SPRING 2015

CLEMSON

CHEMICAL AND BIOMOLECULAR ENGINEERING

Dr. Mark Blenner receives Young Investigator Award

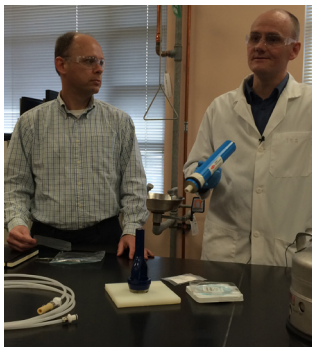
Dr. Mark Blenner, Assistant Professor of Chemical & Biomolecular Engineering, recently received a prestigious **Young Investigator Award from the Air Force Office of Scientific Research** to study strategies for engineering enzymes for more robust activity in changing and extreme terrestrial environments. The project entitled "Engineering Robust Enzyme Activity Through Fundamental Studies of Extremophile Enzymes" was among 57 awards given out to young scientists and engineers across the country that show exceptional ability and promise for conducting basic research relevant to U.S. Air Force needs. The award funds 3 years of research for $360,000.

In this research project, Prof. Blenner and his research group are changing the DNA sequence of bacteria and yeast to make new enzymes. They order the exact DNA they want from private suppliers and then apply the DNA into bacteria, such as Saccharomyces cervisiae, the same type of yeast used to make beer.

One enzyme being studied, organophosphate hydrolase, could be used by the Air Force to degrade nerve agents. They are also working with another enzyme called cutinase that can degrade polyester. If they can use it to degrade polyester, they also want to see if they can re-engineer it in the opposite direction to synthesize the polyester material so it could repair itself when activated. For example, a flight jacket torn in combat could repair itself. Enzymes are biological catalysts that withstand only a very narrow range of temperature. The use of enzymes in applications such as environmental sensing, materials fabrication, and materials degradation will require the enzymes to operate in a wide range of temperatures and environmental conditions. Prof. Blenner's research group is pursuing protein engineering strategies to create new enzymes with robust activity across a wide temperature range.

Congratulations to Prof. Blenner for this well-deserved award!!

Water and Energy - A Growing Concern



Dr. Scott Husson (ChBE) and **Dr. David Ladner** (EEES) are collaborating on research addressing the **"water-energy nexus"** as members of Clemson's **Water-Energy Consortium** (WEC). The WEC comprises over 40 Clemson faculty members whose mission is to "contribute research leading to technology innovations in water systems with a minimization of energy and carbon footprints, as well as energy systems with a minimization of water and carbon footprints."

Drs. Husson and Ladner are focused on **harnessing the energy that is released when low-salinity waters mix with high-salinity waters**, such as when rivers reach the ocean. This "blue energy" can be harvested through a membrane process called pressure retarded osmosis (PRO), which involves water transport from a low-salinity source through a semipermeable membrane to a high-salinity draw solution. Hydraulic pressure in the draw solution compartment increases due to continuous inflow of large volumes of water from the feed solution. Mechanical power equal to the product of hydraulic pressure and water transport rate can be converted to electrical power using hydro-turbines. To make PRO feasible, more effective membranes are needed. The membranes must have high mechanical strength to withstand operational stresses, yet they must be thin and permeable to allow rapid water transport.

To address this challenge, the research team is developing thin-film composite membranes that incorporate unique nanomaterials. Dr. Husson notes that "the research is providing a deep understanding of how chemical functionalization of the membranes and nanomaterial additives impacts their mechanical properties and performance." The project also seeks to improve public science literacy among individuals living in Upstate South Carolina and Western North Carolina by using entertainment media education. Through a partnership with a local television program that serves over 800,000 households in the nation's 36th largest market, the team is developing on-air science demonstrations and web-based science videos to reach a large and highly diverse audience.

It is exciting research that is attracting national attention. Says Dr. Husson,"Clean and sustainable power sources are in demand due to increasing energy consumption, depletion of fossil fuels, environmental concerns, and increases in the cost of fossil fuel-based energy. There remains a need for development of new, emerging alternative energy sources. PRO is one 'untapped' source."

FOCUS ON ALUMNI

Dr. Kyle Brinkman receives Outstanding Young Alumni Award

Dr. Kyle Brinkman was honored at the 20th Annual College of Engineering and Science banquet on April 30th with the **Outstanding Young Alumni Award**. The award was presented to him by Dean Anand Gramopadhye and department chair, Dr. Doug Hirt. At a relatively young age, Prof. Kyle Brinkman has established an impressive track record of multidisciplinary, collaborative research resulting in significant contributions to national and international research initiatives, particularly those between academia and national laboratories. Prof. Brinkman received his B.S. in Chemical Engineering at Clemson in 1998 and his M.S. in Materials Science and Engineering in 2000. In 2004, he received his Ph.D. from the Swiss Federal Institute of Lausanne, Switzerland.

Prof. Brinkman is currently an Associate Professor at Clemson in the Materials Science and Engineering Department. In the ten months he has been active at Clemson as a professor, he has already secured more than $1 million dollars in sponsored research. Prior to Clemson, he was a Program Manager for Energy Efficiency and Renewable Energy at the Savannah River National Laboratory, where he worked from 2008 through 2014. He has been the P.I. or co-P.I. on more than $5 million dollars in sponsored research and has authored or co-authored over 70 peer-reviewed technical publications and government reports. He has made significant advances in various focus areas including hydrogen storage and purification, electronic ceramic materials for solid oxide fuel cell systems, and crystalline ceramics for applications in nuclear energy. His successful collaborations have produced quality results, and he has been recognized by various professional societies and the Department of Energy for his research achievements. Prof. Brinkman's most recent research project, which made the front page of the Greenville News, is exploring new materials that could safely store nuclear waste. His research team is focusing on a crystalline ceramic that will be based on naturally occurring minerals that endure for millions of years. This project won an $800,000 research grant from the U.S. Department of Energy.

The Department of Chemical & Biomolecular Engineering nominated alumnus Dr. Kyle Brinkman for the Outstanding Young Alumni Award because he has proven to be an exceptional scholar, a world-class scientist, and an outstanding leader. Congratulations!

MESSAGE FROM THE CHAIR

Dear Alumni and Friends of the Department:

The Class of 1963 are pictured above during their recent reunion in May. L-R: Wade Ponder, John Cromer, Al Tolson, Larry Murdoch, and Jim Rushton.

Hello from Clemson and we hope you are doing well. One of the most gratifying aspects of this job, and I would say this is true for all of our faculty, is visiting with our alumni who return to campus for recruiting or just to visit Earle Hall with their family and friends. Over the past several years, specific classes of chemical engineering graduates have come together in reunion-style events. For example, coordinated by Jim Rushton, the Class of 1963 has come together four years in a row. This gathering typically involves 5-7 alumni plus their spouses, and we set up the undergraduate lounge as their home base. Activities are pre-arranged and have included a reunion with Professor Emeritus Bill Barlage, a tour of Earle Hall, an overview of the department, and visits to Fort Hill mansion, athletic facilities, the Botanical Gardens, and new buildings on campus.

Dr. Hirt with Rick Wolfe from the Class of 1976.

The Class of 1976, led by Rick Wolfe, organizes their get-together around a home football game and is held at our departmental tailgate on the Earle Hall patio. And the Class of 1965 just met in Earle Hall for their 50th Class Reunion!

If your class is interested in organizing such an event, please let me know. It takes only one individual to get the ball rolling, and we can help by providing contact information for classmates and coordinating activities.

Have a great summer!
Best regards,
Doug Hirt
Professor and Chair

The Class of 1976 are pictured above during a Homecoming Tailgate. L-R: Danny Henderson, Greg Royster, Tommy Ford, John Stoney, Bill Jackson, Parker Downing, Steve Lober, Tom Smith, Jeff Watkins, John Frazer, Brad Peacock, Steve Douglas.

FACULTY HIGHLIGHTS

Prof. Mark Blenner received a new ACREC grant for **"Bioconversion of Animal Fats into Omega-3 Oils."** Dr. Blenner received funding from the Fats and Protein Research Foundation through the Animal Coproducts Research and Education Center to advance microbial conversion of low value animal fat into higher value omega-3 oil and other oleochemicals.

Prof. Amod Ogale (PI) and Prof. Mark Thies (co-PI) received a research grant worth $375,000 from the National Science Foundation to investigate **"High-Strength Carbon Fibers from Eco-Friendly Processing of Biomass."** Prof. Ogale's group will conduct spinning and carbonization studies on fractionated lignin precursors, which will be generated by Prof. Thies' group.

AIChE SOUTHERN REGIONAL CONFERENCE

Several of our AIChE student members competed in the annual **AIChE Southern Regional Conference**. The conference was hosted this year by the University of South Florida in Clearwater Beach, Florida, April 10-11th. Over 500 students from 20 universities from the Southeast participated. The students who worked on our ChemE Car Team team this year were **William Bowman, Benjamin Childs, Jacob Dworkin, Kyle Kwarsick, Kimberley Owen, Crystal Pee, Philip Pstrak, Collin Ray, and Joseph Redzikowski. Seth Elliott participated also and Sean Dix** presented a research paper.

GIRL SCOUTS DAY - WOMEN IN SCIENCE & ENGINEERING

WISE (Women in Science and Engineering) hosted their annual **"Introduce a Girl to Engineering and Science Day"** in February along with their sponsor, Lockheed Martin. Girl Scouts from South Carolina were invited to Clemson University to learn about careers in science and engineering through research activities. In the Department of Chemical & Biomolecular Engineering, the Girl Scouts focused on enzymes used in laundry detergent, and created and designed a filtration process for water purification. Graduate student Christine Duval is shown here working with the Girls Scouts on their enzyme research.

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!

Ruth Albright
Senior Chemical Engineer
SynTerra
Greenville, SC
B.S. Clemson - 1986

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

Uwe Beuscher (Chair)
Global Separations
Technology Leader
W. L. Gore & Associates Inc.
Elkton, MD
Ph.D. Clemson - 1997

Jim Haney
Business Manufacturing and
Technology Director
Elastomers, Electrical & Telecom.
The Dow Chemical Company
Houston, TX
B.S. Clemson - 1989

Martin Hawley
Professor and Department Chair
Chemical Engineering & Materials Science
Michigan State University
East Lansing, MI
Ph.D. Michigan State University -1964

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

Clint Herring
General Manager
CF Industries
Claremore, OK
B.S. Clemson - 1991

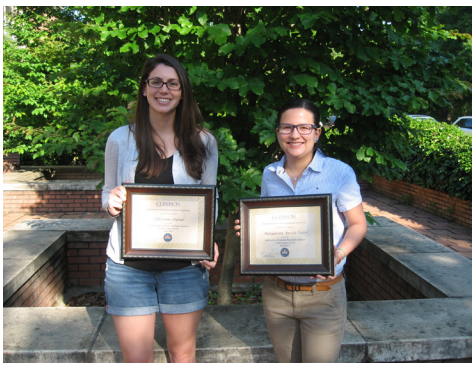
Mark Ingram
Director, Program and
Performance Management
Global Infrastructure Operations
Merck
Whitehouse Station, NJ
B.S. Clemson - 1987

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

Bill Trapp
Director, Chemicals Development
Eastman Chemical Company
Kingsport, TN
B.S. Clemson - 1980

STUDENT HIGHLIGHTS

ChBE graduate student, **Christine Duval**, was honored by the College of Engineering and Science with the **Outstanding Graduate Teaching Assistant** award. She was presented this award by Dean Gramopadhye at a banquet in April. Christine won this award based on the tremendous impact she has in the classroom. The Department also presented **Margarita Arcila-Velez** with the **Outstanding Graduate Research Assistant** award. Christine's advisor is Dr. Scott Husson and Margarita's is Dr. Mark Roberts.

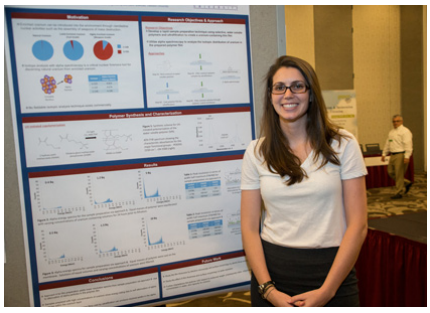


At the College of Engineering and Science awards banquet in April, Dean Gramopadhye and Dr. Hirt presented **Trey Ryder** with the **Western S.C. Section AIChE Scholastic Achievement Award**. This award is presented to the graduating senior in Chemical & Biomolecular Engineering with the highest scholastic average.

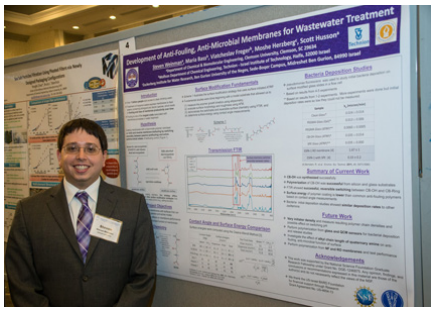
The **ChBE Undergraduate Researcher of the Year Award** was presented to **Samuel Leguizamon.** This award is presented each year to the undergraduate who performs at the highest level of distinction in research.

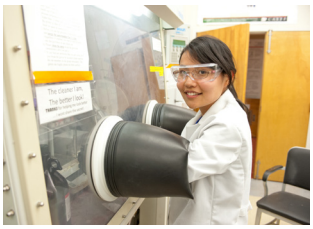
The **ChBE Junior of the Year Award** went to **Andrew Carlin (left)**. Andrew was given this award for completing his junior year with the highest scholastic average. **Seth Elliott** was presented the **Western S.C. AIChE Section Scholarship this year.**

Shelby Thies, an undergraduate honors student who works in Dr. Husson's research group, was accepted to the **Radiochemistry Fuel Cycle Summer School** at the University of Las Vegas. Acceptance to the program is very competitive and she will spend 6 weeks learning about radioanalytical chemistry and taking tours of Department of Energy facilities.



At the American Filtration Society (AFS) Conference in April, **Christine Duval** won second place in the poster competition with her research poster entitled, **"A Rapid Uranium Anaylsis using Ultrafiltration and Alpha Spectroscopy."** **Steven Weinman** won third place for his research poster entitled, **"Development of Anti-Fouling, Anti-Microbial Membranes for Wastewater Treatment."** They are both graduate students with Dr. Scott Husson.





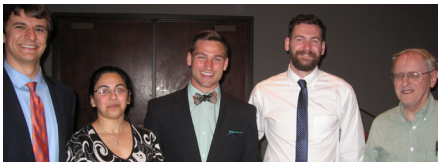
Graduate student, **Juan Wang**, was selected for a **Separations Division Graduate Research Award**. Juan will be recognized at the Separations Division Dinner in Salt Lake City in November and will be presented with a plaque and a $200 check. Dr. Scott Husson is her advisor.

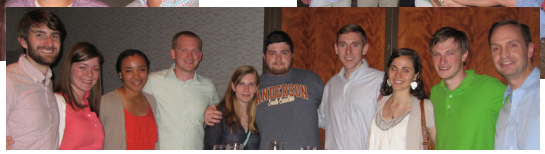
Steven Weinman, graduate student with Dr. Husson, won **1st place in the Membrane Properties** section for the student poster competition at the 2015 North American Membrane Society (NAMS) meeting in Boston. He was first from well over a hundred entries.

Rising Sophomores, **Lauren Gambill** (Genetics & Biochemistry, '17) and **Kyle Pazzo** (Biochemistry & Genetics, '17), were both awarded **ACCAC Creativity & Innovation Fellowships** to advance the work they are doing in Dr. Mark Blenner's lab (ChBE). Lauren and Kyle both started working with Dr. Blenner through Creative Inquiry projects. Lauren's work is focused on understanding and engineering xylose metabolism in the yeast, Yarrowia lipolytica. Xylose metabolism is important as most industrial microbes do consume 5-carbon sugars derived from lignocellulose efficiently. Kyle's work is focused on developing novel protein therapeutic engineering platforms to make antibodies utilizing post-translational modifications. Lauren and Kyle are leading members of a vibrant, interdisciplinary, and young group of undergraduate researchers working in the Blenner Lab for Protein & Metabolic Engineering.

CLASS OF 2015

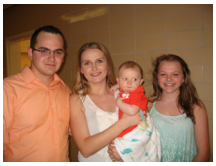
The Chemical & Biomolecular Engineering Department would like to congratulate the Senior Class of 2015. The students were honored at a Senior Reception on April 23rd at the Madren Center, and the department hosted an Open House for the graduates and their families on graduation day, May 8th. The faculty and staff of ChBE wish all of our graduates the best of luck in their future endeavors!

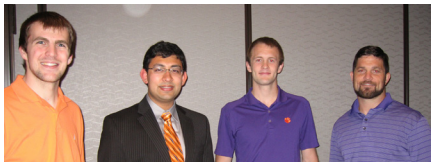


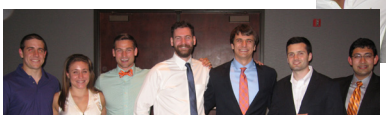


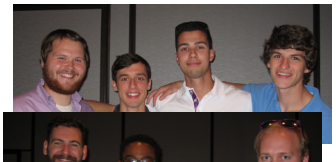
2015 Graduation Candidates
Bachelor of Science Degree in Chemical Engineering

Kaitlin E. Ailey
Fouzan S. Alam
Bryan M. Apperson
Jeremy W. Arvay
Mark C. Atkinson
Debra L. Begonis
Stephen J. Bonds
William W. Chesson
Benjamin A. Childs
Taylor B. Cook
Raymond M. Coolidge
Coleman M. Devore
Benjamin N. Donner
Robert K. Emmett
Matthew A. Fourspring
Martin R. Fox
Ian M. Gayman
Clayton R. Hammontree
Bobby T. Haney
Blake C. Hawsey
Craig M. Huffman
Bradley W. Kallmeyer
Caitlin T. Knight
Matthew L. Laird
Samuel C. Leguizamon
Rebecca E. Lewis
Nicholas M. Luther
Meredith J. Manning
Gabrielle S. Michel
Dmitriy F. Mozol
Kimberley M. Owen
Jake A. Perry
Robert Q. Powers
Kevin M. Quarles
Luke H. Rhym
Jesse R. Richards
Treyton E. Ryder
Lexie Scozio
John C. Smith
Christopher A. Stout
Ryan J. Sullivan
Christian D. Trotter
Zechariah J. Trotter
Kacey K. Tucker
Kevin M. Tuten
Emily J. Voyles
Emily E. Wakefield
Leslie A. Wall
Samuel H. Williams









CLASS OF 1965 - 50th CLASS REUNION

(L-R): Larry Upton, Richard Stuckey, Dendy Sloan, Skeet Martin, Frank Shuler, Doug Edmundson, and Ron Taylor.

The Alumni Association hosted their annual Golden Tiger Class Reunion across campus on June 11th and 12th. We were honored to host our very own Chemical Engineering Class of 1965 in Earle Hall on the afternoon of the 12th. This reunion was organized by their fellow classmate Frank Shuler and a great time was had by all. Some of the classmates had not been back in Earle Hall since they graduated so there was a lot to catch up on. Dr. Hirt gave them a tour of our building and labs and gave them an update on the department. Happy 50th - Class of 1965!! We hope you come back soon!!

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

www.clemson.edu/ces/chbe

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ChBE GRADUATE RESEARCH SYMPOSIUM

On March 4th, ChBE held its annual **Graduate Research Symposium** at the Madren Center. We were honored to have **Dr. Gary Hayes** from the **Sealed Air Corporation** as our keynote speaker. Dr. Hayes is both an alumnus of our department plus a member of our Professional Advisory Board. Our graduate students, as well as some undergraduates, were able to share their research with their peers through poster sessions and oral presentations. Winners this year were (L-R): **Christine Duval** (2nd Place-Poster), **Kryssia Diaz-Orellana** (Honorable Mention-Poster), **Steven Weinman** (Honorable Mention-Poster), **Adam Klett** (Student's Choice-Presentation), **Felipe Polo-Garzon** (1st Place-Presentation), and **Joseph Mannion** (1st Place-Poster).