

ABE @ Illinois

Agricultural & Biological Engineering Spring 2008

Inside:

- > ExplorACES projects attract potential students
- > Bioenergy grant fuels excitement
- > Illinois ABE tops list from *U.S. News and World Report*
- > South Africa: Engineering in a global context
- > Micro steam car competition establishes team spirit
- > USDA-India Agricultural Knowledge Initiative





ABE@Illinois
2008-2009

Editors:
Kaustubh Bhalerao &
Anne Marie Boone

Published by the Department
of Agricultural and Biological
Engineering of the College of
Agricultural, Consumer and
Environmental Sciences and the
College of Engineering at the
University of Illinois at Urbana
Champaign.

338 Agricultural Engineering
Sciences Building
1304 W. Pennsylvania Ave.
Urbana, IL 61801

Phone: (217) 333 3570
E-mail: abe@illinois.edu

Greetings from Agricultural and Biological Engineering

Serving as Department Head of ABE for the past four years has been a wonderful experience. I have been most impressed by the keen sensitivity of the members and friends of ABE for urgent and top priority issues and our excellent ability to join together in analyzing and solving complex problems, while enjoying delightful collegiality. This "graceful effectiveness" has served us well in enhancing the quality of our professional life. With active participation from faculty, staff, students, and external advisors, we have developed an ABE Department strategic plan (available at abe.uiuc.edu). We are excited about our ability to empower human capacity with knowledge and wisdom.

We aspire to be the best agricultural and biological engineering department in teaching, research, and outreach. Our mission is to integrate life and engineering for enhancement of complex living systems that involve agriculture, food, environment, and energy.

Our current technical emphases are in the areas of agricultural automation, bio-energy and bio-products, sustainable environment, biological engineering, and systems informatics and analysis. The core competencies of our people and programs are based on the ACESys (automation-culture-environment systems) model. Our strategic goals for the next five years are to enhance student recruitment and retention, integrate and enhance curricula, increase resources, design organization to advance strategic thrusts, and strengthen faculty capacity.

I believe that a relevant, significant, and exciting organization needs to have the ability to look at the big picture, pay attention to details, make things happen, get things done, and enable people to succeed. It is my great pleasure to present this ABE@Illinois to highlight recent departmental happenings and accomplishments, as well as success stories about the people in and associated with our Department. I hope you enjoy reading about the Department. We are very interested in hearing from you. Please keep in touch.



K.C. Ting,
Professor and Head

New Faces in Agricultural and Biological Engineering



**Kaustubh
Bhalerao**

Kaustubh Deepak Bhalerao joined ABE in the Biological Engineering section as an Assistant Professor in 2005 following the completion of his doctoral degree and postdoctoral research at The Ohio State University in the fields of biological nanotechnology, probabilistic mechanics and modeling. His research interests include automation in the life sciences, nanoscience of protein bioprocessing, and synthetic biology. He teaches ABE 446 (Biological Nanoengineering) and TSM 435 (Electronic and Computer Control

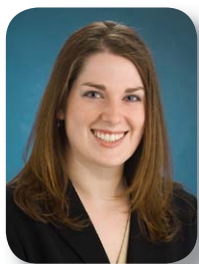
Systems). He is an adviser for first and second year TSM students and is mentoring a new campus wide undergraduate synthetic biology club.



**Luis
Rodríguez**

Following his interdisciplinary PhD at Rutgers University, **Luis F. Rodríguez** joined ABE as an Assistant Professor in the Biological Engineering section in August 2005. His expertise lies in the areas of industrial and systems engineering and bioresource engineering. Prior to joining UIUC, Dr. Rodríguez was a National Research Council Postdoctoral Fellow working at NASA Johnson Space Center and a research scientist at the Universities Space Research Association in Houston, TX. His research interests include the

modeling and analysis of sustainable biosystems and renewable energy systems. He teaches ABE 222 (Agricultural and Biological Engineering II) and is developing two new courses; Engineering of Life Support Systems; and Modeling & Analysis of Biological Systems. He is an adviser for upper level ABE students interested in biological engineering.



Angela Green

The Bioenvironmental Engineering section welcomed **Angela Green**, Assistant Professor, to the Department faculty in February 2008. She completed her doctoral degree in Agricultural and Biosystems Engineering at Iowa State University, where she was supported as a National Science Foundation PhD Graduate Fellow, with research emphasis on systematic assessment of laying hen housing for improved hen welfare. Her professional interests include controlled environment engineering, animal responses to environmental factors, animal-environment interactions, and animal welfare. She will be co-teaching ABE 100 (Introduction to Agricultural and Biological Engineering) and TSM 311 (Humanity in the Food Web) and is developing a new course, Instrumentation for Biological Measurements. She will serve as an advisor to the incoming freshmen ABE students.



Mary-Grace Danao

Mary-Grace Danao became a faculty member of the Department as an Assistant Professor in Biological Engineering in August 2007. Grace received her Ph.D. from the University of Kentucky in 2005 and spent the next two years working as a National Science Foundation International Research Fellow at Cranfield University in Silsoe, Bedfordshire, England. Her research is focused on developing new sensing technologies for monitoring the health and safety of animals, food systems, and the environment. Grace and her students are currently working on stabilizing enzymes in nonaqueous environments and developing biosensor arrays. Grace co-teaches ABE 100 (Introduction to Agricultural and Biological Engineering) and TSM 311 (Humanity in the Food Web) and advises first year ABE students.



Anne Marie Boone

Anne Marie Boone joined the Department in January 2008 as the Student Academic Program Coordinator. She has a background in Crop Sciences and Higher Education and has been a student at the University of Illinois, Urbana-Champaign. In her new position, she will be advising students on coursework and placement, recruiting students, and developing alumni relations. She is establishing Learning Communities for the incoming freshmen ABE and TSM students and is helping to revise ABE 100 (Introduction to Agricultural and Biological Engineering). Anne Marie also mentors the new ABE Student Ambassadors organization. This club provides the Department with recruiting and outreach support by visiting high schools and community colleges, representing the Department at events, and giving tours of the Department to visitors.



Richard S. Gates

Richard S. Gates will join the Department as a Professor in August 2008. Currently he is at the University of Kentucky, where he works as a faculty member in the Department of Biosystems and Agricultural Engineering. A registered professional engineer, he teaches Controlled Environment Agriculture, Probability and Statistics, and Advanced Controls Systems for Agriculture. His recent research and extension activities include a USDA project to quantify ammonia emissions from US broiler and layer operations, and a co-investigator in the first completed EPA Air Consent Agreement project on two broiler house sites in Kentucky. Other interests include bioinstrumentation systems for animal well-being/environment interactions and agricultural air quality.



Lance Schideman

Lance Schideman was welcomed to the Department as an Assistant Professor in the Bioenvironmental Engineering section in October 2007 after completing a doctoral degree and postdoctoral research at the University of Illinois in the Civil and Environmental Engineering Department. His emphasis is on water purification systems that integrate adsorption, membrane and biological processes. His current research interests include intelligent water infrastructure, algae-based bioenergy, integrated water reuse systems, and protecting water resources against emerging threats like endocrine disrupting compounds and homeland security contaminants. Lance will be co-teaching TSM 311 (Humanity in the Food Web) and developing a new graduate course, Case Studies in Water Reuse. He will also be sponsoring the local student chapter of the Water Environment Federation.

Inside:
 Cover stories4
 Open house winners6
 Outside the classroom8
 Micro steam car competition..... 10
 Systems thinking11
 Student stories12
 Alumni & donors.....15

Agricultural and Biological Engineering, Part of \$500 Million Grant

BP announced last year that it would fund the Energy Biosciences Institute (EBI). The energy company chose the proposal put forth by the University of Illinois, the University of California at Berkeley and the Lawrence Berkeley National Laboratory over 52 other institutions because these organizations have a history of delivering “Big Science” according to BP Chief Executive John Browne. The three organizations will receive a total of \$50 million every year over the next ten years. This will fund basic and applied biofuels research including development and cultivation of biofuel feedstock, harvesting, transportation, processing, and ultimately, the delivery of advanced biofuels.

EBI is charged with exploring how an adequate supply of high quality plant biomass can be sustainably produced and utilized in facilities that convert biomass to fuels. Along with feedstock development, EBI researchers will investigate biomass depolymerization, fossil fuel bioprocessing & carbon sequestration, socio-economic systems, and biofuels production. BP has indicated that EBI should pay particular attention to the economic and environmental impact of each process developed or investigated.

Previous research at Illinois on potential biofuel feedstock has shown that *Miscanthus*, a species of tall grass, can reach 3 meters in height in very densely packed fields and yields over 11 tons/acre on average. As part of this program, 340 acres of farmland at UIUC will be set



aside for the study and production of *Miscanthus*. In addition to feedstock development, other Illinois researchers will be working on the socio-economic impacts of biofuels.

The Department is a component of one of eighteen programs to receive funding through this grant. Professor and Department Head K.C. Ting along with Profs. Alan Hansen, Qin Zhang, Tony Grift, Lei Tian, Steve Eckhoff, and Luis Rodríguez are collaborators on the project. The funding provided will allow EBI to hire seven post-doctoral research associates; some have already been hired. The program aims to develop effective and efficient engineering solutions and machinery for the successful production of biomass feedstock while keeping in mind its external interactions and influencing factors, such as social/economic considerations, environmental impact, and policy/regulatory issues. These primary aims will be accomplished through five interrelated tasks: Pre-harvest Crop Production; Harvesting; Transportation; Storage; and Systems Informatics and Analysis. The research team will develop prototypes, computer models and simulations, and ultimately operational machinery design prototypes.

Investigators on the BP project:

K.C. Ting

Alan C. Hansen

Qin Zhang

Tony E. Grift

Lei Tian

Steven Eckhoff and

Luis F. Rodríguez

ABE program still #1

Leanne Lucas

The University of Illinois' Undergraduate Program in Agricultural and Biological Engineering (ABE) has been ranked the best in the United States by *U.S. News & World Report* for the second year in a row.

"We continue to have a high quality program," said K.C. Ting, Head of the Department of Agricultural and Biological Engineering (ABE). "It's hard to hold on to number one, but we have been in the top three for quite a while, so our program has always been strong."

The 2008 edition of "America's Best Colleges" published each year by *U.S. News & World Report*, places Illinois in the top spot. It ranks undergraduate programs accredited by the Accreditation Board for Engineering and Technology. The rankings are based on the judgments of deans and senior faculty from participating colleges, who rate each program they are familiar with on a scale from 1 (marginal) to 5 (distinguished).

"ABE is a unique program," Ting explained. "The ABE Department belongs to the College of Agricultural, Consumer, and Environmental Sciences (ACES) and the College of Engineering. Both colleges are rated among the top five in the nation. For a program to belong to two top five colleges, that's pretty good."

As to the Department's efforts to become number one, Ting stated "ABE developed a strategic plan with a vision of being the 'best agricultural and biological engineering department in teaching, research, and outreach'. We outlined a very clear picture of what we wanted to do. The whole department came behind that plan, and as a result, we have become more effective and efficient in what we do."

Finally, Ting acknowledges that being able to stay at number one will be a 'very difficult thing' saying of his competition "They are all very good. We're in very good company, but that's okay. It's nice to be with the best of the best."



Far left: Prof. Lei Tian's autonomous aerial vehicle surveys a field

Left: A mechanical "arm" lifts harvested feedstock onto a transport vehicle

Engineering Open House and ExplorACES

ABE students win multiple accolades

On March 7th and 8th, 2008 Agricultural and Biological Engineering participated in both Engineering Open House and ExplorACES. The open houses offered a chance to showcase a few of the many globally important research programs and exciting student projects carried out in our Department. As a participant of two open houses, we had displays in the Digital Computer Lab (DCL) as well as displays in our own Agricultural Engineering Sciences Building (AESB).

To encourage our students to participate in Open House and show other potential students the exciting educational programs and opportunities for students offered by the Department, we offered an award for the best student exhibit at the open houses.

First place and a prize of \$500 went to the air cannon exhibit from Sebastian Witkowski and Ed Roy. At the Open House, it was used to launch tennis balls far into the air to the wonderment of open house visitors. Second place went to the IlliniCycler (see following article); team members received a prize of \$300. The third place exhibit in our student competition was the cloud chamber, whose team received a prize of \$200.

Other displays located at DCL included a robot for weed control and an interactive game modeling the carbon cycle. At AESB, we demonstrated an advanced retrofit system used to decrease exposure to diesel engine emissions as well as thermochemical conversion processes used to convert biomass, such as swine manure, into a crude oil product.



Agricultural and Biological Engineering Open House awards:

1st place: Sebastian Witkowski and Ed Roy for "Air cannons"

2nd place: Kim Heinecke, Shotaro Yatsu, Mark Hull, Drew Schilling, Brad Stoll and Jeff Taylor for "IlliniCycler"

3rd place: David Brackmann, Peter DeHaan, and Wes Hammes for the alpha particle cloud chamber

Engineering Open House awards:

1st Place in the "Back to School" category: The IlliniCycler

1st Place in the "Real World" category: The Biofiltration System (part of the EPA P³ project)

2nd place in the Club or Society category: Illini Pullers

The IlliniCycler

PCR on a budget

In Spring 2008, six students devoted their time to reproducing a thermal cycler, one of the most important tools in modern life sciences. A thermal cycler provides the appropriate environment and automation required to replicate DNA in a process known as "Polymerase Chain Reaction" or PCR. The PCR process can take a single strand of DNA and replicate it, forming thousands of copies. The PCR process and the thermal cycler are routinely used in diverse applications such as agricultural and pharmaceutical biotechnology, molecular identification of disease and pathogens, biosafety and forensic investigations.

The goal of the project was to recreate a thermal cycler (called the IlliniCycler) that performs comparably with a commercial device, with the added advantage of being low cost. Creating the fully functional



IlliniCycler required the students to learn and implement several technical skills, including electrical hardware construction, thermal and ventilation design, control and data acquisition,

computer programming and software interface design, market analysis, system integration, safety considerations, aesthetics and above all, team work. The students were guided by Dr. Kaustubh Bhalerao, Assistant Professor in the Department.

The IlliniCycler won first place in the "Back to School" category at the Annual Engineering Open House in March 2008. This bears testimony to the ingenuity, dedication, and proficiencies that students acquire as undergraduates in ABE and TSM (Technical Systems Management). The project was funded by a College of ACES Teaching Enhancement grant.

The EPA P³ Project

A life-changing experience!

Stephen Anderson and Paul Davidson

The origin of EPA P³ (People-Prosperity-Planet) goes back to Spring 2006, when a group of students opted to write a grant proposal rather than a research paper for Dr. Prasanta Kalita's ABE 456 course. This proved to be the beginning of an amazing experience!

Our team of grads and undergrads received an initial award of \$10,000 to compete at the April 2007 National Sustainable Design Expo in Washington, D.C., where we presented our findings to the general public as well as the EPA and other government agencies. Our trip was to conclude following a reception at the National Academy of Sciences Building. However, the EPA director announced our team as one of six award winners (out of approximately 50 competitors) of \$75,000 in additional funds, and we were invited to have breakfast with U.S. Senators Richard Durbin and Barack Obama the following morning.

Illini Pullers

Student organization. Real world experience.

Katie Knapp

For everyone, it is a different day -- the first day the tractor pulls out of the shop, the day the final touches are put on the written design report, or the first day the frame holds up to 1350 pounds. Every team member has a different moment when he or she takes immense pride that their contribution to the team effort has tangible results. Each member, whether an ABE or an Animal Science major, shares the same passion. That passion is for the Illini Pullers Quarter-Scale Design Team, for creating a tractor from scratch and successfully developing a business model along the way.

Illini Pullers offers its members a unique and diverse experience. Students can be involved in every aspect of the team or specialize in one function. For that reason, members come from all over campus with different majors and backgrounds. Everyone has the opportunity to learn from each other and add something different to the group's dynamics, all while helping reach the same

This Phase II award provided funding for field implementation and also encouraged us to develop an international element in our research. We installed two biofilters in central Illinois, allowing us to make new connections with faculty and stakeholders and further test our laboratory research findings.

For the international component of our project, we visited the GB Pant University of Agriculture and Technology in Pantnagar, India (which was begun as part of UIUC's Extension mission in the 1960's). Beginning December 27, 2007, we spent two weeks in India installing our biofiltration system and learning about a culture halfway around the world. Despite challenges including intermittent electricity, scarcity of tools, and a language barrier, the team successfully installed the biofilter. We were also able to visit many historical sites around northern India, including the Taj Mahal, the Jim Corbett Wildlife Park, Nainital in the Himalayas and the Lotus Temple.

goal – to successfully design, build and market an innovative and capable quarter-scale tractor.

Since Illini Pullers functions as a business, all aspects are needed from the powertrain designer to the treasurer, and each function depends on the others for success. As a member of this team, I was able to develop a very unique and valuable skill set that prepared me for my current career. Illini Pullers is an exceptional outlet for engineers to apply their course work. This student organization is set apart from others, in that it also allows members like me, an Agricultural Communications major, to develop skills learned in classes outside of engineering while being exposed to technical scenarios we will encounter in our careers. It is truly real world experience with the benefits of being a student organization.



This project has given team members the opportunities of a complete research experience including writing reports, giving presentations, networking with industry and academic professionals, traveling domestically and internationally, and having a real impact in something about which we, as water quality researchers, are passionate. What started out as a class assignment, developed into a life-changing experience!



Top Left: Sebastian Witkowski and Ed Roy with their air cannon at Engineering Open House

Far Left: Mark Hull describes the IlliniCycler to Open House visitors

Top Right: The EPA P³ team visits the Taj Mahal in Agra, India

Above: The Puller in action

Left: The Illini Pullers with their prize-winning tractor

What some ABE students have to say about study abroad programs in the Department:

“One way in which we find value in our lives is through connections with others. On this trip I not only made newfound acquaintances but also saw my peers and my instructors in a new light.”

“...only here would I have the opportunity and the support to go on a ten-day trip half-way around the world.”

The Ag Mech Club

Brad Nobbe, TSM Class of 2008

My name is Brad Nobbe. I am a Senior in the Technical Systems Management program in the Department. I grew up working at a John Deere dealership in southern Illinois, and I was looking for a program that could help me prepare for that career. When I look back on my development over the last four years, I realize I have gained so much more than I ever expected. It was my perspective that only classes would lead to my future success, but I found out that working with other members in the Department and being involved in the Illini Agricultural Mechanization Club could enhance my character. The Ag Mech Club is a registered student organization that encourages student interaction not only with each other, but also with the faculty. It also allows students to work together outside the classroom on projects and tasks that are of common interest to the club members. Activities include a fund

raiser (the lawn mower winterization), a field trip, a club cookout, a visit to the Louisville Farm Machinery Show, the golf outing, the awards banquet, monthly club meetings, and various other events. Each event brings students and faculty closer together in achieving the goals of the Department. Although club activities imply a few additional responsibilities, students understand the advantage of cultivating relationships and sharing success. Club members take great pride in their accomplishments as an organization and have a genuine interest in improving the environment in the Department. I believe a great deal of the club's success can be attributed to the interest of the faculty and their constant willingness to assist the growth of the club. Both the Department and the club will continue to develop if the students and faculty maintain the same level of commitment they have established in recent years.

Trip to South Africa:

Engineering in a global context

For a third time since 2004, students from ABE will be embarking on a visit to South Africa for a month-long summer program coordinated by Professor Alan Hansen.

The objectives of this program are to raise student awareness and understanding of African cultures in an increasing global context. Students identify and solve real world South African-based engineering problems in collaboration with students and faculty from the University of KwaZulu-Natal, South Africa.

Typically, two students are teamed with two senior South African engineering students to work on an engineering design project. Examples of projects from previous visits have included designing and testing sugarcane cutting devices, installing an automatic weighing system for sugarcane, and designing and testing a flood irrigation system. Projects for Summer 2008 include designing a microalgae bio-diesel production system and designing a small scale biomass heating and cooking device for low income households.

The program also takes advantage of the wondrous Drakensberg Mountains and game reserves in the vicinity. Weekend excursions for sight seeing as well as trips to local industries and agricultural tours make this experience uniquely rewarding.

This program has had a life changing impact on the participants. It has broadened their outlook considerably and will have a lasting influence on their academic, professional, and personal lives.



Water Resource Engineering in Chile

Gina Francis talks about her experiences in Chile and Peru

During the Fall 2007 semester I was fortunate to be able to study abroad in Concepción, Chile. While there I hoped to take classes to finish an International Minor in Engineering, become fluent in Spanish, and learn about the culture of South America. I reached all my goals and learned more than I could have anticipated. It was surprising how much I learned about the soil and water systems in each area I traveled to.

While in northern Chile near the Atacama Desert, I found out that the mining industry, which supports most of Chile's economy, was severely affecting the water supply. By using large amounts of water and polluting what was left, there was barely enough water for the residents. In addition, the logging industry in southern Chile has caused many

erosion problems and created very infertile soils. In Perú, the problem was not lack of water, but poor infrastructure and inefficient transportation of water between the rainforests and Andean lakes in the east to the deserts in the southwest.

As a Soil and Water Resources Engineer, I am motivated to work in a world where the scarcity of resources will become an ever increasing concern. I know that the experiences I am having as a student

of ABE will prepare me for a career where I can help many international communities improve their standards of living through better availability of basic resources.



ASABE and you

Elizabeth Brooks, ABE Class of 2009

I joined the American Society of Agricultural and Biological Engineers (ASABE) my freshman year in order to meet other agricultural and biological engineering students and to get involved in the Department. Getting to know students and professors in the Department outside of the classroom through ASABE has made my college experience really enjoyable. I've learned a lot from other members about who the best professors are, which classes to take, and in general how to survive in the College of Engineering. I have also benefited from my relationships with the faculty, who have helped me find jobs and scholarships, tutored me in some difficult classes, and written many letters of recommendation for me.

ASABE exists primarily to help students with pre-professional career development. At our monthly meetings, we usually have a guest presentation from a practicing engineer. Students can ask questions and connect with people in their chosen specialization. Beyond the university level, events like the Midwest Regional Rally and the Annual International Meeting provide additional ways for students to make contacts. At these conferences, I have met students from other

schools and professional engineers and kept up with new technologies in the field.

One of the best reasons to become an ASABE member is that there are many opportunities for developing leadership skills. Since joining, I have served the club as treasurer, fundraising chair, vice president, and currently, as the club president. As treasurer, I realized what a significant opportunity it is for students to attend professional events at a very low cost. Last year, the lawnmower summerization fundraiser was a great success. With some additional funding from university sources, the club was able to cover almost all of the expenses for the members who attended the conferences.

Working towards a degree from the top ABE program in the nation has been a challenging, yet rewarding, task. It is sometimes easy to get buried under a pile of homework. However, countless opportunities can be found at this University. These activities can open doors to people and experiences that you would never get in the classroom. ASABE has given me the opportunity to make good friends, network, travel, and take on leadership responsibilities. I encourage students to join ASABE and have the fullest college experience they can.

Far left top: The team hikes in the Drakensburg mountains on a week-end excursion

Far left: Making biodiesel out of sunflower oil in South Africa

Above: Gina Francis overlooks Machu Picchu "The Lost City of the Incas" in Peru

“Things like the steam car are a fun way to learn how to manage your time and work with people you didn’t previously know.”

— Cody Krulac

Right: Sarah Grajdura builds her micro steam car

Bottom Right: Dr. Hansen gives Alex Awerkamp, Emelie Schwartz, Sarah Grajdura, and Jason Motsinger suggestions on how to fine tune their car

Bottom: The micro steam car

Micro Steam Car Competition

ABE 100 establishes a foundation of teamwork

On December 7, 2007, the first floor of AESB was turned into a race track as eight student teams from ABE 100 (Introduction to Agricultural Engineering) put their micro steam cars to the test. The 8th Annual Micro Steam Car Challenge celebrates the culmination of a semester long project by first year ABE students. In September, students were given a set of low cost raw materials, tools, and instructions on how to build the car. The students were challenged to maximize the distance and speed their cars could travel on 20 ml of ethanol fuel. With kits on hand, the teams soon found that the project was more than just applying science and engineering concepts. It was a great opportunity to get to know their classmates, build teamwork, and have fun.

Says Sarah Grajdura, “The micro steam car competition was a great way to begin the first semester in ABE because of the amount of teamwork that was needed. By the end of the project, I got to know everyone in my group pretty well. Initially, I was a little hesitant about building a micro steam car since I’d never done anything like that before, but once our group began meeting twice a week, we had a lot of fun building the car together (even though we had



some problems with items catching on fire). The competition itself was fun as well because our group got the chance to see our peers’ cars as well as cars made by graduate students. The best thing about this experience was seeing our hard work come together, with the car finally moving. Overall, I think this was a great start to my freshman year in ABE.”

Cody Krulac thought that, “... even if there was some frustration involved in the building of the car, it could only give us a little dose of what some projects will be like during our time here at the U of I. Things like the steam car are a fun way to learn how to manage your time and work with people you didn’t previously know.”



Robotics in Agriculture

Craig Cordill on simulating a harvester-to-bin operation using LEGO® MindStorms™

Robotics in agriculture is fast becoming commonplace. In order to get people into this high-tech field, the American Society of Agricultural and Biological Engineers (ASABE) created a “Robotics Competition” to take place in Minneapolis, Minnesota at the 2007 annual international meeting. The challenge of the competition was to create an autonomous harvesting system from harvester to bin. Basically, on a small scale, we had to build a machine to transfer BBs from a harvester to the bin using another vehicle to transport it. The hard part was that the robot had to do all of this with no human intervention and only wireless signals. It was quite a challenge.

The team decided to use LEGO® MindStorms™ to create the whole system. These worked great because we all played with LEGO®s

“...even watching the robots when the system didn’t work was fun.”

— Craig Cordill

as kids. With the MindStorms™ computer “brain”, we could program our LEGO® creations to do different tasks. We built 3 different vehicles: a harvester and two “trucks”. The harvester and the trucks communicated with each other by sending messages such as “ready to unload” or “proceed to pit”. If a truck was busy unloading, it could respond likewise, and the other truck would be called instead.

The robots had to effectively communicate in the same way that a harvester driver and truck driver have to communicate in order to get the grain to the bin.

While there were lots of little challenges to get the system working, it was rewarding to see it in action. Actually, even watching the robots when the system didn’t work was fun. It may be a few years before a system like ours is commonplace and robots drive our machines, but the time is coming. I’m just looking forward to this year’s competition in Rhode Island!



The Solar Decathlon

Technologies of the future – here today

A team of University of Illinois students and faculty has been selected as one of 20 teams to compete in the 2009 Solar Decathlon. Each team will receive \$100,000 start-up funds from the Department of Energy to design, build and operate an energy efficient, fully solar-powered home. Approximately \$500,000 more will need to be raised in order for the U of I team to compete.

The team will spend almost two years designing and building an 800-square-foot home. In the fall of 2009, they will transport their solar house to the National Mall in Washington D.C. and compete against the other institutions, including the previous winner from the 2007 Decathlon Technische Universität Darmstadt, from Darmstadt, Germany.

“This is truly a multidisciplinary project and provides a great opportunity for our students from the Colleges of ACES and of Engineering to get actively involved with the team in areas such as indoor environmental control, construction, efficient energy and water usage,” said Professor Xinlei Wang of the Department. “The biggest

challenge for this competition is to win more contests and achieve better standing in the overall competition than in 2007.”

The purpose of the competition is to educate the student participants about renewable energy and energy efficiency and to challenge them to think in new ways about energy; to raise public awareness about efficient technologies; and to help increase market acceptance of solar energy technologies. This is the fourth Solar Decathlon — the first being held in 2002. This year we will look forward to several of our students participating in the 2009 contest. For a complete listing of the institutions in the 2009 competition, sponsors, and other information, visit <http://www.solardecathlon.uiuc.edu>.



Top: A video of the robotics competition can be found at www.abe.uiuc.edu

Above: Visitors tour the UIUC entry for the 2007 Solar Decathlon

The Technical Systems Management Program



**Naftali Garber,
TSM Class of 2009**

Having been born and raised in the city of Chicago, I am not your average TSM student. Without any farming knowledge, or desire for such, I discovered

the TSM program and never looked back.

Transferring from the Department of Electrical Engineering has given me a unique perspective on what an engineering major is and should be—

TSM fits the bill perfectly. The TSM program provides the best of both worlds; it has taught me technical knowledge and problem solving

skills and given me the business foundation I am seeking. From the first class, TSM 100, which has always been taught by the director of the TSM program, a student quickly realizes that they are not just a student, but a member of a family. Every teacher is eager to assist the student before, during and after class; classroom material, advising or the score of the last night's Illini game are all valid topics. The enthusiasm of the professors trickles down to the student at every

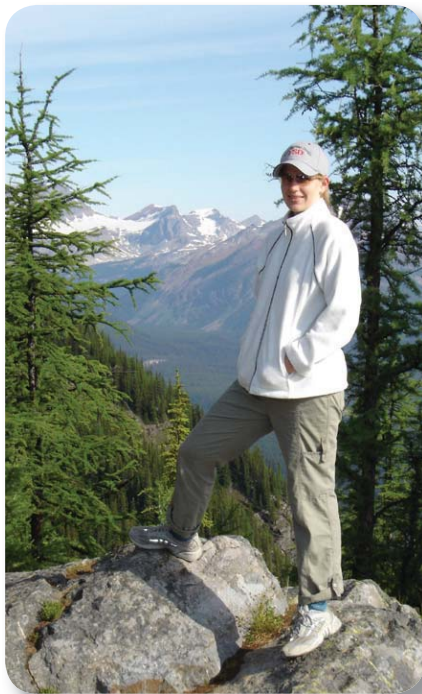
level, motivating students to pursue both activities in clubs and professional experience. It is no surprise that the starting salary of TSM graduates is so high.

"TSM is not just a major, but it is who I have become."

— **Naftali Garber**

TSM is not just a major, but it is who I have become, it has given me the skills and knowledge to excel—that I can take to the bank.

What drew me to Food and Bioprocess Engineering and Agricultural and Biological Engineering?



**Tricia Templin,
FBE B.S. '00, M.S. '02**

I decided that I was going to be an engineer my second or third year of high school because I enjoyed math. I did not necessarily have a

concept of what engineers did, but I decided I might as well go for it. To help decide which engineering discipline to choose, I joined a summer program in engineering at Illinois (the JETS program). It was in this program that I first learned about Food and Bioprocess Engineering. Previously, I would have only associated agricultural engineering with the off-road equipment specialization. The presentation on Food and Bioprocess Engineering captured my interest for several reasons. The curriculum combined traditional engineering courses of math and physics with chemistry, biology and food science. I was attracted to a career at a food company that made products that I could buy at the store, knowing that I had worked on

them. It was also a small department, giving me an opportunity to meet and work with professors and other students on a more personal level.

I joined the food and bioprocess area in the fall of 1995. The first two years were primarily core engineering classes and electives common to all engineering disciplines. Starting my junior year, I began to take more classes in food science, agricultural engineering and microbiology, which I found much more interesting. I graduated with a BS in 2000 after taking some time off for study abroad and internships with Tate & Lyle and Nestle. After graduation, I continued for a master's degree in the same department. I liked the idea of working on a thesis, designing experiments and working on something that had a real world application. I was awarded a Jonathan Baldwin Turner fellowship to help pay my expenses. When I graduated, I had learned tons about grain processing, which came in very handy when interviewing with food companies such as Quaker, Nestle, Frito Lay and General Mills. Eventually, I chose a job at General Mills and have been working since graduation as a Project Engineer.

Graduate Studies in Agricultural and Biological Engineering



**Malia Appleford,
Ph.D. Student**

I am not your usual engineer. I didn't have an engineering degree when I came to Illinois; I have a BA in Biochemistry and Art History and a master's in

Art History, of all things. I spend my free time acting in musicals, and I'm from the suburbs of Denver—just about the least agricultural place you'll find. Yet, I've found my home in ABE.

I came to engineering because I wanted to be part of the solution to the problems I see in the world. I am particularly passionate about sustainable agriculture. This, combined with the systems philosophy of Agricultural and Biological Engineering, drew me to the discipline. As an agricultural and biological engineer, I can use my biological training and my diverse knowledge to engineer systems that will help solve water quality and energy problems.

I applied to a lot of different grad schools (including environmental and mechanical engineering programs), but when I visited here, I knew it was different. I walked in without an appointment and ended up getting a tour from the Department Head—that's how much this Department cares about its students. ABE has this incredible family feel in a top-ranked program, which makes it a great place to be a grad student. The Department is small enough that everyone—faculty, grad students, and undergrads—all know and encourage each other, yet we are working on cutting-edge research and have an international presence. Moreover, the faculty is flexible and has your best interests at heart. I decided I wanted to specialize in a relatively new and exciting subfield—ecological engineering—and the Department here has been immensely supportive as I've designed my coursework and research. Really, what more can you ask for in a graduate experience?

Agricultural and Biological Engineering after Junior College



**Ryan Goss,
M.S. Student**

Welcome to the University of Illinois, home of 40,000 of the best and brightest, highly skilled, highly educated students from all over the world. Words like

these can be somewhat intimidating. When I considered going to a world class institution, I contemplated what would make me stand out from all the other students. As a transfer student, I was under the impression that I was somehow behind in everything. I soon realized that I was actually academically ahead of many of the other students. I attribute this to the one on one attention I was able to receive while in junior college. I was able to form relationships with my professors and get comfortable enough with them to ask for their help. No one expects you to fully understand everything you're taught immediately.

Asking questions is the only way to get the answers you need. Understanding this principle was by far the most influential item to my success at the University of Illinois.

A common misconception with large universities is that you lose the one on one attention that is common in smaller institutions. While I can't speak for all departments on our campus, I can speak for this Department. After arriving on campus it did not take long for ABE to welcome me as part of the family. This family atmosphere was a great asset to my success at Illinois. Getting involved in clubs such as ASABE and Illini Pullers, as well as other activities outside of the classroom, was a great way to get to know the students and faculty. This exposure helped me to build the relationships with my professors that opened the door for me to ask for help. These relationships also led to my future as a Graduate Research Assistant in ABE. This Department truly is a place "where everybody knows your name."

Students transfer to the Department from many places including:

- Black Hawk College
- Carl Sandburg College
- Highland Community College
- Illinois Central College
- John Wood Community College
- Joliet Junior College
- Kankakee Community College
- Kaskaskia College
- Kishwaukee College
- Lake Land College
- Lewis & Clark Community College
- Parkland Community College
- Rend Lake College
- Richland Community College

The Department has collaborations with several countries around the world including:

- Belgium
- Brazil
- France
- Germany
- India
- Israel
- Japan
- Malaysia
- Mexico
- People's Republic of China
- South Africa
- Taiwan
- The Netherlands
- United Kingdom

Right: An artist's rendition of a Mars base (Source: Pat Rawlings)

Farming in Space?

Researcher tackles life-support issues for Mars

It takes years to go to Mars and back and would require a lot of gear and supplies. The cost is prohibitive and supplies cannot be sent on a regular basis.

So, how do you produce food on Mars? And, what happens to all of the waste that builds up during a three-year trip? Luis Rodríguez, Assistant Professor, is working with NASA to answer these questions.

NASA is focusing its effort on developing systems that will allow astronauts to produce their own food, among other things. Crop production and food processing are particularly challenging because crops require a long list of resources, including light, water, fertilizer, and Earthlike temperatures, among others.

A Mars greenhouse, using hydroponics and supplemental lighting, is one system being considered for crop production. Post-harvest processing is also a consideration. Although

International Collaborations

No boundaries

During the period from December 23rd to January 10th, ABE Professor Prasanta Kalita, along with a group of 15 UIUC students and colleagues traveled to India to conduct workshops and build research collaborations. Dr. Kalita was the lead teacher on an intensive, weeklong workshop, "Landscape Hydrology and Water Quality", which was taught at Punjab Agricultural University, Ludhiana and was a part of the USDA-India Agricultural Knowledge Initiative (AKI) program. They visited several federal research laboratories in and around Delhi, as well as the GB Pant University of Agriculture and Technology at Pantnagar, where Dr. Kalita and two colleagues from the UIUC-Center for Teaching Excellence conducted another workshop on "Effective Teaching Pedagogy to Maximize Learning".

Following these workshops, the students worked on a US-EPA funded research project at Pantnagar. In a completely different working environment, our students partnered with Indian students and faculty and installed a water biofiltration system at the Agricultural Research Center of Pantnagar University. It was a very successful project, with the installation being visited by several Deans, Directors, the Vice Chancellor, and the Agriculture Secretary of the State during that time. We now have a UIUC-GBPUIAT research plot at Pantnagar. State-of-the-art sensors and instrumentation at Pantnagar will collect experimental data which will be relayed to our office here in Urbana through a satellite system. This trip was fully funded for the whole group by external grants (from USDA and US-EPA), the NSF funded UIUC-WaterCAMPWS, and UIUC Environmental Council.


some vegetables are essentially pick-and-eat, grain, oil and protein crops require multiple steps before edible foods are produced. Robotics may be used for the labor intensive tasks. A tangible green reminder of home during a long voyage also provides a strong psychological benefit to the crew.

Recycling resources is another key issue. All waste water will need to be cleaned to drinking water standards. Oxygen and the atmosphere need to be maintained, so the carbon dioxide that is exhaled needs to be recycled to form breathable oxygen.

The challenge is to figure out ways to do all these things reliably. There is no abort-to-



Earth option. Limited launch windows force astronauts to weather troubled times. Thus the major challenge has been to ensure that the system will work the first time. Rodríguez concludes "It's hard to get bored working with NASA."



- **Agricultural and Biological Engineering**
- **Technical Systems Management**

*Integrating life and engineering
for the enhancement
of complex living systems*

SOIL & WATER ENGINEERING
OFF-ROAD EQUIPMENT ENGINEERING
BIOENVIRONMENTAL ENGINEERING
FOOD & BIOPROCESS ENGINEERING
BIOLOGICAL ENGINEERING



Agricultural and Biological Engineering
338 Agricultural Engineering Sciences Building
1304 W. Pennsylvania Avenue
Urbana, IL 61801

SAVE THE DATE

for a

Celebrate ABE@Illinois Event

September 5-6, 2008

For more information:

<http://abe.uiuc.edu>