair  
Dept. of Chemical Engineering  
The Pennsylvania State Univ.  
University Park, PA  
Ph.D. MIT - 1985

# STUDENT HIGHLIGHTS



The National Science Foundation recently announced awardees of the 2014 NSF Graduate Research Fellowship Program (GRFP). NSF received over 14,000 applications and made only 2,000 fellowship award offers. Recipients of the Fellowship included ChBE Senior **Julie Robinson** (2014) (pictured left), **Scott Cole** (BioE 2014) who worked with Dr. Kitchens on research, and ChBE 2011 Alumnus, **Jennifer Moffitt**. In addition, current ChBE Graduate Student, **Steven Weinman**, received an Honorable Mention. The program recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited U.S. institutions.



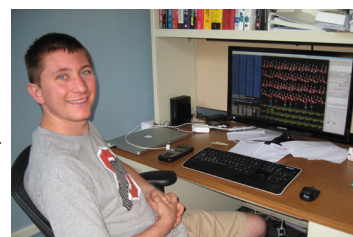
Undergrads **Taylor Cook** and **Joseph Redzikowski** both won NASA SC Space Grant Consortium Undergraduate Research Fellowships, which will allow them to work with their advisor, Dr. Mark Blenner, on Synthetic Biology for Space Exploration this summer.



PhD student, **Sam Lukubira**, (Advisor Prof. Amod Ogale) was awarded 1st Place Honors in the SPE Global Plastics Environmental Conference (GPEC) 2014 poster contest for his poster entitled, "Processing and Characterization of Meat and Bone Meal-Based Bioplastics."



**Cameron Bodenschatz**, a PhD student working with Dr. Rachel Getman, was awarded the NASA Space Technology Research Fellowship (NSTRF) for this coming school year, which provides money for tuition, health insurance, advisor allowance, and a stipend. In addition to this award, he will be paired with a research mentor from NASA and will be part of a 10-week visiting technologist experience at a NASA or other non-profit research center where he will be able to collaborate with other scientists.



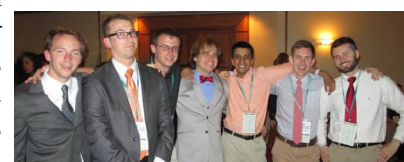
ChBE graduate student, **Julian Velez**, competed in the Graduate School's 3-Minute Thesis Contest on March 31st. He won third place with his thesis entitled, "Recovering Liquid Lignin as a Renewable Biofuel or Biopolymer." The competition "challenges research-based higher degree students to present a compelling oration on their thesis and its significance in just three minutes in language appropriate to a non-specialist audience." Congratulations, Julian!!



In April, the following students received **departmental awards** for this school year: **Ryan DeFever**, ChBE Undergrad Researcher of the Year; **Kayla Murdaugh** (left), ChBE Senior of the Year Award; and **Julie Robinson**, Western S.C. AIChE Scholastic Achievement Award. Graduate awards went to: **Jesse Kelly** (right), Outstanding Graduate Research Assistant; and **Julian Velez**, Outstanding Graduate Teaching Assistant.



**Dylan Bruckner** (AIChE Student Chapter President), and several of our ChBE students, along with Dr. Mark Blenner, represented Clemson at the AIChE Southern Regional Conference hosted by the University of Puerto Rico in San Juan in March. They competed against hundreds of other college students from several universities in ChemE paper, poster, jeopardy, and car competitions. **Ryan DeFever** (left) and **Jeremy Arvay** were in the paper competition and Ryan won 2nd Place Overall. **Kim Owen**, **Kayla Murdaugh**, **Heather Snyder**, and **Katie Ailey** also won 3rd Place Overall in jeopardy. Members of the ChemE car team were **Joy Coats**, **Jayraj Joshi**, **Ben Childs**, **Kim Owen**, **Matt Filanova**, **Joe Redzikowski**, and **Jacob Dworkin**.



# CLASS OF 2014



The Chemical & Biomolecular Engineering Department is proud to recognize the Senior Class of 2014. The students were honored at a Senior Reception on May 1st at the Madren Center. The department also hosted an Open House for the graduates and their families on graduation day, May 9th. The faculty and staff of ChBE wish all of our graduates the best of luck in their future endeavors! Congratulations!

## 2014 Graduation Candidates Bachelor of Science Degree in Chemical Engineering



Kiah L. Baker  
Matthew D. Bell  
Peter Beshay  
Alexandra J. Brown  
Dylan M. Bruckner  
David R. Carey  
Andrew S. Casella  
Robert J. Clark  
Joy C. Coats  
Michelle E. Coburn  
David C. Cooke  
Grace C. Custer  
Davis L. Cyr  
Ryan S. DeFever  
Marinesa C. Fabrizio

Joshua G. John  
Jacob R. Johnson  
Kyle T. Johnson  
Jayraj N. Joshi  
Christopher J. Keffer  
Thomas W. Kelly  
Georgia L. King  
Brian P. Klett  
Mason H. Leavitt  
Laura W. McLean  
Kayla D. Murdaugh  
Siddharth S. Parasnavis  
Alec R. Patterson  
Kyle M. Perry

Julie R. Robinson  
Joshua D. Rochester  
Tyler A. Scherbarth  
Steven J. Schofield  
Cheyenne M. Simmons  
Heather M. Snyder  
Andrew C. Tamashunas  
Luke E. Thies  
Katherine R. Turner  
Kyle Vassallo  
Paul H. Watters  
Bradley S. Weaver  
Thomas W. Welch  
Brantley J. Wentworth



## GRADUATE STUDENTS



**Dr. Nolan Wilson**  
Doctorate Degree  
Dissertation: "Drug Delivery with Feedback Control in Bioresponsive Hydrogels"  
Advisors: Dr. Anthony Guiseppi-Elie, Dr. Mark Blenner

**Lizzie Bollmann**  
Masters Degree  
Thesis: "Density Functional Theory Study of the Thermodynamic of Catalytic Remediation of Nitrate in Water"  
Advisor: Dr. Rachel Getman

## LIFE OUTSIDE THE CLASSROOM



Many of our seniors took time to pursue other interests. Senior **Grace Custer**, a music minor, found a passion for playing music on the **Carillon bells in the tower of Tillman Hall**. Grace has blessed our campus with many musical numbers on the bells.

Senior **Ryan DeFever** is the **President of the Clemson University Dixie Skydivers**, organizing their information sessions and dropzones. To get a glimpse of a couple of his skydives, please go to one of these links: [https://www.youtube.com/watch?v=s\\_LGEpfDang](https://www.youtube.com/watch?v=s_LGEpfDang)  
[https://www.youtube.com/watch?v=HN6SzoUh\\_Nk](https://www.youtube.com/watch?v=HN6SzoUh_Nk)



Senior **Drew Casella** served as the **Student Senate President** this school year: "I have had the privilege to serve as the **Student Senate President** for the 2013-2014 term and the experience has been life-changing. . . . The balance between Chemical Engineering and this commitment takes its toll on my sleep but that is a cheap price for the invaluable experiences and knowledge. I have come to know Clemson University on a deep level and I will forever be happily indebted to this institution. The most important thing I've learned is this: you will never stop learning. I am looking forward to starting a career in industry where I will always carry the lessons I've learned in Earle Hall, Student Government and every corner of this campus."





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

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## ChBE GRADUATE RESEARCH SYMPOSIUM



The **ChBE Graduate Research Symposium** was held on March 5th in the Holmes Ballroom at the Clemson House. This symposium allowed our graduate students to share their research projects with their peers and faculty members, at the same time giving them valuable presentation experience.

ChBE was honored to have **Dr. Ewe Beuscher** (pictured left with Dr. Hirt) as our keynote speaker this year. Dr. Beuscher is the **Global Separations Technology Leader at W.L.Gore & Associates Inc.**, which is the world leader in fluoropolymer materials. They are best known for the **Gore-Tex®** brand of apparel. Dr. Beuscher received his degree in Mechanical Engineering from RWTH Aachen in Germany in 1992 and his Ph.D. in Chemical Engineering from Clemson University in 1997. He is currently a member of the ChBE Professional Advisory Board. Since joining W. L. Gore, Dr. Beuscher contributed to developments in a wide variety of separation applications, including adsorption, catalysis, chromatography, polymer fuel cells, gas-liquid contactors, barrier materials, gas separation, liquid purification, and most recently advanced microfiltration.



This all-day event included a poster session in the morning, followed by oral presentations throughout the day. Some of our undergraduate researchers also participated in the poster session. The award winners of the Symposium were (pictured L-R): **Murtaza Shabbir-Hussain** (Advisor Dr. Mark Blenner) Poster Honorable Mention; **Christine Duval** (Advisor Dr. Scott Husson) Best Poster; **Julian Velez** (Advisor Dr. Mark Thies) Best Presentation; and **Meng Zhang** (Advisor Dr. Amod Ogale) Presentation Honorable Mention.

