

BAEG Life Line



From the Department Head

I am sad to report that Prof. Ivan Leroy Berry, age 77, passed away Monday, Dec. 29, 2014, in Fayetteville. He came to the University of Arkansas in 1985 as a Professor in the Department of Biological and Agricultural Engineering, and retired in 1999. He served as Interim Department Head during 1997-1999. Ivan attended the University of Missouri, and received both a bachelor's and a master's degree in Agriculture and Agricultural Engineering. He later earned a Ph.D. in Agricultural Engineering from Texas A&M University. He spent much of his professional career with the USDA Agricultural Research Service, living with his family in Columbia, Missouri; Kerrville, Texas; Bryan, Texas, and Lincoln, Nebraska. His professional specialization was in the "Structures and Environment" area and we are grateful for his significant technical contributions to the poultry industry. He will be greatly missed.

Eighteen students in five teams showcased their senior design projects on April 30 (photo). Spring commencement reception was held for the graduates, families, friends and faculty on May 9. Ms. Shelby Paschal, one of our graduating seniors and Student Club President was selected as the "Most Outstanding Graduating Senior" in the College of Engineering. She delivered the Engineering Commencement address on May 9.

Mr. John Westerman (BSBAE 1994) of Mid-South Engineering Co. in Hot Springs, AR was inducted in the Arkansas Academy of Biological and Agricultural Engineering (AABAE) on April 24 (story). AABAE provides annually funds for scholarships, student membership in ASABE, travel for student competitions and student club activities. On April 25, Mr. Jeff Madden (BSAGE 1988) of Riceland Foods was recognized as a Distinguished Alumnus and Mr. Shawn Brewer (BSBAE 1995, MSBAE 1998) was recognized as an Early Career Alumnus of the College of Engineering.

Prof. D. Julie Carrier was recognized with the John Imhoff Award for research in the College of Engineering on April 27 (photo). On May 1, Dr. Thomas Costello, Distinguished Professor Yanbin Li and Dr. G. Scott Osborn were recognized for excellence in teaching, research and service to students in our department, respectively (photo). The UA Alumni Association *surprised* Prof. Jin-Woo Kim on April 28 with balloons in his office with Dean John English (photo) announcing his selection as the 2015 Alumni Association's Outstanding Faculty Researcher Award.

I invite you to visit us or look us up at www.baeg.uark.edu and provide your feedback. We welcome news and updates from our alumni and friends. Your continued support of our programs is greatly appreciated. It would be a gratifying tribute to endow the scholarship honoring Prof. Carl Griffis.

Lalit R. Verma, Ph.D., P.E.

In This Issue

BAEG Faculty Directory

Faculty Accomplishments

2015 Academy Inductee

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SIGNIFICANT FACULTY ACCOMPLISHMENT

Dr. Matlock Testifies Before U.S Senate Committee on Agriculture and Water Pollution



Dr. Marty Matlock testified before the U.S. Senate Committee on Agriculture, Nutrition and Forestry On December 3 on topic of "Farmers and Fresh Water: Voluntary Conservation to Protect our Land and Waters." Arkansas Senator John Boozman is a member of the committee.

Matlock was asked to testify about the effectiveness of voluntary conservation programs in reducing water pollution from agriculture, as opposed to government regulations, Matlock cited his 25 years of experience researching agricultural impacts on water quality, and said the current system of "incentivized" implementation is working well and should continue.

Matlock said that government regulation works where there are clear sources of pollution, such as pipelines from wastewater treatment facilities or concentrated animal feeding operations. In the case of the most farming operations, however, he said there were too many potential sources of pollution to effectively regulate.

Matlock said that all farmers who take part in a U.S. Department of Agriculture programs must implement conservation plans, and argues that this requirement has been effective at reducing soil erosion and nutrient loss from agricultural landscapes. He cited statistics showing that these conservation plans, developed by agriculture scientists over the past 80 years, have been proven to reduce pollution.

Matlock serves on the executive committee of the Field to Market Alliance for Sustainable Agriculture, made up representatives from the entire U.S. agricultural supply chain and conservation organizations. The Field to Market program defines sustainable agriculture as meeting the needs of the present while improving the ability of future generations to

meet their own needs.

"We have made a lot of progress in the past 40 years, but we are not done yet" Matlock said. "Field to Market is committed to developing science-based and proven initiatives to share with farmers to increase productivity while improving the environment and the social and economic well being of agricultural communities."

Matlock argues that as these innovations are developed they will be adopted more efficiently under the current system, without direct government regulation.



Dr. Saraswat receives ISAE Fellow Award

Dr. Dharmendra Saraswat, an Associate Professor/Extension Engineer-Geospatial, has been named a 2014 Fellow of Indian Society of Agricultural Engineers (ISAE). ISAE Fellow is the highest honor a member can receive. A total of 10 fellows were named for 2014, making up a group of 0.03 percent of the entire membership. Dr. Saraswat was chosen "In recognition of his distinguished services to ISAE and for his valuable contributions to the Profession of Agricultural Engineering." Dr. Saraswat received a certificate and a plaque for the Fellow Award from Dr. VM Mayande, President ISAE on February 23, 2015 during 49th Annual Convention of ISAE at Punjab Agricultural University, Ludhiana, India

BAEG FACULTY

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Dr. Runkle Presented at PAGE 21 Project

Dr. Benjamin Runkle presented preliminary findings at the 3rd General Assembly of the PAGE21 project in Twente, the Netherlands (November 12-14, 2014). This European Union project is designed to improve understanding of arctic permafrost landscapes through a mixture of field measurements, satellite data, and advanced climate modeling. The conference provided an exciting platform for exchanging ideas and techniques between these normally distinct research communities. Runkle's presentation was titled "Multi-annual evapotranspiration in the Lena River Delta" and showed the dominant role of temperature in driving evaporation using 13 years of field data in this remote, Siberian landscape.

Dr. Matlock Lead Poultry Sustainability Summit at International Conference

University of Arkansas professors Marty Matlock and Greg Thoma led a sustainability workshop at the 2015 International Production and Processing Expo in Atlanta, Georgia.

Matlock presented the sustainability framework developed by the University of Arkansas sustainability research team over the past five years. The team worked with Field to Market: The Alliance for Sustainable Agriculture, the U.S. Soybean Export Council, the U.S. Dairy Research Institute, the National Pork Board and

the National Institute of Animal Agriculture.

The framework emphasizes a continuous improvement strategy in which stakeholders across the supply chain set sustainability goals and work to achieve them. Strategies are developed working with stakeholders, and implemented at the farm level, and measured regularly. If goals are not being reached, the strategy is adapted to incorporate new technologies, approaches, and practices. Matlock reported that this approach creates a cycle of innovation and improvement that increases efficiency of operations while decreasing negative environmental impacts.

Thoma summarized results of life cycle assessments performed by the University of Arkansas sustainability research team, saying that to be effective sustainability analyses must be grounded in scientific methodologies and that the data must be transparent, validated, widely available and inexpensive. Thoma also stressed that the same data and models should be used across the entire supply chain, including producers, processors, retailers, policymakers, and nongovernmental organizations.

The Sustainability Summit was sponsored by the American Feed Industry Association, the North American Meat Institute and U.S. Poultry and Egg Association.

Matlock also led a panel discussion with leaders from Tyson Foods, JBS USA, Butterball LLC, and GNP Company. The panel members answered questions from participating producers, representatives of federal agencies, retailers, restraint trade organizations, and consumer advocates. Following the workshop Matlock and Thoma were interviewed by *Poultry Health Today*; the interview is available [online](#).

The International Production and Processing Expo represents the entire chain of protein production and processing regularly drawing over 30,000 attendees and more than 1,100 exhibitors. It is held each January in Atlanta, Georgia.

Dr. Osborn and Dr. Matlock Receive U.S. Patent



U.S. Patent 8,979,743, titled "System and Method for Dissolving Gases in Fluids and for Delivery of Dissolved

Gases" was issued to Dr. S. Osborn, and Dr. M. Matlock. The patent is part of a technology manufactured by BlueInGreen LLC

Dr. Kim Speaks at i-bio Seminar



Dr. Jin-Woo Kim made an invited lecture at the 2014 Fall i-bio Seminar by the School of Interdisciplinary Bioscience & Bioengineering, Pohang University of Science and Technology (POSTECH) in November 4, 2014. The title of his lecture was "Building Blocks of Bio/Nano Technology for Advanced Materials and Devices."

Dr. Yi Liang Receives a New Grant



Dr. Yi Liang receives a new grant for her project "Characterizing Therman micro-Environment during Broiler Transportation"

total amount \$118,891

SIGNIFICANT FACULTY ACCOMPLISHMENT

Dr. Zhu Speaks at Department of Food Science



Dr. Jun Zhu presented “Sustaining Agriculture and Rural Communities for the 21st Century” on Monday, Feb. 9, at the Department of Food Science.

His Research interests include developing advanced technologies to convert agricultural production wastes such as livestock and poultry manure, crop residues, and lignocellulosic biomass to renewable biomass to renewable energies and materials.

Dr. Carrier Receives Research Grant



Dr. Carrier receives a grant from ASTA and the amount is \$49,999 for her research “Seasonal and tree size-related effects on biological activity of loblolly pine and sweet gum.”

Dr. Yanbin Li Presents at International Congresses



Dr. Yanbin Li gave an invited lecture entitled “Nanotechnology-based biosensors for rapid detection of pathogenic bacteria and virus in agriculture and food” at Shenyang Agricultural University on September 1-2, 2014, in Shenyang, Liaoning Province, China. Dr. Li gave an invited presentation “A nanopore-based aptasensor for rapid detection of pathogens” at the 2nd International Summit on Precision Agriculture (ISTPA) in Beijing, September 11-15, 2014, and then he gave an invited presentation

“Nanobiosensor for biodetection in agriculture and food” at the 18th World Congress of CIGR (International Commission of Agricultural and Biosystems Engineering) in Beijing, September 16-19, 2014.

Dr. Matlock Takes Part in U.S.D.A. Workshop on Agricultural Coexistence



Marty Matlock, is an invited participant in the U.S. Department of Agriculture’s Stakeholder Workshop on Coexistence, March 12-13

at North Carolina State University in Raleigh, North Carolina. The purpose of the workshop is to advance understanding of agricultural coexistence – the concurrent cultivation of conventional, organic, identity preserved, and genetically engineered crops consistent with farmer choices and consumer preferences. Workshop participants will discuss opportunities for achieving coexistence and explore interests and concerns of all stakeholders.

The workshop is the product of U.S. Secretary of Agriculture Tom Vilsack’s Advisory Committee of Biotechnology and 21st Century Agriculture. Matlock was appointed to the committee in 2011, and was reappointed for an additional two-year term in 2014. The members met over 2011-2012 to explore concerns and opportunities for coexistence. The committee issued a report in November 2012 that included a set of recommended actions by the USDA to support conflict resolution between agricultural producers across the technology spectrum.

Participants in the workshop will explore three issues:

1. The current state of coexistence
2. Knowledge gaps, challenges, and the U.S.D.A.’s responses so far to the committee’s recommendations
3. Additional steps the U.S.D.A. is considering to respond to the challenges.

Stakeholders representing industry, farmers, government, and academia will work to expand their understanding of coexistence-related issues and raise questions, voice concerns, and share their expertise and insights about addressing the challenges of coexistence.

Dr. Verma Receives ISAE Fellow Award



Dr. Lalit R. Verma Professor and Head of the Department of Biological and Agricultural Engineering was named a 2014 Fellow of Indian Society

of Agricultural Engineers (ISAE). ISAE Fellow is the highest honor a member can receive. A total of 10 Fellows were named for 2014, making up a group of 0.03 percent of the entire membership. Dr. Verma was chosen “In recognition of his valuable contributions to the Profession of Agricultural Engineering.” Dr. Verma is the Immediate Past-President of the American Society of Agricultural and Biological Engineers (ASABE) and a 1999 Fellow of ASABE. He is also a Fellow of the Institute of Biological Engineering (IBE) and the American Institute for Medical and Biological Engineering (AIMBE). In 2014, he was inducted into the University of Nebraska’s Biological Systems Engineering Hall of Fame.



Happy Birthday to Dr. Otto Loewer!

Dr. Otto Loewer celebrates his 70th birthday on February 20, 2015.

Dr. Loewer joined the family of University of Arkansas in 1985 as Biological & Agricultural Engineering Department as the Department Head and Professor. He served as Dean College of Engineering in 1996-2002.

He is also a founding director of the university's Economic Development Institute.

2015 Academy Inductee



Alumni Mr. John Westerman were inducted into the Arkansas Academy of Biological and Agricultural Engineering during the ceremony on April 24th, 2015.

Mr. John Westerman graduated with a Bachelor of Science in Biological and Agricultural Engineering from the University of Arkansas in 1994. Following graduation from the University of Arkansas Biological and Agricultural Engineering Department in 1994, he started to work at Hi-Tech Engineering in Hot Springs Arkansas. He worked as a project engineer from 1994 to 1996. His primary work responsibilities included the detailed design of lumber handling equipment and machinery for the wood products industry. The work included the design and fabrication oversight of the equipment. The equipment included sawmill and planer mill lumber trimmer, sorter and edger lines as well as various lumber handling conveyors. This equipment was utilized in high speed lumber manufacturing facilities.

Mr. Westerman joined Mid South Engineering Co., in 1996 as a project engineer and project manager consulting with companies in the wood products industry. His primary role has been to help with the implementation of new process equipment centers in lumber and panel plants. This includes the upfront planning and estimating of projects as well as the detailed Implementation of the projects. This also involves the assessment of existing process centers and equipment and making recommendations for improvement.

He has been married to LeAnn since 1994 and has three children, KatiBeth (16), Grace (13), and Nathan (8). He is a member of Walnut Valley Baptist Church and has taught various age group Bible classes. He enjoys hunting and fishing, camping, and most outdoor activities. He likes to work around his house and has enjoyed various building projects as well as gardening and yardwork.

FEATURED FACULTY



Dr. Jun Zhu came to the University of Arkansas just over a year ago from University of Minnesota Southern Research and Outreach Center. Zhu is the lead co-director of CARS, specializing in waste management. Zhu takes a two prong approach in his research program. The first is through waste management and treatment technology

and the second is through resource management and recovery technology. Having been in Arkansas for just one year, most of his prior work was in animal systems such as swine and dairy manure in the upper Midwest. Since moving to Arkansas he has expanded his work to include poultry litter waste treatment technologies and is developing technologies to use it as a resource.

Much of the poultry litter in NWA is exported to neighboring states. Alternatives to this practice are needed for various reasons including the possibility that regulations could change prohibiting this practice and it is expensive. Additionally, Arkansas farmers in other parts of the state require annual applications of fertilizer to support crop production. Although a waste product, litter is a good source of N and minerals and a potentially a good, inexpensive fertilizer. Zhu is investigating technologies of converting this resource into an affordable fertilizer and an environmentally friendly product by reducing the volume of the product and using various treatments to make different products. The challenge of this issue is developing technologies that are affordable. Although many of these processes can be done, they are not yet economically feasible.

In Zhu's previous research on agriculture waste treatments he worked on liquid swine and dairy manure projects such as reducing odors using a two phase lagoon. In this system the 1st stage supernatant discharges to the 2nd lagoon where the top layer is aerated to create a biological cover, preventing odors from the bottom reaching the top. This system can reduce up to 80% of noxious fumes. In another project liquid manure was treated with sequencing batch reactors to remove N and P, so the remaining water met the discharge limits. The N was changed

to gas and released to the atmosphere while the P could be used in compost or fertilizers or other products.

In Zhu's research on resource recovery, he is producing bio-hydrogen from animal waste. He first started this system using liquid swine manure and added glucose to produce the hydrogen (H). Although this worked, it was cost prohibitive. To make the system more economical he replaced the glucose with sugar processing wastewater because it contains high levels of carbon. With this approach he can treat two waste streams in one process to produce H. Next, methane can be produced with the waste of the H production process and struvite fertilizer can be made with the effluent of the methane production. The resulting water is quite clean. There is still more work to be done in this arena, however. The two gases H and methane are not pure enough for a fuel cell. The gases contain 60-70% and 40-50% CO₂, respectively, and must be cleaned up for a more pure form. A green gas can be made from the H, methane and CO₂ that is carbon neutral and is a substitute for natural gas.



Other research Zhu is conducting is recovery of N from dairy manure for use in culturing media of fungi and bacteria that produces lactic acid. Lactic acid is of interest because it is the precursor for poly-lactic

acid polymer which is used in bioplastics. The obstacle of this process is the sterilization of the culture media since manure is a biologically rich material. Autoclaving is cost prohibitive and consumes too much energy. Zhu is looking into filter technologies that can block the bacteria but allow the nutrients to pass.

Future areas of work: Zhu is considering expanding into rice waste management since Arkansas is the leading producer of this crop. He is interested in examining the conversion of rice straw into useable products or developing technologies that use the residues to co-ferment with another resource like manure.

Funding: Zhu has received funding through national, state and local sources including USDA-NIFA, Minnesota Department of Agriculture and local producer groups while in Minnesota and through the Arkansas Agriculture Experiment Station.

Dr. Kim Receives the Distinguished Achievement Award for Research

Congratulations to Professor Jin-Woo Kim, who was selected to receive the Distinguished Achievement Award for Research to be given out on October 30 at the annual Alumni Awards Celebration.

Dr. Kim had a surprise visit in his office by Dean English and Alumni Association reps for this announcement,



Dr. Carrier Receives the Imhoff Award for Research

On Monday, April 27, 2015, the College of Engineering held its inaugural faculty awards reception at the Carnall Hall. Engineering dean John English said that the event was to appreciate and celebrate the hard work and achievements of the faculty.

In this event, Dr. Julie Carrier received the Imhoff award for research. Carrier conducts research in the area of bioenergy and bioprocess engineering of nutraceuticals. In 2014, she had eight refereed journal articles, 16 poster presentations, five oral technical presentations, and reviewed 20 technical manuscripts. She had seven grants and also co-authored three grants totaling over 14.7 million dollars.



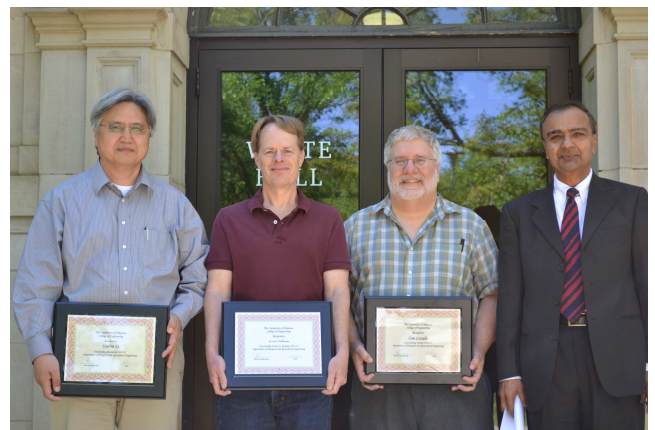
College of Engineering Recognizes BAEG Faculty Members

The College of Engineering recognized faculty and staff members in a college-wide meeting.

Biological and Agricultural Engineering department also presented Outstanding Teacher, Outstanding Researcher, and Outstanding Service to Students awards to the faculty members.

The following faculty received awards:

- College of Engineering Outstanding Teacher: Dr. Tom Costello
- College of Engineering Outstanding Researcher: Dr. Yanbin Li
- College of Engineering Outstanding Service to Students: Dr. Scott Osborn



Journal
Publications

Han, F.F., X. Qi, L.Y. Li, L.J. Bu, Y.C. Fu, Q.J. Xie, M.L. Guo, Y. Li, Y.B. Ying, and S.Z. Yao. 2014. Bio-inspired preparation of fibrin-boned bionanocomposites of bio macromolecules and nanomaterials for biosensing. *Advanced Functional Materials* 24(31):5011-5018.

Hu, Q.Q., X.H. Xu, Z.M. Li, L.Z. Xu, Y. Zhang, J.P. Wang, Y.C. Fu, and Y. Li. 2014. Detection of acrylamide in potato chips using a fluorescent sensing method based on acrylamide polymerization-induced distance increase between quantum dots. *Biosensors & Bioelectronics* 54(15):64-71.

Huang, X.L., Z.D. Xu, Y. Mao, Y.W. Ji, H.Y. Xu, Y.H. Xiong, and Y. Li. 2015. Gold nanoparticle-based dynamic light scattering immunoassay for ultrasensitive detection of *Listeria monocytogenes* in lettuces. *Biosensors & Bioelectronics* 66:184-190

Lin, J.H., R. Wang, R.R. Jiao, Y.T. Li, Y. Li, M. Liao, Y.D. Yu, M.H. Wang. 2014. An impedance immunosensor based on low-cost microelectrodes and specific monoclonal antibodies for rapid detection of avian influenza virus H5N1 in chicken swabs. *Biosensors & Bioelectronics* (in press). available online, doi:10.1016/j.bios.2014.09.037

Wang, H., Y. Li and M. Slavik. 2014. Rapid detection of *Campylobacter jejuni* in poultry products using quantum dots and nanobeads based fluorescent immunoassay. *International Journal of Poultry Science* 13(5):253-259.

Wang, R., L.Z. Xu, and Y. Li. 2014. Bio-nanogate controlled enzymatic reaction for virus sensing. *Biosensors & Bioelectronics* (in press). available online, doi:10.1016/j.bios.2014.08.071

Wang, W., M. Li, W. Fang, and Y. Li. 2014. Intervention technologies for reducing *Vibrio parahaemolyticus* in sea foods: A review. *Journal of Food Science*. (in press) available online, doi:10.1111/1750-3841.12727

Xu, L.Z., X. Xu, H. Xiong, L.X. Chen and Y. Li. 2014. Rapid detection of vegetable cooking oils adulterated with inedible used oils using fluorescence quenching method with aqueous CTAB-coated quantum dots. *Sensors and Actuators B: Chemical* 203:697-704.

Zhou, L, J.P. Wang, D.J. Li, and Y. Li. 2014. An electrochemical aptasensor based on Au nanoparticles dotted graphene modified glassy carbon electrode for label-free detection of bisphenol A in milk samples. *Food Chemistry* 162:34-40.

Kotagiri, K. & Kim, J.-W. Stealth nanotubes: strategies of shielding carbon nanotubes to evade opsonization and improve biodistribution (Review Article). *International Journal of Nanomedicine* 9, 85-105 (2014). *Invited paper for a special issue: Emerging nanotechnology approaches in tissue engineering & regenerative medicine*

Lee, J.S., Chen, J., Deaton, R. & Kim, J.-W. A DNA-based pattern classifier with *in vitro* learning and associative recall for genomic characterization and biosensing without explicit sequence knowledge. *Journal of Biological Engineering* 8, 25 (2014).

Lim, K.-T., Baik, S.J., Kim, S.W., Kim, J.H., Seonwoo, H., Kim, J.-W., Choung, P.-H., Choung, Y.-H. & Chung, J.H. Development and characterization of fast-hardening composite cements composed of natural ceramics originated from horse bones and chitosan solution. *Tissue Eng. Regen. Med.* 11(5), 1-10 (2014).

SCHOLARSHIP RECIPIENTS

Arkansas Academy of Biological and Agricultural Engineering
Khoa Thai
Paul Aaron Naegle
Sarah Elizabeth Wirtz
Arlena Tran

Biological and Agricultural Engineering
General Scholarship
Khoa Thai

Billy Bryan Scholarship
Arlena Tran
XZin McNeal Scholarship
Clayton Dean Shook
Aya El-Khouly
Lyndsey Nicole Copley
Sarah Elizabeth Wirtz

J.A. Riggs Tractor Scholarship
Sarah Elizabeth Wirtz
Thomas Matthew McVey
Jacob Allen Hickman

John W and Trannye Odom White Scholarship
Sarah Elizabeth Wirtz

Student Awarded Beaver Water District Scholarship

Andrew Stephens, a sophomore in biological and agricultural engineering, together with Stephanie Maxwell, a senior majoring in civil engineering and Julia Allen, a senior majoring in crop, soil, and environmental science, were recently



awarded Beaver Water District Steele-Croxton Memorial Scholarships.

The scholarship, funded through voluntary contributions by Beaver Water Dis-

trict Board members and other interested individuals and organizations, is named for the late Joe M. Steele and the late Hardy W. Croxton, leaders and past board members. The Memorial

Scholarship Fund provides support to qualified students within the U of A's College of Engineering and Dale Bumpers College of Agricultural, Food and Life Sciences. The scholarship's aim is to support students studying and exploring careers related to water.

Beaver Water District supplies drinking water from its abundant storage in Beaver Lake to Fayetteville,

Significant Student Accomplishment

Shelby Paschal Receives College of Engineering Outstanding Seniors

In April, each department in the College of Engineering named one student as their 2015 Outstanding Senior. This year, The College of Engineering selected Shelby Paschal as the College Outstanding Senior!



Shelby Paschal has maintained a 3.97 GPA in biological engineering while staying active in leadership roles and research in the field of water quality. She has worked at the Arkansas Water Resources Center since her sophomore year and interned last summer at the

Smithsonian Environmental Research Center where she researched water quality trends in the Chesapeake Bay.

She is an active member of Tau Beta Pi, serves as the student chapter president of the American Society of Agricultural and Biological Engineers and was honored as

one of the 2014 Outstanding Undergraduate Students for the Arkansas Section of ASABE. Post-graduation, Shelby will pursue a position in environmental consulting and sustainability of water resources.

Congratulations,

Shelby!

Senior Design Expo

The Senior Design Expo was held on April 30, 2015 under Dr. Tom Costello's, Dr. Julie Carrier's, and Dr. Scott Osborn's supervision. There were eighteen senior design students in five teams presenting their projects.



Design of a Specialty Food Production System for Use On-site at a Restaurant

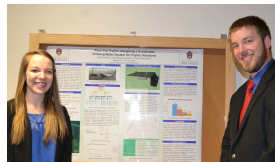
Pablo Bolanos, Jared Schnebelen, Benjamin Sharon

Faculty mentors: Dr. D. Julie Carrier and Dr. Thomas Costello

Design of Organic Waste Treatment and Energy Recovery using Algae Production Coupled to Anaerobic Digestion

J. Barrett Carter, Barret Knutson, Khoa Thai

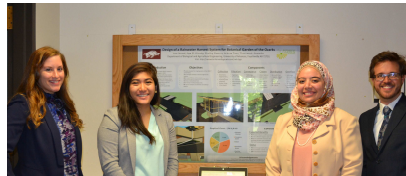
Faculty mentors: Dr. D. Julie Carrier and Dr. Thomas Costello



Water Supply Management Options for a Community in Honduras

Derek Daniels, Trent McKenzie, Shelby Paschal, Katherine Smith

Faculty mentor: Dr. Thomas Costello



Design of a Rainwater Harvest System for the Botanical Gardens of the Ozarks

Aya El-Khouly, Lee Nosal, Shelby Owens, Arlena Tran

Faculty mentor: Dr. Thomas Costello



Improved Carbonation Process for Beer to Reduce Costs and Carbon Emission

Daniel Bugler, Elizabeth Marhefka, Benjamin Matthews, Sarah Wirtz

Faculty mentor: Dr. G. Scott Osborn



Congratulation to the Class of 2015!

Undergraduate:

Pablo Bolanos

Daniel Bugler

Joe Barrett Carter

Derek Daniels

Aya El-Khouly

Barrett Knutson

Elizabeth Marhefka

Benjamin Matthews

Trent McKenzie

Lee Nosal

Shelby Owens

Shelby Paschal

Jared Schnebelen

Benjamin Sharon

Katie Smith

Khoa Thai

Arlena Tran

Scholarship Donation Opportunities

Please accept my contribution to the following scholarship(s). My check for
\$ _____ is enclosed.

Billy Bryan Scholarship Fund _____

Joel T. Walker Memorial Scholarship Fund _____

Carl L. Griffis Memorial Scholarship Fund _____

Biological and Agricultural Engineering **General** Scholarship Fund _____

Biological and Agricultural Engineering **Student Support** Fund _____

NAME: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

PHONE: _____ E-MAIL ADDRESS: _____

Remit Payment To: *Dept. of Biological & Agricultural Engineering*

203 Engineering Hall

University of Arkansas Fayetteville, AR 72701