PURDUE UNIVERSITY

Agricultural & Biological ENGINEERING

Winter Issue 2014/2015

From the Department Head

Our programs are larger and more vibrant than ever. A couple of indications of this are the numbers of students we graduated in 2014 – we reached the 100 mark at May graduation with an additional 13 in August and 40 in December. Information on some of the many extracurricular opportunities our students pursue are highlighted throughout the newsletter. ABE has recruited some highly talented faculty in this past year to address program growth, and more information about this talented group is available in the newsletter. Finally, as you might guess with the growth that has occurred, our facilities are under more pressure than ever. We are working on future space plans and will share these with you throughout this coming year. ▪

ABE Named #1 By US News & World Report—Again!

Does that headline look familiar? It should! Purdue Agricultural & Biological Engineering is honored to share the top spot in the US News & World Report rankings in the biological/agricultural specialization .This marks the fourth consecutive year our undergraduate program has received this recognition. Our graduate program is also atop the list of graduate programs, for six consecutive years. Our students, alumni, faculty, and staff make the difference – and that difference moves the world forward! ▪

Inside this issue:

ABE Students Celebrate our #1 status with Glenn W. Sample Dean of Agriculture, Jay Akridge.

Maha Fluid Power Research Center Celebrates 10 Years

The Maha Fluid Power Research Center celebrated a major milestone October 1-3, 2014. The event marked the 10th anniversary of the Center's founding. Several events, including tours and a celebration banquet, were attended by past and present students and collaborators, as well as faculty and staff from ABE. We congratulate our colleagues on a job well done and look forward to many more celebrations.

Research at the Center is bi-focal: energy saving hydraulic drive systems and development and optimization of pumps and motors. The Center is a member of the Engineering Research Center for Compact and Efficient Fluid Power. ▪

2014 ABE Outstanding Students

Hahus

Every Spring the ABE faculty select the Outstanding Freshman, Sophomore, Junior, and Senior in each of the programs. This year's Outstanding Seniors include Ian Hahus (AE), Corbin Abrell (ASM), and Gordon Showalter (BE). Ian is pursuing a graduate degree at the University of Florida in Land and Water Resources Engineering. Corbin has taken a position with Monsanto and hopes eventually to have his own farm. Gordon is pursuing a dual PhD in Astrobiology and Oceanography at the University of Washington while studying arctic extremophiles in the Deming Lab.

Abrell

Showalter

The Outstanding Juniors are: Nicole Solitro (AE), Joel Waterman (ASM), and James Nolan (BE). Nicole spent the Spring semester studying abroad at the University of Canterbury in New Zealand and was a member of the team that created a water turbine design selected for use in Bangang, Quest, Cameroon. Joel has completed Basic Training and Infantry School with the National Guard and is currently in the Army ROTC program. Joel plans for a civilian career while fulfilling his National Guard commitment as an officer and plans to pursue an officer slot in the Army Corp of Engineers. James spent six months studying at ETH Zurich in Switzerland researching the application of gold mushroom-shaped microelectrodes to recording neuronal networks. An active member of the Purdue iGEM team (international Genetically Engineered Machines), he hopes to have a career in biotechology startups.

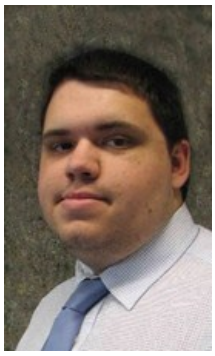
Solitro

Waterman

Nolan

McNeely

The Outstanding Sophomores are: Danielle McNeely (AE), William Sparks (ASM), and Jaycey Hardenstein (BE). Danielle spent the summer conducting research at Purdue regarding reconstruction of Tanzanian wetlands. She would like to use her degree to bring clean water and better food production to parts of the world that are in need. William is contemplating double majoring in Sustainable Agronomic Systems in addition to minoring in Food and Agribusiness Management. He hopes to have a career in agriculture, then return to the farm. Jaycey conducts research through the Laboratory of Renewable Resources Engineering on food pathogen detection. This summer she conducted research at NASA Ames Research Center within the Space Life Sciences Training Program and intends to continue on to graduate school to conduct biomedical research relating to regenerative medicine or nanobiotechnology.



Sparks

Hardenstein

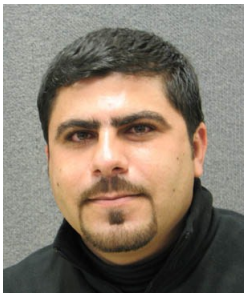
The Outstanding Freshmen are: Megan Shivley (ASM) and Lauren Bailey (Pre-

2014 ABE Outstanding Students, cont.

Shivley

ABE). Megan is hoping to minor in Crop Science. Not having been raised on a farm, she still has a passion for agriculture and appreciates the fact that she can use her ASM degree to follow a number of different career paths. Lauren's love of genetics and music made Purdue an easy choice. She hopes to follow her undergraduate degree with a PhD in human genetics. She is also a member of the "All-American" Marching Band, among other musical organizations. ▪

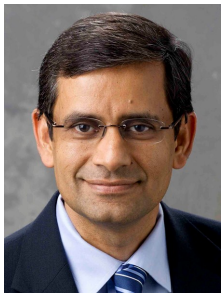
Bailey



Outstanding PhD Student, 2014 Amjad Assi. Professor Rabi Mohtar, major professor.

Outstanding MS Student, 2014 Raymond Red Corn. Professor Abigail Engelberth, major professor.

Professor Indrajeet Chaubey named Head of EAPS



Professor Indrajeet Chaubey was named the Head of Earth, Atmospheric, and Planetary Sciences (EAPS) in 2013. He joined the Agricultural & Biological Engineering Department as an associate professor in 2007, with a joint appointment in EAPS.

Dr. Chaubey received the ADS/Hancor Soil and Water Engineering Award from the American Society for Agricultural and Biological Engineers (ASABE) at the 2014 Annual International Meeting, thus keeping his feet firmly planted in the College of Engineering, College of Agriculture, and the College of Science. Dr. Chaubey's research efforts within ABE remain vibrant. ▪

Patently Excellent

The ABE Department is proud of the creativity of our faculty. Since June of last year, six faculty members have received patents for their work:

US 8,790,904 "*Process for Preparing Enriched Glucan Biomass Materials*."Issued July 29, 2014. Inventors: Michael Ladisch, Nathan Mosier.

US 8,474,254 "*System and Method for Enabling Floating of Earthmoving Implements*."Issued July 2, 2013. Inventors: Monika Ivantysynova, Christopher Williamson, Joshua Zimmerman.

US 8,761,898 "*Flexible Neural Probe For Magnetic Insertion."* Issued: June 24, 2014. Inventors. David Jaroch, Jenna Rickus, Pedro Irazoqui.

US 8,715,981 "*Electrochemical Biosensor*."Issued May 6, 2014. Inventor: D. Marshall Porterfield.

US 8,598,379 "*Method of Lowering the Cloud Point of Fatty Acid Esters*."Issued December 13, 2013. Inventor: Bernard Y. Tao.

US 8,474,254 "*System and Method for Pump-Controlled Cylinder Cushioning*."Issued June 4, 2013. Inventors: Monika Ivantysynova, Christopher Williamson.

US 8,454,469 "*Power Split Transmission with Energy Recovery*."Issued June 4, 2013. Inventors: Monika Ivantysynova, Carl Blake, Christopher Williamson.

Spotlight on New Faculty

ABE has welcomed several new faculty members this year.

Dr. Robert M. Stwalley III

Dr. Bob (as the students have decided to call him) has three degrees from Purdue, making him a 'triple-domer' with black and gold blood. His undergraduate degree is from ABE, and his graduate work was done in ME. His wife, Dr. Carol (as he has decided to call her), also has all three degrees from Purdue, but her pedigree is pure: all three of hers are from ABE. Dr. Bob met his wife in room 205 of the ABE building, and they have been happily working and raising kids together ever since. They have four children: Kathryn (BS-Purdue, grad school-Purdue), Robert (undergrad-Purdue), Elizabeth (Jefferson HS), and Daniel (Tecumseh JHS). Dr. Bob has spent numerous years in industry and as a consultant in private practice. His specialization is energy and optimal resource utilization. He wanted to be an Ag Engineer from the time he was in the fifth grade and met his father's good friend, Purdue ABE Professor Bruce McKenzie. Returning to ABE and teaching today's students has brought him through a full circle of experiences. He is thrilled to be back home in Agricultural & Biological Engineering. ▪

Dr. Margaret Gitau

Dr. Margaret Gitau will join our faculty in August of next year (2015) from Florida A&M University where she is an Associate Professor in Biological and Agricultural Systems Engineering and is affiliated with the Center for Water and Air Quality. Dr. Gitau received her PhD from Penn State and her research interests include Watershed Modeling, BMP Selection and Placement, Water Quality Modeling, and Sustainable Water Resources Management, among many others. Her favorite way to spend her spare time is gardening - particularly edible gardens. There's "nothing like home-grown lettuce." She loves the changes in color and the bright colors that come with the fall. You can see some of her publications listed at academia.edu. ▪

Dr. Meng Deng

Dr. Deng arrived on campus January 14, 2014, from MIT where he was a visiting scientist and a postdoctoral fellow at the University of Connecticut Health Center. Educated in both China and the US, his BE is in Chemical Engineering (Tsinghua University) and his PhD is in Chemical Engineering (University of Virginia). Dr. Deng and his wife welcomed their first child, Shirley, on August 3rd, so his education continues! His research is focused "on the design and development of new biomaterials for biotechnology and biomedical applications. Of particular interest is to build biological tissue substitutes (such as bone and muscle) to treat tissue injuries and diseases." His research spans from basic science to transitional technology and is "based on the convergence of materials science, micro/nano-scale engineering, and cell biology/medicine." He loves to travel, but we plan to keep him close to home. This semester he is teaching a new course, ABE 59100, Polymeric Biomaterials and will be taking the reins for ABE 37000 Biological and Microbial Kinetics and Reaction Engineering in the Spring. ▪

Dr. Sadegh Dabiri

Dr. Dabiri is an Assistant Professor of Ag & Bio Engineering/ Mechanical Engineering. He received his BS degree from Sharif University of Technology in Tehran, his MS and PhD in Mechanical and Aerospace Engineering from UC Irvine, and after that spent two years at MIT as a Postdoctoral Associate.
He is interested in teaching different aspects of physics of fluids with an emphasis on engineering applications. Dr. Dabiri's research interest is to use computational fluid dynamics to study multiphase flows such as turbulent multiphase flows, cavitation and bubble dynamics, sprays and liquid atomization, mixing in supercritical conditions, and solid particles transport in fluids.
He chose Purdue University because of the international reputation of its engineering program, its colle-

gial atmosphere, and its commitment to excellence in research and education. ▪

Dr. Sara McMillan

Sara McMillan received her B.S. and M.S. in Civil and Environmental Engineering from the University of Iowa and her Ph.D. in Environmental Science and Engineering from the University of North Carolina Chapel Hill. Before joining Purdue, Dr. McMillan was an Assistant Professor in the Department of Civil and Environmental Engineering at the University of North Carolina at Charlotte. Her research focuses on hydrology and biogeochemistry of coupled human and natural systems, particularly utilizing ecological engineering solutions to improve water quality. She integrates field-based research with quantitative modeling approaches to develop solutions to advance the science of ecosystem restoration. Her current research projects include: understanding the impact of geomorphology on nutrient retention in restored streams; characterizing hyporheic flowpaths in streams and their impact on nutrient cycling; and investigating the effects of best management practices in agricultural and urban watersheds on ecosystem function in receiving streams. ▪

Dr. Shweta Singh

Dr Singh is an Assistant Professor of Agricultural & Biological Engineering and Environmental & Ecological Engineering. She received her B. Tech Degree in Chemical Engineering from Indian Institute of Technology, Banaras Hindu University (IIT-BHU) in Varanasi, India; Masters in Applied Statistics and PhD in Chemical Engineering from The Ohio State University, and, after that, spent a year with the Western Ecology Division of the US-EPA as a National Research Council Postdoctoral Fellow, followed by another year of Postdoctoral work at the University of Toronto, Canada.

Her research is focused on sustainable engineering by including the natural systems' role in human-built systems and developing models to study these Coupled Natural-Human (CNH) systems. She also focuses on the issue of nitrogen management from an industrial and economic perspective, urban systems' interaction with biodiversity, and industrial by-product synergy networks. Complex systems methods are frequently utilized in answering the research questions as CNH systems are diverse and complex.

She is interested in teaching courses that look at complex interactions of human systems with the environment along with mathematical modeling and thermodynamics.

She loves to spend time in nature and is deeply committed to preserving natural systems along with providing solutions for sustainable growth. Purdue is an excellent place to make that happen. ▪

Lien/Krutz Scholarship Update

With Dr. Gary Krutz's partial retirement, the ASM and ASABE Clubs began an effort to endow a scholarship in honor of his years in the department, and in memory of Ray Lien. These two men had a lasting effect on the ASM (previously AgMech) and Ag Engineering programs in the department of Agricultural & Biological Engineering, and this was started as a way to preserve that legacy. Many of our alumni benefited, and continue to benefit, from their teaching, guidance, mentoring, and friendship. In addition to collecting funds to endow the scholarship, we have received a number of stories about both men. We are gaining on our goal of $50,000 to endow the scholarship and welcome contributions. The purpose of collecting the stories is to compile a handout to be given to scholarship recipients that tells these stories and preserves the memories for continuing generations.

"...Professor Lien's guidance eased the transition and was very helpful throughout my Ag Mech studies. It is an honor and a privilege to contribute to this scholarship." Larry Loehr

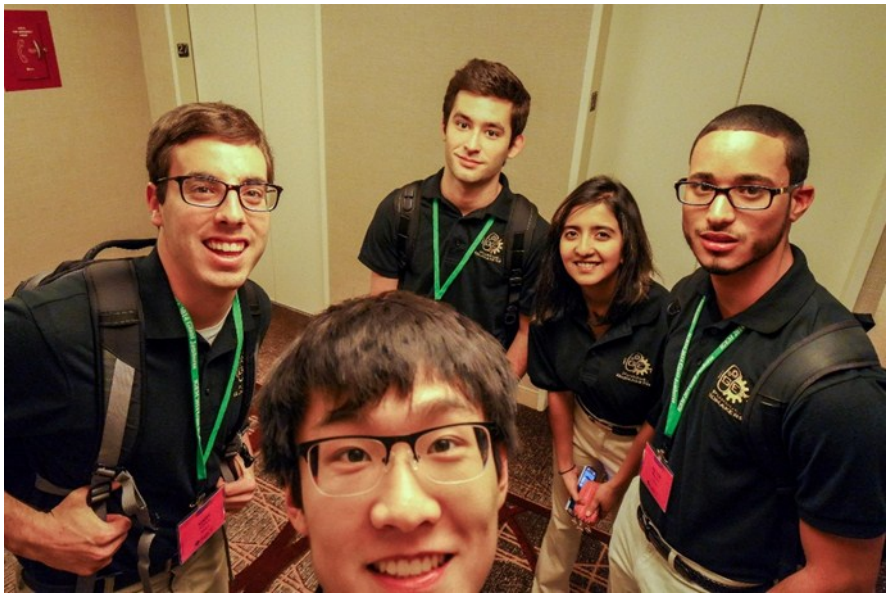
"...One of the things I learned from ...was the art of vertical stacking of files. (This was before computers) I am still able to use that art to find articles of interest, although it sometimes takes quite a while." John Gottbrath

"... I remember [Professor Lien] had a calculator in his office we could use for homework sometimes. It was bigger than a toaster, but at that time was really unique and useful. He was a very caring and dedicated person." Keith Hiatt

"Prof. Lien was a huge factor in my college life and also in my career." David Nurrenbern ▪

Purdue BioMakers Leave Their Mark

The Purdue iGEM team was there for the early years of iGEM, joining in 2006, the third year for the international competition. Chartered on campus as the Biological Engineering Club (BEC), they became the Purdue Biomakers in 2013. The International Genetically Engineered Machine (iGEM) competition is the premier international undergraduate research competition in synthetic biology and genetic engineering. In this competition, students are challenged to apply and even discover new engineering principles to design and redesign cells such as bacteria at the level of DNA. Often the outcome is innovative solutions to real-world problems as wide spread as human health, food production, and energy. Importantly, the students are always required to address safety and to develop and evaluate their work in the context of existing human practices and policies.



From left: Mark Aronson, Tony Tan, Chris Thompson, Swetha Vinjimoor, Peter Mercado. Presenters for the Purdue iGEM team

The team earned an Honorable Mention in their inaugural year for "best bridging strategy" for creating biologically generated photos by modifying *E.coli* to express color via a traditional ink jet printer. The 2013 team (the competition is calendar-year based) placed third in the North American Regional in Toronto, beating out competitors like MIT, Stanford, Cornell, and Yale, as well as the other 65 teams competing. They also won the "Best New Biobrick Part, Natural" award and moved on to face the best of the South American, Asian, and European divisions at the International competition at MIT. This award-winning team adapted statistical methods from the manufacturing industry to improve the predictability of engineering DNA.

The 2009 project involved making useful products from bacteria. The Purdue team worked on developing a consumer products patch that changes color in response to sunlight-induced DNA damage, alerting you to apply more sunscreen.

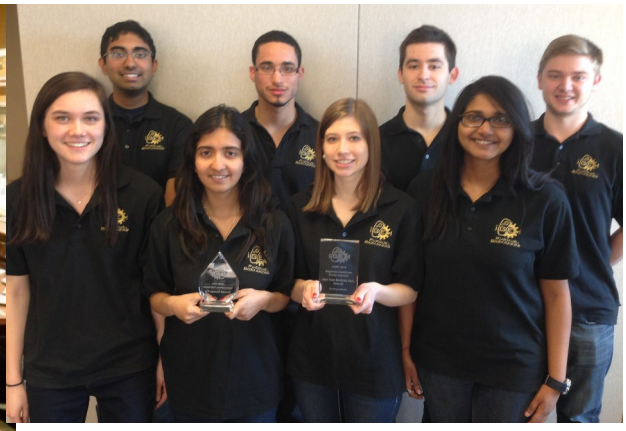
The 2010 project was a "seek-and-destroy" organism to attack the most stubborn and aggressive type of brain tumors in humans. In 2007, the team brought home the bronze in "Bacterial Warfare." The idea was to use three different types of *E. co*li in a battle to the death. To put it simply, A kills B, B kills C, C kills A. The excitement is in the variables: will the death rate surpass the growth rate? It's a deadly game of rock-paper-scissors to determine which bacteria will ultimately survive. The results provide important insights into the complex microbial ecosystems that exist in places like garden soil and our gut.

The 2011 and 2012 teams earned gold medals, continuing on to the World Championship Jamboree. The 2012 team worked with biofilms as a means of

treating waste discharge via the membrane bioreactor process (MBR). This process was developed 40 years ago and is used prominently in Japan, due to the inability of the conventional process to keep pace with population.

While the awards and designs vary from year to year, the most valuable product seems to be the students themselves. Having demonstrated an ability to innovate in a team environment and compete in an international setting, many of the Purdue iGEM alums have gone on to receive prestigious fellowships and scholarships including NSF Fellowships, Barry Goldwater Scholarships, the Astronaut Scholarship, and Kauffman Fellowships.

From left: Aronson, Tan, Hailey Edmondson, Joe Muskat, Thompson, James Welch, Zach Oberhaus. Exploring Boston.



Clockwise from bottom: Tan, Edmondson, Oberhaus, Sriram Boppana, Ryan Wagner, Betsy Benner, Welch, Sam Lee, Thompson, Soo Ha, Professor Jenna Rickus, Casey Martin, Aronson, Michael Drakapolis, Vinjimoor, Mercado, Muskat. Team dinner – largest Purdue team ever!

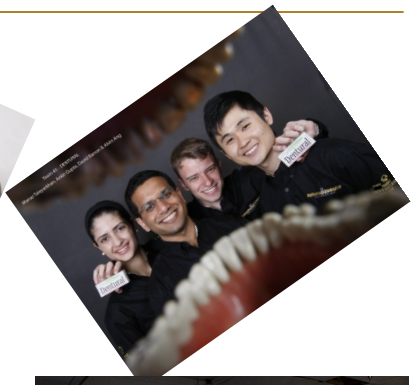
From left: Tan, Muskat, Drakapolis, Oberhaus, Martin, Edmondson, Boppana, Welch. Visit to Harvard.

Although the team didn't place in 2014 (only 6 out of 200 teams placed), this was the biggest team in Purdue iGEM history and was a great learning experience. The attendees were inspired by the projects and the iGEM culture and can't wait to get started on next year's project.

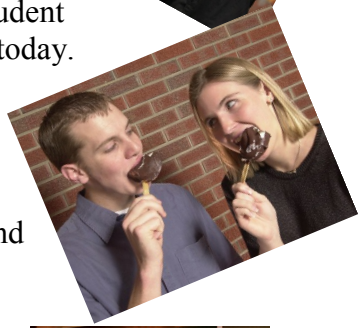
The team would like to invite alumni to be a part of this exciting adventure. Contact the officers at purduebiomakers@gmail.com and Like them on Facebook. ▪

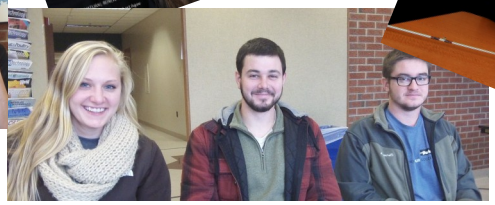
PURDUE
PETE.COLI

PURDUE UNIVERSITY
STUDENT
SOYBEAN PRODUCT
INNOVATION
COMPETITION



Student Soybean Innovation Contest





The Purdue University Student Soybean Product Innovation Competition is a highly successful program sponsored by the Indiana Soybean Alliance and administered through the department of Agricultural and Biological Engineering. Dr. Bernie Tao, Indiana Soybean Board Professor of Agricultural and Biological Engineering believes in the value of the program: "In today's globally competitive environment, innovation and entrepreneurship are critical skills for success. The ISB-sponsored student competition is an excellent way to foster these abilities in our students as well as teaching them the importance of utilization of renewable resources, such as soybeans."

The contest began in 1995 and produced the first commercialized product – soybean crayons. In addition to winning the contest for the student team, Prang bought the rights and continues to market the crayons today. Quite a variety of products have emerged: from soybean candles to soy clay pigeons; from pharmaceutical coatings to Soytures, a medical-grade, self-absorbing suturing material; from hot glue sticks to liquid bandage to denture adhesive; and numerous edible products that increase nutrition while holding down cost. The second-place winners of the 2014 contest were Sara Richert (ABE), Sean Anderson (FORS), and Evan Anderson (ABE), also known as Team SOOTS. Their innovation is an organic, ecofriendly boot conditioner and polish The program is administered by Micky Creech, ABE. "In 2014, the 20th anniversary of the competition, we were pleased to have fifteen teams successfully complete the process – the largest number of teams ever" according to Creech. ▪

College of Agriculture Entrepreneur Day

Glenn W. Sample Dean of Agriculture, Jay Akridge, welcomes the crowd to the 2014 session.

From left: Vorst, Morton, Clayton, Doster, Garwood, Kelley, Hart-Wells

What began in 2012 as a dream has grown into a College-wide event. Joe Garwood (AgMech ’78), along with Professor Gary Krutz, saw the potential for a paradigm shift for ABE undergraduates. Bringing his entrepreneurial expertise to campus became the springboard for a departmental event on October 12, 2012, that featured Garwood, Brian Vorst (AE ’93), Stanley Morton (AE ’66), Vane Clayton (AE ’81), David Doster (AE ’79), and Kevin Kelley (AE ’92, MS ’95), along with Elizabeth Hart-Wells of the Trask Program. Sharing their successes (and failures) in a presentation session followed by a time for questions and answers, they opened a new door for ABE graduates.

Joe Garwood talks with ABE students.

Following the response to the event, Jay Akridge, the Glenn W. Sample Dean of Agriculture, suggested that we establish an annual event and include other departments in the College. November 7, 2013, was the first college-wide event. Joe Garwood returned to speak for ABE, this time to a much wider audience. Along with special guests of the Dean, Sue Ellspermann, Lt. Governor of Indiana, and Dan Hasler, President and Chief Entrepreneurial Officer of the Purdue Research Foundation, four other Departments highlighted alumni from their programs: Barb Cohen (BCHM ’79), Malcolm DeKryger (ANSC ’83), Kim De Wees (AGEC ’95), and Mona Baker Wolf (FS ’72) brought life lessons from an entrepreneur to the Deans’ Auditorium in Pfendler Hall.

From left: Layer, Stapley, S. Hefty, D. Hefty, Orr, and Villwock

This year’s program was held November 13, 2014, and Chris Layer (AE ’81) returned to campus to share insights from his career as an entrepreneur, both with the seniors in ABE 490, and at the evening event. Guests from other Departments in the College: David and Stacey Hefty, Agricultural Economics; Donald Orr, Animal Science; Jonathan Stapley, Food Science; and guest of the Dean, Don Villwock, Agricultural Economics. ▪

Faculty Honors and Awards


Buckmaster

Dennis Buckmaster
David C. Pfendler Outstanding Counselor Award, 2013

Indrajeet Chaubey
ASABE ADS/Hancor Soil and Water Engineering Award, 2014

Kari Clase
College of Agriculture TEAM (Together Everyone Achieves More) Award for the Center for Direct Catalytic Conversion of Biomass to Biofuel (C3Bio). 2014


Clase


Engel

Bernie Engel
ASABE Fellow, 2014

Bill Field
Honorary Master Farmer designation 2014 (Indiana Prairie Farmer and Purdue Extension)


Field


Frankenberger

Jane Frankenberger
Purdue Cooperative Extension Specialists' Association Mid-Career Award, 2013

Nadia Gkritza
National Academy of Engineering Frontiers of Engineering Education Symposium Attendee 2014


Gkritza


Irudayaraj

Joseph Irudayaraj
Fellow, American Institute of Medical and Biological Engineers, 2014

Monika Ivantysynova
SAE Fellow, 2014,outstanding achievements in fluid power research, developing energy efficient systems for mobile vehicle applications.
Purdue Innovator Hall of Fame, 2014


Ivantysynova


Keener

Kevin Keener
ASABE Rain Bird Engineering Concept of the Year, 2014

Michael Ladisch
Fellow of the National Academy of Inventors (2013)
Appointment to FFAR – Foundation for Food and Agricultural Research. 15 -member board of directors.


Ladisch


Mosier

Nathan Mosier
College of Agriculture TEAM (Together Everyone Achieves More) Award for the Center for Direct Catalytic Conversion of Biomass to Biofuel (C3Bio). 2014

Jiqin Ni
Indiana Agricultural Leadership Program Class 15


Ni


Okos

Martin Okos
Book of Great Teachers, 2013

Jenna Rickus
Regional Finalist (top 3), Gold Medal, Best Natural Part. Faculty Advisor. International Genetically Engineered Machine (iGEM) undergraduate research competition "Back to the Basics of Synthetic Biology". 2013


Rickus


Stroshine

Richard Stroshine
ASABE Superior Paper Award for "Three-Dimensional Transient Heat, Mass, Momentum, and Species Transfer in the Stored Grain Ecosystem: Part II, Model Validation." TRANS ASASBE 56:1. 2014 (with Dirk E. Maier)


Umulis

David Umulis
Purdue University Teaching Academy, 2013

Faculty Award Nominations


Engelberth

Abigail Engelberth
ABE Nominee for Richard L. Kohls Outstanding Early Career Award (Agriculture), 2014.

Daniel Ess
ABE Nominee for Richard L. Kohls Outstanding Undergraduate Teaching Award (Agriculture), 2014


Ess

Nathan Mosier
ABE Nominee for Outstanding Graduate Mentor and Teacher Award 2014


Vacca

Jenna Rickus
ABE Nominee for Outstanding Counselor, 2014

Andrea Vacca
ABE Nominee for Outstanding Teacher (Engineering), 2014

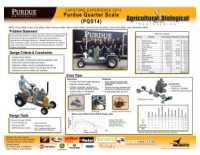
Would you like to see Alumni News in the newsletter? If so, we need to hear from you! New jobs, promotions, weddings, babies, awards—brag to us and we'll brag on you!

For the most current information, make sure you see the monthly ABe-Notes at https://engineering.purdue.edu/ABE/AboutUs/Newsletter

Save the Date!

Each Spring, we combine our Outstanding ABE Alumni and Service Awards with the poster presentation of our senior projects. Join us at the ADM Agricultural Innovation Center on Thursday, April 23, 2015 at 10:00 am for the awards and 1:00 pm for the poster session. Up-to-date information can be found at the website: www.purdue.edu/abe





Agricultural & Biological ENGINEERING

The work we do here matters!

Winter Issue 2014/2015

Alumni and Employers—we need your help! If you haven't already, please stop by http://tinyurl.com/nt8fzzn and complete a survey! Help us to continue to strive for excellence.

Make sure to keep your information up-to-date! Email Carol at cmweaver@purdue.edu with any new information.

Do you have information on a job or internship that might be a good fit for one of our students or graduates? We need your help in identifying opportunities for our students. Contact Yvonne Hardebeck (765.494.1172 or hardebey@purdue.edu) or Nate Engelberth (765.494.3060 or nengelbe@purdue.edu).

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