The Biological Engineering Major at Penn State

Combining world-class engineering with biological sciences for building a better world.

Choose your own path. Create your own vision.

Undergraduates
Agricultural engineering
Biological processing and products
Biomass energy
Food engineering
Machine systems
Natural resources engineering

Graduate Students
Key department research areas:
Bioenergy/value recovery
Biologically based production
Bionanomaterials
Food process engineering
Machine systems
Natural resources engineering
Structures and environments

Start here.
Dept. of Ag and Biological Engineering
Student Information
249 Ag Engineering Building
University Park, PA 16802
Phone: 814-865-7792
Fax: 814-863-1031
E-mail: abedepth@psu.edu

Penn State is committed to affirmative action, equal opportunity, and the diversity of its workforce. U.Ed.ENG-10-36
ENGINEERING & TECHNOLOGY FOR A SUSTAINABLE WORLD

Welcome to our 5th issue of DISCOVER
Careers in Agricultural and Biological Engineering

Choosing a major, deciding on a career, or taking the first steps toward a profession? This special issue of Resource is designed to help you in the process, showcasing opportunities in the growing, thriving field of agricultural and biological engineering. You will find the profiles and interviews thought-provoking.

And we hope that you will be impressed with the diverse possibilities—from internships and studies abroad to the jobs awaiting agricultural and biological engineering graduates.

Interested? Turn the page!

ADVERTISING SCHOOLS

Inside Front Cover
Penn State University

University of Illinois
University of Arizona
University of Arkansas
Texas A&M University
Purdue University
University of Saskatchewan
University of Minnesota
University of Kentucky
University of Tennessee
University of Saskatchewan
South Dakota State University
Michigan State University
The Ohio State University

Inside Back Cover
University of Nebraska-Lincoln

Back Cover
University of Florida

Cover ©sunnyfrog/dreamstime.com

RESOURCE: Engineering & Technology for a Sustainable World

Vol. 16 No. 8

Resource: Engineering & Technology for a Sustainable World (ISSN 1076-3333) (USPS 009-560) is published eight times per year—January/February, March, April/May, June, July/August, September, October/November, and December—by American Society of Agricultural and Biological Engineers (ASABE), 2950 Niles Road, St. Joseph, MI 49085-9659, USA. Periodical postage is paid at St. Joseph, MI, USA, and additional post offices.

SUBSCRIPTIONS: Contact ASABE order department, 269-932-7024. COPYRIGHT 2009 by American Society of Agricultural and Biological Engineers. Permission to reprint articles available on request. Reprints can be ordered in large quantities for a fee. Contact Donna Hull, 269-932-7026. Statements in this publication represent individual opinions. Resource: Engineering & Technology for a Sustainable World and ASABE assume no responsibility for statements and opinions expressed by contributors. Views advanced in the editorials are those of the contributors and do not necessarily represent the official position of ASABE.

Magazine staff: Donna Hull, Publisher, hull@asabe.org; Sue Mitrovich, Managing Editor, mitro@asabe.org; Glenn Laing, Contributing Editor, lang@asabe.org; Melissa Miller, Professional Opportunities and Production Editor, miller@asabe.org; Sandy Rutter, Consultants Listings, rutter@asabe.org. Editorial Board: Chair Suranjit Panigrahi, North Dakota State University; Secretary/Vice Rafael Garcia, USDA-ARS; Past Chair, Edward Martin, University of Arizona; Board Members Wayne Coates, University of Arizona; Jeremiah Davis, Mississippi State University; Donald Edwards, retired; Mark Riley, University of Arizona; Brian Steward, Iowa State University; Alan Van Nahmen, Farm Buddy; and Joseph Zulovich, University of Missouri.

American Society of Agricultural and Biological Engineers
2950 Niles Road
St. Joseph, MI 49085-9659, USA
269-429-0300, fax 269-429-3852
hq@asabe.org, www.asabe.org

December 2009

3
Food and process engineers work on the boundary where biology meets engineering. They combine design expertise with large-scale manufacturing to develop the processing methods needed by industry. They are experts in food pasteurization, sterilization, freezing, and dehydration as well as packaging, transportation, and storage of perishable products. They also use microbiological processes to produce fermented foods, fuels, biochemicals, and pharmaceuticals, and to treat municipal, industrial, and agricultural wastes. Increasing concerns about food safety and environmental protection are creating a growing demand for food and process engineers.

Bioprocess Engineering

Bioprocesses include bioreactors, fermenters, and other systems for the production of pharmaceuticals, vitamins, preservatives, and food supplements. Bioprocess engineering also includes the use of biological organisms to produce energy, including fermentation to produce ethanol and anaerobic digestion to produce methane. Graduates in this new, rapidly expanding field pursue careers in medicine, biomedical engineering, environmental engineering, natural resources, agriculture, and related areas.

Aquaculture

Aquaculture refers to raising fish and shellfish to sell as food and for other uses, such as ornamental and bait fish. Aquacultural engineers concentrate on increasing production while decreasing costs and environmental impacts. They seek ways to reduce pollution from aquaculture production systems, reduce excess water use, and improve ponds and other fish-rearing systems. They also work with aquatic harvesting, sorting, and processing systems. Agricultural and biological engineers who specialize in water quality, biotechnology, power and machinery, natural resources, food processing, environment, and sanitation are well-suited for careers in this expanding field. As natural fish supplies decline around the world, aquaculture is an area that will continue to grow.

Energy

Our society runs on energy, which is produced in many ways, including the combustion of fossil fuels like coal and gasoline. Too often, harmful substances are released when producing or using energy. These waste products cause air and water pollution and may contribute to global warming. Biological and agricultural specialists are developing alternative energy sources, such as plant-based fuels and solar power systems. These energy options may help sustain our quality of life while reducing adverse effects on the environment. These specialists also seek ways to conserve energy and improve the environment using current technology. Alternative energy is a growing field, and energy conservation will pose ongoing challenges for the future.

Structures and Environment

Structures and environment engineers design and build greenhouses and animal housing, storage structures for food products, and waste handling facilities. In particular, these engineers design the systems that provide environmental control for these facilities, including ventilation systems and equipment that heats, cools, lights, reduces harmful emissions, and controls conditions in and around specialized agricultural facilities, such as plant growth chambers, bioprocessing laboratories, commercial greenhouses, animal production facilities, cotton gins, grain elevators, and food processing plants.

Aquaculture

Aquaculture refers to raising fish and shellfish to sell as food and for other uses, such as ornamental and bait fish. Aquacultural engineers concentrate on increasing production while decreasing costs and environmental impacts. They seek ways to reduce pollution from aquaculture production systems, reduce excess water use, and improve ponds and other fish-rearing systems. They also work with aquatic harvesting, sorting, and processing systems. Agricultural and biological engineers who specialize in water quality, biotechnology, power and machinery, natural resources, food processing, environment, and sanitation are well-suited for careers in this expanding field. As natural fish supplies decline around the world, aquaculture is an area that will continue to grow.

Bioprocess Engineering

Bioprocesses include bioreactors, fermenters, and other systems for the production of pharmaceuticals, vitamins, preservatives, and food supplements. Bioprocess engineering also includes the use of biological organisms to produce energy, including fermentation to produce ethanol and anaerobic digestion to produce methane. Graduates in this new, rapidly expanding field pursue careers in medicine, biomedical engineering, environmental engineering, natural resources, agriculture, and related areas.

Food and Process Engineering

Food and process engineers work on the boundary where biology meets engineering. They combine design expertise with large-scale manufacturing to develop the processing methods needed by industry. They are experts in food pasteurization, sterilization, freezing, and dehydration as well as packaging, transportation, and storage of perishable products. They also use microbiological processes to produce fermented foods, fuels, biochemicals, and pharmaceuticals, and to treat municipal, industrial, and agricultural wastes. Increasing concerns about food safety and environmental protection are creating a growing demand for food and process engineers.
Information and Electrical Technologies

As in other industries, information and electrical technologies provide agriculture with increased efficiency, reliability, and safety. Information and electrical technologies are used throughout modern agriculture, from radio-frequency identification collars on livestock, to electronic yield monitors and obstacle sensors on harvesters. The future of this field is very promising, and includes combining computers and sensors with mechanical systems for automated harvesting and sorting of produce, and using satellite-based guidance systems and robotic actuators to create tractors and combines that steer themselves across the field.

Standards and Safety

Modern agriculture depends on mechanization, but these large machines can present hazards, especially when combined with long hours and solitary working conditions. Manufacturers strive to build equipment that is safe to operate and maintain by following industry-wide safety standards. Using injury data, field tests, and laboratory analysis, safety specialists study the use, and possible misuse, of agricultural machines, and help ensure the equipment’s compliance with safety regulations. To keep informed of new standards, they often participate in the organizations that develop these guidelines. Safety specialists and engineers are employed by equipment manufacturers and government agencies, and they often work as consultants.

Soil and Water

Soil and water engineers study the interaction of plants, animals, and humans with soil and water. They seek ways to control soil erosion and reduce the effects of sediment and surface runoff on water quality. They design, build, and maintain drainage and irrigation systems for agricultural operations as well as water control structures for reservoirs, floodways, and channels. They also design equipment for applying fertilizers and pesticides. Soil and water engineers are experts in the principles of hydrology. They must also understand chemistry, environmental science, and the mechanics of water and wind erosion.

Power and Machinery

Modern agricultural machines must be mechanically sound and biologically sensitive, and onboard computers are becoming standard equipment. These machines are designed and tested by engineers educated in a power and machinery curriculum. To keep up with the growing demand for innovative, high-tech equipment, equipment manufacturers need more university-trained engineers. Power and machinery graduates are commonly employed by farm equipment manufacturers, but they also qualify for positions outside the farm equipment industry. Many have found engineering employment with other companies, including industrial facilities and manufacturers of construction equipment.

Environmental Quality

Environment concerns are in the news: food processing plants are asked to reduce the pollutants returned to estuaries and bays, large-scale livestock production systems affect local water and air quality, and questions arise about the sustainability of the seafood industry. These and other environmental issues illustrate the opportunities available for engineering graduates who understand the Earth’s sensitive ecosystem and the biological and physical treatment of pollution. The demand for environmental engineering graduates has never been greater, because everyone must do a better job of protecting and improving the environment.

Thanks to Paul Heinemann, Professor, Penn State Department of Agricultural and Biological Engineering, for his knowledge and editing expertise on the above.
CHOOSING A DEGREE IN AGRICULTURAL AND/OR BIOLOGICAL ENGINEERING can be a rewarding path. Creative challenges and diverse opportunities abound. Many students delve into studies and research that leads to new solutions or the development of new products and processes. And education isn’t confined to formal classrooms. “What I want to be when I grow up” is often confirmed when studying abroad or learning on-the-job through internships.

The students and career professionals on these pages have taken the ag and bio engineering path, and all affirm that it is the scenic route to an exciting profession working in service to humankind.

We hope you will be enlightened, enthused—even energized—by their stories, captured in their own words, with accompanying photos that reveal their personalities and interests.

**Tom Hefferan**

**HOMETOWN:** Grand Rapids, Michigan  
**GRADUATION:** Michigan State University, Biosystems Engineering B.S., May 2004  
**PRESENT WORK:** Process Engineer, Eli Lilly, Carolina, Puerto Rico  
**INTERESTS:** Basketball, tennis, running and playing at the beach with my wife and our chocolate lab

I chose Biosystems Engineering because I was looking for a leading-edge degree continuing to shape itself. At the time, I had been reading quite a bit about foodborne diseases, genetically modified foods, and globalization. What I thought (and still think) is that this major will continually grow in importance throughout the 21st century as our old ways of doing things (for example, food transport) are modified to keep up with global demands for safe, cheap, and healthy food products.

Directly out of college, I worked with an engineering design firm focused on the food, dairy, and pharmaceutical industries. I spent much of my time on start-ups—projects that are in the installation, commissioning, and qualification phase in a new or existing manufacturing facility. This experience gave me an opportunity to do the things I love: hands-on work with equipment, troubleshooting, and process design—as well as see a variety of foods, people, and equipment.

During a start-up at Eli Lilly’s human insulin manufacturing site in Carolina, Puerto Rico, I saw a challenge I hadn’t tackled: the biotech industry—and an opportunity to work as a process engineer with a production team.

At Lilly, I support all technical aspects of nine clean-in-place (CIP) systems that are used in our Fermentation/Primary Recovery and Purification buildings. In short, my job is to make sure these systems are operating reliably, safely, meeting all cleaning specifications.

Our facility is ramping up production, while trying to reduce the use of raw materials, such as cleaning agents. Corporate places a “green” focus on manufacturing, and my project in limiting water usage is (hopefully) a big piece of that puzzle.

Recently I’ve gotten into a hobby that mirrors some of my work experiences: home beer brewing. Much to the dismay of my wife, I turn our kitchen into a virtual lab on brewing day. It’s been really fun to use practical engineering tools in a process as rewarding as beer brewing.

My advice to college/career seekers? Don’t lose sight of the skills needed by today’s engineering professionals, which go beyond technical problem solving: presentation of ideas and information, interpretation of technical information, leadership, and teamwork.

I had no idea that I would be working in the pharmaceutical/biotech industry when I was going through the biosystems engineering coursework, so don’t get frustrated if you don’t find your dream job right away. You may find something in a different industry that you like even more.
**Tyler Schifferl**

**HOMETOWN:** Fordyce, Nebraska  
**GRADUATION:** South Dakota State University, Agricultural and Biosystems Engineering B.S., May 2009  
**PRESENT WORK:** Design Engineer, Vermeer Corporation, Pella, Iowa  
**INTERESTS:** Horse training, rodeo, rock climbing, guitar

I grew up on the family ranch, training horses and rodeoing. I enjoy pole vaulting and rock climbing, but I love to ride and rope and have trained horses on summer jobs since I was 16. I do cowboy-style trick roping assemblies for elementary school children, make horse tack, and have tied over 500 horse halters for my business. I even made an instructional DVD about how to make halters.

As a kid, I was always building and fixing things, and doing construction on the ranch. I thought engineering might be the field for me, specifically ag engineering because of the diversity within the field.

I selected SDSU because of the ag/bio program and the rodeo team. The track coach asked me to pole vault (vaulting 5.05 m was a college highlight!), and I was able to train horses for the university’s equine science program on the side, too.

My professors had a passion for agriculture and engineering, and I felt right at home. Because of my mechanical bent, a power and machinery class—studying implements and the engines that power them—was terrific: everything from internal combustion engines to transmissions to seeders. I took away many applicable skills, which I used in my internship and continue to apply in my professional career.

I’m working as a design engineer in Vermeer’s trenchless division. I design reamers for horizontal directional drills and do some prototype design on some new products. With the economy as it is, I feel blessed to have a job, let alone a job with a company that I really admire. I’m in my element!

---

**Christine Kierleber**

**HOMETOWN:** Colome, South Dakota  
**GRADUATION:** South Dakota State University, Agricultural Engineering B.S., December 2010  
**INTERESTS:** Biking, fishing, horseback riding, painting

I like to think of myself as a well-rounded person. I love to be artistic yet do technical activities as well. Sitting around doing nothing drives me crazy! In middle and high school, I jumped in with both feet in local and regional science fairs. Sophomore and junior years, I attended the International Science and Engineering Fair, and a wide variety of projects intrigued me.

Success with fair projects, excelling in math and science, and having encouraging calculus and chemistry teachers all led me to explore careers in engineering. Choosing the discipline was more difficult. The opportunities available are amazing! When it came down to selecting a major, my farm background and the incredible institutions available for study played huge roles.

At SDSU, I am one of the founding members of the campus Alpha Omega Epsilon engineering sorority colony, currently in charge of group philanthropies: the Brookings Breast Cancer Awareness Bike Ride, Children’s Miracle Network State-a-thon, and Relay for Life. I am also active in ASABE, the American Society of Women Engineers, and have served as a math tutor for freshmen ag eng students.

I worked on an undergrad research project for many hours in the lab, running tests, analyzing data, and writing about a new process for producing ethanol through liquefaction and saccharification without alpha amylase and glucoamylase enzymes. There is a patent pending on it! And last summer, through an internship, I worked on finding new value-added uses for distillers grains, and am readying a paper to submit for publication.

After college: a master’s in engineering or pharmaceutical sciences awaits. I would love to work in research and development, perhaps in a biopharmaceuticals lab.
Elizabeth Brooks Bruns

**HOMETOWN:** Lincoln, Illinois

**GRADUATION:** University of Illinois, Agricultural Engineering B.S., May 2009

**PRESENT WORK:** Civil Engineer, U.S. Army Corps of Engineers, Rock Island District, Water Quality and Sedimentation, Rock Island, Illinois

**INTERESTS:** Whitewater kayaking, college basketball, the St. Louis Cardinals, music; swimming, baking and eating desserts!

Students know about engineering—civil, mechanical, electrical, etc.—and some even know they want to study engineering, but many are unaware of the diverse kinds of engineering, much less where they would best fit.

When I applied to college, I had no idea what I wanted to do. I started in general engineering, but I wasn’t satisfied. I had friends in ag eng and after speaking with some professors, I decided to change my major to a better fit with my background and interests.

I learned as much, if not more, outside the classroom than in it in preparing for a career. One of my best learning experiences was with a team of undergrads on a water quality research project. I not only learned a lot about the topic, but I also learned about the process of performing research and how to work within a multi-disciplinary team.

Surprisingly, I also learned a lot from a class called “Rigidity and Flexibility in Japanese Arts and Cultures.” The Japanese way of thinking is very different from the American way, including religious beliefs, philosophical perspectives, artistic expressions, aesthetics, and the tea ceremony. The lesson that stuck: enjoy each moment and the people in it. As a three-time cancer survivor, recent college grad in a new job, and a newlywed, I adhere to that!
HOMETOWN: Pittsburgh, Pennsylvania

GRADUATION: The Pennsylvania State University, Wildlife and Fisheries Science B.S., 2000, and Environmental Science M.S., 2004; The Ohio State University, Food, Agricultural, and Biological Engineering PhD, 2012

INTERESTS: Soccer, hiking, downtime with my dog, local live music

I lose my keys almost every day, and I hate waking up early! I’m allergic to almost anything that touches my skin, and I chose a profession where I encounter poison ivy and mosquitoes all the time!

As an undergrad, I loved science, animals, and the outdoors, so Wildlife and Fisheries Science was a good fit (and it meant less math and physics than veterinary science!) I knew about environmental engineering, but I didn’t want to clean air stacks in factories or clean up landfills. (Environmental engineering has come a long way since then!) I wanted to be the next Diane Fossey or Jane Goodall. I thought that engineers were just geeky guys punching numbers on their calculators.

I learned about career possibilities from my advisor and discovered I could incorporate my wildlife science background into engineering. The two are not mutually exclusive—which is sometimes the perception because of how segregated departments can seem from each other.

My first class as an Ohio State graduate student was an upper-level engineering course on how to collect data to conduct research on stream morphology. Before I knew it, I was taking almost all agricultural and ecological engineering courses and doing well. And I was doing a lot more than just sitting in a lab crunching numbers. We were outside almost every day collecting data on streams and rivers. I was able to use my knowledge of wildlife biology to incorporate fish and habitat into the hydrology of streams and study how they were related. I chose to go for a PhD to learn more about my field and to make sure I had a place at the table with other engineers!

As a graduate student, I try things I never would have as an undergrad, and I find I’m really good at them. You can learn a lot from being really bad at something, but you won’t know unless you give it a try!

I would like to become a professor after graduation and focus on outreach and extension—bridging the gap between the experts and everybody else. If that doesn’t work out, I’d like to be a research scientist/engineer in stream geomorphology/ecology. Or maybe I’d like to be ...
Agricultural and Biological Engineering

BIOENVIRONMENTAL ENGINEERING

BIOLOGICAL ENGINEERING

FOOD & BIOPROCES ENGINEERING

OFF-ROAD EQUIPMENT ENGINEERING

SOIL & WATER ENGINEERING

Technical Systems Management

CONSTRUCTION MANAGEMENT

ENVIRONMENTAL SYSTEMS

MECHANIZATION, MARKETING AND TECHNOLOGY MANAGEMENT SYSTEMS

PRODUCTION SYSTEMS

RENEWABLE ENERGY SYSTEMS
THE UNIVERSITY OF ARIZONA
engineering for the basic necessities of life

B.S. in Biosystems Engineering
M.S. and Ph.D. in Agricultural and Biosystems Engineering

Biological/Biosystems Engineering
- Bioprocessing/Bioreactors
- Enzymatic conversions
- Plant pharmaceuticals

Controlled Environment Engineering
- Greenhouse Engineering
- Hydroponics/Tissue Culture

Alternative Energy Engineering
- Biodiesel/Ethanol/Hydrogen
- Algae/Biomass

Sensors and Control
- Biosensors
- Nanotechnology

Water Resources/Irrigation Engineering
- Irrigation systems
- Water management
- Water Quality

Additional Undergraduate Tracks in
- Biomedical Engineering
- Pre-Medicine

Department of Agricultural and
Biosystems Engineering
1177 E. Fourth Street
Shantz Building, Room 403
Tucson, AZ 85721
(520) 621-1753 Phone
(520) 621-3963 Fax
http://ag.arizona.edu/abe

Biological Engineering

Biological engineers improve people’s lives and help assure the future quality of life on our planet by solving problems associated with living systems. Biological engineers integrate engineering with a variety of living systems to help keep people healthy and safe.

Our students do real-world projects that teach hands-on application of engineering design as well as teamwork and communication.

In addition to our ABET-accredited undergraduate Biological Engineering program, we offer four graduate programs:

- Master of Science in Biological Engineering
- Master of Science in Biomedical Engineering
- Master of Science in Engineering
- Ph.D. in Engineering

Department of Biological and Agricultural Engineering
205 Engineering Hall
University of Arkansas
Fayetteville, AR 72701
479-575-2351
Jesi Lay

HOMETOWN: Broken Arrow, Oklahoma
GRADUATION: Oklahoma State University, Biosystems Engineering, Environmental and Natural Resources, B.S, 2010
INTERESTS: Running, lacrosse, sustainability

I found out about biosystems engineering by surfing OSU’s website. I wanted to change my major from industrial engineering to one with a focus on environmental issues. At the time, I didn't even know biosystems engineering existed!

This year I have gotten involved with Clean Water Mission, an organized effort to provide clean water via water filtration systems to high-poverty areas in and around Monterrey, Mexico. As well, I interned with the Water Management Department of Woolpert, Inc., in Columbia, S.C. I'm not an office person, and I got to do a lot of field work in water initiatives.

My best college experience has been with the “Real Cowboys Recycle” tailgate recycling program. I have been able to develop leadership, communication, and networking skills, as well as create friendships and ties to the Stillwater community. And to think, all of this due to recycling!

I’ll never forget how it all began ... three girls walking from tailgate to tailgate, digging elbows-dip through trash bags to collect recyclables. One year later, the program has grown and evolved, won several awards, and recycled over 56,000 aluminum cans for Stillwater's Habitat for Humanity. My experience with Tailgate has helped me grow in so many ways and was integral for me becoming a Morris K. Udall Scholar.
Like most high school students, I started getting recruitment letters in my junior year. I had an interest in agriculture, and I liked to figure out how and why things work. So, when I stumbled across an agricultural engineering program, I knew it was a great match for me.

The only previous exposure I had with ag engineers was when someone complained about how "some engineer welded a big plate in front of that one little bolt ..." Guilty of saying such things, so when designing, I make things easy to fix when things go wrong! I like the engineering challenge—coming up with new ways for work to be faster, easier, and more efficient.

I chose the University of Minnesota because it was close to home, offered a great scholarship package, and, while college shopping, I met a few excellent professors. I am very hands-on, and I liked the U’s large workshop. I was interested in the ski team, too, and that definitely affected my choice.

My standout experience so far is studying abroad in Australia. I can hardly stop talking about it! I would recommend study abroad to anyone. You learn more about yourself and about different cultures.

If you are thinking about ag/bio engineering, tour a school when classes are in session. It’s not the same when the students are gone. Talk to professors. Go to the shop. You can tell a lot about a school by what the shop looks like—if it is active in developing new products or if a lot of time is spent with theoretical developments. Ask what real-world projects the profs are working on. Look at the surrounding community for grocery stores, shopping centers, and other conveniences you might need. And apply for all the scholarships you can. There is no other time in your life when you have this kind of opportunity for people to give you money!
Andrew Olson

HOMETOWN: Kingman, Arizona

GRADUATION: University of Arizona, Biosystem Engineering, B.S., 2008

PRESENT WORK: Engineer, Aero-Flite, Inc., Kingman, Arizona

INTERESTS: Car restoration, motorcycles, fishing

Aero-Flite, Inc., is the largest private operator of CL-215 water-scooping aircraft in North America. It specializes in providing rapid, reliable aerial fire suppression service to customers in the United States and Canada.

At Aero-Flite, I provide engineering support for aircraft structural repairs on short notice. A typical day involves communication with clients, reviewing damage on aircraft, analysis, and preparing and reviewing the repair process. This year, I worked with a client to design a removable ferry fuel system for long-duration flights, transporting aircraft from the mainland to Hawaii.

Every day is exciting—each repair project unique from the last. And each repair relies on the ability to efficiently diagnose, analyze, and design a repair to put the aircraft back into service quickly and, most importantly, safely.

I was born and raised in Kingman, Ariz. When I left for college, I never thought that I would return. But lo and behold, here I am! My hobbies include restoring my car, riding my motorcycles, catching the waves on the Colorado River, and fishing. On weekends, I race motorcycles every chance I get.

I was referred to the ag and biosystems department at the U of A by a close family friend and never looked back. I chose the major and the department because of the size and friendliness of the people.

My advice? Don’t get caught up in planning for the future while attending classes. Unplug tomorrow and focus on what needs to be done now. Get through school, gain confidence in your skills and abilities, and show a willingness to learn on the job.

Stephanie Swanson

HOMETOWN: Cedar Rapids, Iowa

GRADUATION: Iowa State University, Agricultural Engineering B.S., 2008

PRESENT POSITION: Engineering Development Program, General Mills Flour Mill, Kansas City, Missouri

INTERESTS: Reading, ultimate frisbee, cooking, long walks with my puppy

I grew up on a farm and was active in FFA, which led me to Iowa State. I signed up for chemical engineering, but after only a semester decided to switch to ag eng for the diversity of courses and the broad education I would receive in chemistry, biology, engineering mechanics, controls, design, and more. I studied abroad, had several internships, and the professors were incredibly helpful every step of the way.

I found internships at Caterpillar and General Mills through the Iowa State career fair. It’s really an incredible event! Every spring and fall, anywhere from 200 to 500 companies actively recruit Iowa State engineering grads, and many recruiters are former Iowa Staters. It’s a great opportunity to get your résumé in and land some interviews—to show yourself off rather than applying online and being another number in a pile of résumés.

My internships affected my post-graduation choices. What I learned in the classroom was essential to what I did on the job. Fluid mechanics, control systems, statistics—they all play a part in reliability and efficiency on the plant floor. Without the internships, I wouldn’t have known what I wanted to do and how to apply what I was learning in the classroom. Each internship experience helped me discover what I was really interested in—not only for the next semester of classes, but sifting out jobs I wanted to apply for when I graduated.

I love coming to work every day in steel-toed shoes, wearing a hard hat and safety glasses, and knowing that what I do improves the performance of our plant and makes someone’s job easier. The people at General Mills are always striving to be more competitive, build a greater team atmosphere, and be an excellent corporate citizen in the surrounding community and the world. I come to work confident, knowing that what I do makes a difference, and I’m glad to be a part of this corporate setting.
How did you find out about agricultural and biological engineering? What led you to it?

SARA: I thought I wanted to be in the medical field. When I started college, I was planning on going to pharmacy school. However, after a few chemistry courses, I decided that profession was definitely not for me!

REBECCA: I was drawn to ag and bioengineering because I wanted to improve the environment, and I thought that the food, agricultural, and biological engineering department at Ohio State would help me achieve that goal. I really enjoyed the research, and I like how engineering can implement improvements that make a direct impact on everyday life.

In what class did you learn the most, and what did you take away from it?

SARA: Without a doubt, 773 Engineering Soil-Water Management, taught by my graduate advisor, Dr. Ward. We received a problem within a stream presented by our instructor. We then met with the client to understand their concerns with the stream and with regulatory agencies to understand the legal aspects within Ohio. Based on our findings, we recommended solutions to the client.

The other course I learned a lot from was my study-abroad to South Africa when I was a senior in undergrad engineering. We set-up drip irrigation systems for HIV clinics and rural schools. We also built tower gardens to reuse gray water to grow vegetables. In South Africa, many people struggle to meet their basic needs. As an engineer, I was able to use my skills to better people’s lives. That trip was one of the most rewarding experiences, educationally and personally, and I was really lucky be part of it.

What about your undergraduate experience on the whole, Sara?

SARA: The best part of my undergraduate experience was being on the rowing team. I made great friends, who I still talk to regularly. I learned the meaning of hard work, dedication, and most of all, pushing myself to greater challenges, which will help me in any aspect of my life.

You had a great internship, Rebecca. Tell us about it.

REBECCA: Yes, with the Ohio EPA division of surface water in the modeling department. I had no experience working in a technical position before, and I was eager to show off what I had learned in school and contribute to the group. I worked as a field intern, learning how to collect stream geomorphology data and water chemistry samples that would be used in TMDL analysis. I was also in charge of maintenance of field equipment and downloading data from data loggers. Canoeing and collecting samples was so much fun, and I got paid for it! I learned new skills that have helped me in my schooling: how to take accurate field measurements, taking time to ensure the integrity of the sample. I also learned that it pays to work hard; people recognize hard work.

How did you find out about internship opportunities, and how did you land this one?

REBECCA: At a career fair hosted by The Ohio State College of Food, Agricultural, and Environmental Science. I applied on-line and was selected to interview with Ohio EPA. After the interview, I was offered a position.

Did your internship influence post-graduation choices?

REBECCA: I decided to continue on to graduate school. I loved working on streams and understanding what outside factors control the stream chemistry, geomorphology, hydrology, and biology.

What does the future hold for you both?

REBECCA: Sara and I work in the same lab at Ohio State. Somewhere down the road, we want to open our own consulting firm and work on stream restoration projects.

SARA: But first, I would like to get a job as a soil and water engineer and work to preserve and improve the quality of our waterways. I’ll take pretty much any engineering position that allows me to be outside enjoying nature!
You get the idea.

If it has to do with making life better, biological and agricultural engineers do it.

Find your place in one of our three flexible emphasis areas:

- Environmental and natural resources engineering
- Food and bioprocess engineering
- Machinery and bioenergy engineering

Find out more about biological and agricultural engineering at Texas A&M. Visit our website:

http://baen.tamu.edu
Preparing students, citizens, and industry for the future...

We Offer Three Majors
Agricultural Systems Management
Agricultural Engineering
Biological Engineering

For more information contact:
765-494-1181
taylordc@purdue.edu
www.purdue.edu/abe

Bioproducts and Biosystems Engineering

We invite you to explore opportunities in:
- Bioproducts Engineering
- Bioprocessing and Food Engineering
- Environmental and Ecological Engineering

For more information contact:
612-624-1293
bbc@umn.edu
www.bbbe.umn.edu

Celebrating 100 years of Engineering education, research and extension

What if we could transform agricultural waste into a valuable resource?

BIORESOURCE ENGINEERING

At the University of Saskatchewan we will prepare you to tackle our world’s biggest challenges.

Learn how you can make a difference.

www.engr.usask.ca/departments/abe/
Email: agbioengineering@usask.ca
Tel: (306) 966-5301

LOUISIANA STATE UNIVERSITY

“One of the Top 16 Most Popular National Universities”
(2009 U.S. News and World Report)

“Engineering for Life”

Dept. of Biological & Agricultural Engineering
Baton Rouge, Louisiana 70803
Telephone: 225/578-3153 Fax: 225/578-3492
Daniel L. Thomas, PhD, PE, thomasdl@lsu.edu
www.bae.lsu.edu

Offering Undergraduate Biological Engineering and Graduate Biological and Agricultural Engineering Opportunities

LSU IS AN EQUAL OPPORTUNITY/EQUAL ACCESS UNIVERSITY
Biosystems & Agricultural Engineering

B.S., M.S., and Ph.D. degrees

B.S. in Biosystems Engineering Specializations:

- Machine Systems Automation Engineering
- Food and Bioprocess Engineering
- Controlled Environment Systems
- Bioenvironmental Engineering
- Pre-Biomedical Engineering
- Pre-Veterinary Medicine

Scott A. Shearer
Professor and Department Chair
128 Barnhart Building
University of Kentucky
Lexington, Kentucky 40546-0276
Phone: 859-257-3000
Fax: 859-257-5671
E-mail: Scott.A.Shearer@uky.edu
www.bae.uky.edu

We Grow Ideas
1. **HAVE FUN with your engineering courses.** Don't believe the rumor that engineering courses are too tough. Far from being inscrutable and indecipherable, engineering courses are among the most ordered, logical and, therefore, understandable courses. And they're fun!

2. **CHECK your assumptions.** Always be aware of the assumptions that you're making, and validate them periodically. (Indeed, this is not just an engineering lesson, but a life lesson as well.)

3. **DEVELOP your creativity.** It's a myth that engineers are like automatons that deal with numbers, hardware, technical stuff, and nothing else. Absolute nonsense! At the same time, don't despise the required non-engineering courses. That's where you find the ideas and insights that can provide you with just the right solution to an engineering problem in the future.

4. **LEARN effective communication.** Another myth is that engineers are introverts, and not very comfortable with language. More nonsense! Engineers can be fluent in expressing abstract ideas in mathematical form or in computer code, so there's no reason why they can't be effective in expressing their ideas in English or any other language. Read widely so that you get exposed to various language and communication styles.

5. **SEEK to gain research experience.** Typical classroom engineering problems are mostly idealized, with imagined or predetermined scenarios and parameter values. Gaining some experience in research eases the transition from the ideal world to the real world.

6. **Pursue internship opportunities.** An internship gives you the opportunity to observe, mingle, and work with engineers in their natural habitat—an office, a laboratory, or out on the field. More important, an internship can give you a vision of what your future could look like as a practicing engineer.

7. **NETWORK professionally.** Join your professional engineering society. It has benefits, one of which is getting to meet the practicing engineers in your field locally, nationally, and internationally—an excellent way to learn about the profession's culture. By interacting with working engineers, you learn about your field—and they get to know you and what you can offer now and in the future.

8. **CONNECT what you are doing now with what you want to do in the future.** The most successful engineering students are those who have a picture in their minds of where they would like to go professionally, and who understand how what they do now connects to that future. If you practice making those connections, it will be easier to maintain your motivation all the way through to your program's finish line.

9. **TAKE CARE of yourself.** Take care of yourself, not just mentally, but emotionally, physically, and spiritually. Aim for a balanced life. Treasure family ties and friendships. Do something good for others, and remember those who do not have as many opportunities in life as you do.

10. **PLAN for continuous career improvement.** Your education doesn't stop when you graduate. Take the Engineers in Training (EIT) examination immediately. A master's degree is highly recommended, and keep in mind that being an engineer doesn't necessarily mean working for a company. You could start your own business—get an MBA or partner with someone knowledgeable in business. Maintain membership in your professional engineering society, and attend its annual meetings. Get that Professional Engineer's license! Plan to keep learning and growing as an engineer and as a person.

Excerpted from “10 Things Engineering Students Should Mind to be Successful” by Joel L. Cuello, Professor, Department of Agricultural and Biosystems Engineering, The University of Arizona, Tucson, USA. Read the article in its entirety at: http://ag.arizona.edu/abe/People/Faculty_Homepages/Joel_Cuello/.
WHAT MAKES FOR A PICTURE-PERFECT UNDERGRADUATE RESUME? Good grades, of course, but also experiences that build useful skills, like internships and overseas study.

You can find internships in several ways. Academic departments often have internship coordinators who match students with company openings. Alumni and employers often provide job descriptions directly to the faculty, hoping to find suitable interns. And most universities, and even some departments, host career days or fairs, where companies find candidates both for internships and for permanent employment.

An internship in agricultural and biological engineering typically involves hands-on work on real-world projects. Interns get paid to use the skills and abilities they acquired in the classroom, and they get some exposure to the career opportunities that await them after graduation.

In addition, as our world becomes increasingly globalized, agricultural and biological engineers need to interact effectively with people from other nations and cultures. Overseas study is a great way to acquire this kind of experience. Like internships, study abroad programs vary tremendously. Study trips guided by professors may last a few weeks. Or you can move in with a host family and attend a foreign university for a full year. Students who study abroad come home with renewed enthusiasm, and with experiences that will last a lifetime. Here are some students and career professionals who made it happen.

**Nohemi Atayade**

**HOMETOWN:** San Luis, Arizona  
**GRADUATION:** University of Arizona, Agricultural and Biosystems Engineering B.S., with a focus on Water Resource Engineering, 2006  
**PRESENT WORK:** Project Engineer, George Cairo Engineering, Inc., Mesa, Arizona  
**INTERESTS:** Spending time with friends, cooking and baking, hiking, and watching sports

I am the GCE Project Engineer for Maricopa-Stanfield Irrigation and Drainage District. As the district’s engineer, my responsibilities range from protecting the district’s interest and coordinating with the district’s engineering needs to coordinating land issues with the Bureau of Reclamation on behalf of the district.

I love working for a small company, and I get to be a part of big projects that will have an impact in my community for years to come. I enjoy working with irrigation districts in Arizona and southern California, and helping to meet their needs in whatever capacity.

For me, it all started during orientation as a freshman at U of A. I got lost on campus and ended up walking into an engineering seminar. It seemed interesting, so I immediately looked into the different types of engineering. Being from the Yuma, I had an interest in agriculture, as it was all around me. I was hooked on ag engineering after my first summer as an intern for the USDA Natural Resources Conservation Service. I was teamed with two soil conservationists, and their love for agriculture was contagious. To this day, they are still my mentors even though I no longer work for them.

My time spent as an intern was an invaluable experience since it led to a full-time position at GCE. My internship made the transition from student to engineer much smoother. By the time I graduated, I was familiar with many of GCE’s projects, irrigation districts, as well as the contractors we work with.

Like many young engineers, I have learned that design is only one part of engineering. Much of my time is spent on communications, documentation of design alternatives, and management of projects—addressing scopes, coordinating with clients and contractors, as well as cost estimates. No amount of classes could have prepared me, and good on-the-job-training is key.
**Carol Faulhaber**

**HOMETOWN:** Sedalia, Missouri  
**GRADUATION:** Iowa State University, Agricultural Engineering B.S., 2009, M.S., 2011  
**INTERESTS:** Cooking, movies, jewelry making

Right out of high school, I worked as a lab assistant, evaluating methane uptake rates for activated carbon made from waste corn cobs. The big picture of the project was to assess activated carbon for use in natural gas vehicle tanks—to increase fuel storage capacity. Very cool!

The following summer, after my college freshman year, I worked as an industrial placement intern with the Nebraska Department of Environmental Quality. I labored over a tire-derived fuel feasibility study for a coal-fired boiler at an ADM ethanol plant and conducted several waste assessments to decrease the plant’s waste streams. Also very cool!

Sophomore spring and summer, I interned at Cargill’s Indianapolis Dry Corn Mill Plant, working on energy reduction projects, helping start energy teams, and assisting with environmental training. One of my favorite things was eating lunch in the workroom with the Cargill hourly employees—very humbling to see how knowledgeable they were on plant operations! The standout experience, though, was giving energy presentations—to increase awareness of how much energy a plant consumes compared to the amount of energy an average home uses. I made an “energy savings tips” pamphlet, and employees began to think about ways they could save energy in the plant.

This past summer I did another internship for Cargill—flour milling in Massachusetts! These internships influenced my decision to go for a master’s degree and a career in food and bio-processing.

I love going to different stores to look at different food products and imagine how they are made. I dream about owning a Trader Joe’s someday! I enjoy cooking, too—trying new recipes and the satisfaction that comes from preparing a meal.

I love all aspects of ag engineering—especially the practical application of my courses. In a power and electricity class, for example, I learned how to wire an outlet for a house (and it gave me an appreciation for the work electricians do)!

---

**Randy Swestka**

**HOMETOWN:** Cresco, Iowa  
**GRADUATION:** Iowa State University, Agricultural Engineering B.S., May 2010  
**INTERESTS:** Motorcycling, line-wetting, golf, snowmobiling

I grew up on a typical Iowa farm: swine, corn, and soybeans. On nice days, and even some cold wet ones, I ride my motorcycle. I’ve been caught in some wicked storms, but I enjoy travel and the outdoors.

A high school counselor suggested ag eng after listening to how much I enjoyed agriculture. His reasoning was “Pick something hard that you’re interested in, and see where it takes you.” I read more about ag eng, and the road so far has been great.

An internship with the Iowa Department of Natural Resources led me into evaluating the financial and environmental impacts of implementing an environmental management systems decision-making framework into production agriculture. The project required a big-picture thought process. The supply chain effect has enormous environmental and financial impacts!

I also worked in the Agricultural Waste Management Laboratory at Iowa State University as an undergraduate—primarily in air emissions monitoring, but I participated in other neat projects, too. This work led me to pursue graduate study.

During my junior year, I studied at the University of Tasmania in Australia—the most standout experience in my college career. On any day, I could experience all four seasons. I snorkeled the Great Barrier Reef, ate crocodile and kangaroo, traversed an opal mine, slept under moonlight in the Outback after spectacular sunsets, and camped with aborigines. I had class in a rainforest! I traveled around Australia for nearly a month and stopped by Fiji on my way home to learn how to scuba dive. Amazing!

After graduation? The real world! I aspire to be proprietor of my own consulting firm and run Swetska Farms. Most of all, I want to be a professional engineer.
Mary Louise Gifford

HOMETOWN: Albany, New York
GRADUATION: State University of New York College of Environmental Science and Forestry, Environmental Resources and Forest Engineering B.S.
PRESENT ENDEAVOR: PhD candidate, The Potsdam Institute for Climate Impact Research, Berlin, Germany, working concurrently with the University of California, Berkeley, Energy and Resources Group
INTERESTS: sailing, biking, swimming, running, dancing (tango and salsa), photography, yoga, traveling

I've lived in India for a year. I've lived in Germany for a year. I've been to lots of countries: Honduras, Costa Rica, China, Japan, Fiji, Switzerland, the UK, Germany, Kenya—to work or participate in conferences. I had dinner with the prince and princess of Udaipur, India, at a castle located on an island in the center of a lake. My experiences have been diverse: from scaling rainforest trees, to dining with the Vice President of Kenya and discussing the current environmental concerns in sub-Saharan Africa. I have worked with Nobel Laureates on one of the most significant scientific documents in the field of climate change and have assisted Honduran migrant workers on moving boulders across hurricane destructed trails.

I began as a biology major and fell in love with learning. As a freshman, I was the youngest member of a team in the Puerto Rican rainforest. For four months in the summer, then again two months in the winter, I swung from a harness high up in the canopy to measure photosynthesis!

I soon changed my major to Energy Resources and Forest Engineering. Initially, it was really difficult to switch majors. I felt intimidated by the other engineers around me who seem to speak in code! I questioned if I was really capable on all the math and physics required.

Sophomore year, I co-founded a student chapter of Engineers Without Borders at Syracuse University. This is a national non-profit organization that partners with developing communities to improve their quality of life through environmentally sustainable, equitable, and economical engineering projects.

My experience with Engineers Without Borders taught me that the person who knew the most was not the engineer but the local car repairman who had a deep understanding of his natural surroundings. I learned that the application of engineering theory requires more knowledge than engineering coursework can provide. I also learned that globalization, natural resource conservation, and climate change present challenges that we must solve together, rather than in our own national self-interest, address. And I learned not to do construction projects during the rainy season!

After graduation, I worked for the United Nations on a scientific panel that informs member nations about climate change. While not the traditional engineering path, I quickly learned in job hunting that an engineering degree was an incredible asset.

My work and experiences have spanned a number of disciplines, all leading to a common theme: the world is not static. As human societies develop and as the quality of living improves, so the demands on the Earth’s limited natural resources increase.

In my career, I hope to work within the United States to foster the awareness of innovative energy sources and draw on my experience in other countries. I want to stand on the shoulders of giants and lead our world toward a path of sustainability through a position of influence related to renewable energy—perhaps as a scientific advisor for a member of Congress, the executive branch, or as a director at a UN climate program.
I was interested in biology and math in high school—like lots of students—so I thought some type of bioengineering or biomedical engineering was for me. Wasn’t sure what. MSU was close to home, offered solid academics, good scholarships, and the opportunity to do research right away. So, away I went. It just seemed so easy.

Immediately, I got a job in the biosystems/biosystems lab and got a huge yen for food engineering and, more specifically, food safety. It’s a hot topic today.

Through internships, I did research on biosensors for bacteria pathogens for two summers at the Lawrence Livermore National Laboratory. That fueled the appetite!

Someday, I hope to be a professor of food engineering—with an emphasis on food safety.

As an undergrad, I sang in an all-male a cappella group—the Spartan Discords and MSU Men’s Glee Club. The Glee Club traveled to Italy—what a great summer, singing in Europe! I helped with the musical side of a campus ministry throughout my undergrad years, too.

One of the best classes I had at MSU was Philosophy of Law. It exposed me to a different type of thinking than I was used to. I still wish I had taken more food science courses—I’m really taken with the field. I encourage those who are prospecting to do just that—try out the courses for the pure fascination of the studies.

Life at the University of Maryland is good ... the first semester challenging. I’m working on spectral imaging for raw produce safety with the USDA. It’s nice being close to so many government agencies involved with food. It brings a new perspecttive. And I decided to sing with a gospel choir to try something different!
Gail Bornhorst

HOMETOWN: Houghton, Michigan
GRADUATION: Michigan State University, Biosystems Engineering, Food Engineering Specialization B.S. 2007; University of California, Davis, Biological and Agricultural Engineering, Food Engineering M.S., 2010
INTERESTS: Travel, photography, acting/theatre, and cooking (even though I’m a food engineer, that doesn’t mean I know how to cook!)

I studied abroad in León, Spain, for six months at the Universidad de León. León is about four hours north of Madrid and two hours from the northern coast.

While in León, I ate up the classes in food science and technology (for the food engineering specialization part of my degree). I was at a Spanish university taking classes with all Spanish students. There were no other American students there, and this made for a more “real” experience. I got to see how another educational system works and how students in another country matriculate. I took language classes and met other exchange students from all over Europe.

At what other point in your life will you have half a year to travel overseas and work on your degree? Everyone should do a study abroad! It pushes your comfort zone.

After graduating from MSU, I had an internship for seven months at the W.K. Kellogg Center for Food and Nutrition Research in food chemistry. It was the perfect transition between graduation and graduate school. Currently, I am working on a master’s program at the University of California, Davis. After finishing the degree, I plan to pursue a PhD in food engineering. I tell everyone I know that food engineering is one of the coolest fields of study anywhere!

Justin Siebert

HOMETOWN: Festus, Missouri
GRADUATION: University of Missouri, Biological Engineering, 2010
INTERESTS: Basketball, church activities, volunteering for an after-school program for kids in public housing

In 1996 (I was 9), I was injured in a car wreck, my spinal cord stretched and twisted, leaving me paralyzed from the waist down. I had to start using a wheelchair to get around. After the crash, I got involved in wheelchair sports. I played tennis, softball, and basketball with the Gateway Confluence Wheelchair Sports Foundation, based out of Alton, Ill. When deciding where to go to college, this was a big factor. Colleges I seriously considered had to have wheelchair basketball teams!

I knew I wanted to pursue engineering because I loved math and science in high school. I was sold on biological engineering after reading a Popular Science article about a biological engineer who had created mechanical arms for a man who had lost his arms in an electrical accident. The man could move by just thinking about it, using the nerve endings in his chest to control his arms. I was blown away. It sounded like something out of science fiction.

Students should find a school where they can have a balanced college experience, so they don’t get burned out on one thing and can become a well-rounded person. What influenced my decision to attend Mizzou? The wheelchair basketball team, the engineering program, and in-state tuition. The class where I discovered the most personal knowledge was a service learning class taken as a humanities elective. I learned that I could help improve people’s lives, and it helped me get involved with volunteering.

Last summer, I interned at the Denver Rescue Mission, a non-profit homeless shelter and rehabilitation center. I worked in the Literacy and Education Center with men in long-term rehab. I did a lot of GED tutoring, taught some life skills classes, and helped men in the program write resumés and create budgets. The internship didn’t really have anything to do with engineering, but it was something that I really wanted to do.

After graduation, I want to Teach For America or enter a similar program, and teach high school math or science for a few years. I really enjoy helping others learn. While that may not be engineering work directly, I hope to encourage kids, who may not think they could go to college, to actually pursue careers in math, science, and engineering.

After that, I may try to get a job with an engineering company or go to grad school—not sure, but whatever I do, it will be with faith in God, who has brought me this far.
Paul Davidson

HOMETOWN: Newton, Illinois
GRADUATION: University of Illinois, Agricultural and Biological Engineering, Soil and Water Resources B.S. 2005, M.A. 2007, PhD, 2009

INTERESTS: Basketball, running, working out, riding 4-wheelers, Cubs and Illini football and basketball games

When I began at U of I, I thought all ag engineers designed farm machinery, and I was pretty interested in that. However, after discovering that there were additional aspects of ag eng, and taking my first soil and water course, I got interested in soil and water resources. I completed my B.S. and was persuaded to hang around for my M.S. The same professor again persuaded me to hang around for my PhD, which I hope to complete this year. I don’t regret any of my time at U of I. I have been given many opportunities for professional development and international experience.

I was a part of a team that worked with University of KwaZulu-Natal students to design and construct a pedal-powered watercraft that could exceed the world-record speed for a man-powered watercraft. While in Natal, we went on weekend excursions and saw a herd of elephants (we were within ten feet of them!), crocodiles, giraffes, rhinos, hippos, monkeys, and more. I was lucky enough to spend a few early mornings at the beach learning to surf! It’s not easy for a 6’6” guy to learn to surf!

I also traveled with students and faculty to India to install a water filtration system. Our system is actually a biofilter (woodchip media), which takes advantage of indigenous soil bacteria to reduce nutrients like nitrate in tile-drained water. We visited the Taj Mahal, the Himalayas, spent a day at Nainital (a lake about 7,000 feet above sea level), and toured Jim Corbett Park, complete with Bengal tigers and elephants.

Last year, I spent two weeks in Taiwan with my adviser, presenting seminars on water quality and water resources research. We toured Taipei 101, the tallest building in the world, and visited the ocean and the mountains. I was invited to play basketball with a group of students, and I never turn down an opportunity to dribble. It was about 100°F, with the humidity approaching 100 percent. However, we put in a good two hours of play, and were challenged by a host of others, intrigued by somebody two meters tall!

These travels were the high points of my college experience. And now for graduation. I hope to find a job dealing with water resources, a job that is a constant challenge, one that pushes me to solve problems.
Brandon Hartley

HOMETOWN: Santa Fe, Texas
GRADUATION: Texas A & M University, Agricultural Engineering B.S., 2010
INTERESTS: Fishing and running with friends in the Texas hill country and bayous back home

I found out about ag/bio engineering from my high school calculus teacher. She was trying to put together a group to attend Aggieland Saturday, a day showcasing TAMU departments, and I was looking for any excuse not to spend a weekend on a school-sponsored field trip. She asked what my interests were, and after I said “agriculture,” she replied, “Good. TAMU has an ag eng department. No more excuses. I’ll sign you up!”

I knew I wanted to attend Texas A&M, and I decided on a major even before sending in my application. The traditions and overall atmosphere of the university influenced my decision, and I urge others to consider the department, the participation of the faculty with the students, and the activities at the university’s chapter of ASABE in order to make an informed decision. In the end, when classes get difficult and things get tough, it’s the faculty and students in the department who make things easier to manage.

I want to pursue bio-energy after graduation, and I would like to help begin and expand development of alternative energy for the Texas gulf coast, maybe even start an alternative energy company. There are many options. I believe I would enjoy offering a way for producers to cut costs while producing affordable energy to the rest of the country.

And I recommend taking Golf II in college! Before the class, I couldn’t get a golf ball in the air. Now I can hit a consistent 150-yard shot with a six-iron. Some engineers move into management or human resources during the course of their careers, and golf is something that stays with you no matter what position you hold. It has opened up a whole new arena for networking and potential “business meetings!”

When Brandon Hartley traveled to Belgium last summer, he gained a first-hand appreciation for international soil and water issues. Hartley, a Texas A&M University bio and ag engineering major from Santa Fe, Texas, is one of 24 students who have traveled with the department’s Environmental Soil and Water Study Abroad Program to Belgium over the summers to obtain a different view of environmental soil and water issues.

“The program gave me a chance to experience something totally different from what I was used to,” Hartley said. “It gave me a global perspective on what I will be pursuing after graduation and some of the problems I may need to face in a global market.”

Clyde Munster, biological and agricultural engineering professor, organized the program. “Students need to get international experience,” he said. “The job market is not just state- or United States-wide anymore.”

The five-week program is hosted by the Katholieke Universiteit of Leuven, Belgium, and it satisfies the Texas A&M international and cultural diversity requirement. Field trips to different water and wastewater projects unique to Europe are included, allowing “compare-and-contrast” with European ways to solve environmental problems and cutting-edge technology.

Hartley was intrigued by Belgium’s sophisticated recycling program. “Every piece of land is put to good use. What is not used for towns or cities is used for agriculture,” he said. “Everything is recycled because they don’t have room for landfills.”

“Students gain a different perspective on the world and other people’s culture. They see things a little bit differently,” says the program director. “But they also see that we’re all basically the same.”

Kathy Wythe, Texas Water Resources Institute
Q. THE WORD “HECTIC” OFTEN APPEARS WHEN THE SUBJECT OF COLLEGE ADMISSIONS COMES UP. WHAT’S THE PROCESS REALLY LIKE?

I’m afraid “hectic” is an accurate description of life in a college admissions office. But that doesn’t mean it’s a negative environment. Most people who work in college admissions do so because they love the fast-paced nature of the business. College admissions professionals wear many hats, including student recruiter, official spokes person, counselor, academic advisor, evaluator, roadrunner, marketer, and event planner.

Q. WHAT CHANGES HAVE YOU NOTICED IN INCOMING STUDENTS (AND THEIR PARENTS) DURING THE TIME THAT YOU’VE BEEN INVOLVED IN ADMISSIONS?

The questions, interests, and concerns of students twenty years ago tend to be the same ones we see today. However, there has been a dramatic change with parents. Today’s parents are significantly more involved in the college decision process than was the case in the 1980s or 1990s. In the past, parents gave their student certain parameters (i.e., cost, location), but the student was in charge of the process. Today’s parents not only participate in the process, they often drive it. The decision is often considered a “family” decision rather than just the student’s.

Q. WHAT IS THE UNIVERSITY MOST CONCERNED ABOUT IN THIS ECONOMY?

One of the consequences of the economic situation is that students are looking at colleges closer to home. At many universities, the number of new out-of-state students has dropped. This is particularly troublesome because the number of graduating high school seniors in most states is also declining. The shrinking in-state pool of prospective students combined with the economy’s impact on out-of-state students is a double-whammy for many colleges and universities.

Q. WHAT “GIVENS” WON’T BE COMPROMISED—CLASS SIZES, FACULTY-STUDENT RATIOS, ETC.?

Most schools are concerned about maintaining class size and faculty-student ratios as well as maintaining academic standards. Faculty tell us there is nothing that can better prepare a student for university than to successfully complete a strong college-prep program in high school. We believe high school students who complete at least four years of English, four years of college-prep math, three years of science, three years of social science, and preferably four years of a foreign language are most likely to succeed in college.

Q. WHAT ABOUT FINANCIAL AID?

The most important thing for students to do is to apply for federal financial aid by completing the online FAFSA (Free Application for Federal Student Aid).

Q. ENGINEERING CONTINUES TO BE AN IN-DEMAND PROFESSION. ARE DEGREED ENGINEERS BETTER SITUATED FOR THE JOBS OF THE FUTURE?

Engineering is one of the fields that is continuing to fare well during difficult economic times. Demand for engineering graduates from good programs, particularly women and minority engineers, remains high.

Q. WHAT’S THE SINGLE BEST ADVICE YOU CAN GIVE TO STUDENTS (OR WHAT DO YOU WISH YOU HAD BEEN TOLD WHEN YOU APPLIED TO COLLEGE)?

I like to tell students that colleges and universities are like people—each one has its own distinct personality and character. Only by visiting schools can students get a true sense of how they would fit in. So I strongly encourage students to visit every single college or university that they are seriously interested in attending, regardless of how close or far away it may be.

Q. HOW DO COLLEGE ADMISSION DEANS AND STAFF DEAL WITH APPLICATION ESSAYS? DO THEY READ EVERY ONE? WHAT ARE THEY REALLY LOOKING FOR?

Essays and personal statements are taken seriously by admission committees. And yes, every single one is read. But while essays are important, the most amazing essay in the world cannot offset a spotty academic record. Essays play a larger role when evaluating applicants with similar academic records and test scores.

Admissions committees use essays as a way of learning something about the applicant that goes beyond the high school transcript, test scores, and individual grades. A personal statement should be a personal reflection of the student’s strengths.

Q. WHAT’S YOUR FAVORITE PART OF THE PROCESS?

My favorite part of the college recruitment process is the start of the school year when our new freshmen and transfers begin their university studies. It’s really fun to be on campus and soak up all the excitement and enthusiasm in the air at the beginning of fall classes. There’s nothing else I’ve ever experienced that can rival it. I’ve gotten many letters over the years from students graduating from the University who tell me that their college choice was the best decision they ever made. It’s great to be in a position where you can become a difference-maker in the lives of students.
SEARCHING FOR AGRICULTURAL AND BIOLOGICAL ENGINEERING PROGRAMS?

It’s not all black and white. Focusing in on your “perfect school” requires some time and research.

All these schools offer degree programs in agricultural and biological engineering. Contact them directly for more information. School representatives or admissions advisers will be happy to answer your questions and arrange for a closeup view—a campus visit. Try to schedule appointments with the engineering departments before you go.

Then, zoom in on your search!
<table>
<thead>
<tr>
<th>Location</th>
<th>Institution</th>
<th>Program</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University of Missouri</strong></td>
<td>Agricultural Systems Management</td>
<td></td>
<td><a href="http://www.fse.missouri.edu">www.fse.missouri.edu</a></td>
</tr>
<tr>
<td><strong>MONTANA</strong></td>
<td>Montana State University</td>
<td>Civil Engineering</td>
<td><a href="http://www.ce.montana.edu">www.ce.montana.edu</a></td>
</tr>
<tr>
<td><strong>NEBRASKA</strong></td>
<td>University of Nebraska</td>
<td>Biological Systems Engineering</td>
<td><a href="http://bse.unl.edu">http://bse.unl.edu</a></td>
</tr>
<tr>
<td><strong>NEW JERSEY</strong></td>
<td>Rutgers-The State University of New Jersey</td>
<td>Civil, Agricultural, and Geological Engineering</td>
<td>New Brunswick, N. J.</td>
</tr>
<tr>
<td><strong>NEW MEXICO</strong></td>
<td>New Mexico State University</td>
<td></td>
<td><a href="http://www.nmsu.edu">www.nmsu.edu</a></td>
</tr>
<tr>
<td><strong>NEW YORK</strong></td>
<td>Cornell University</td>
<td>Biological and Environmental Engineering</td>
<td>Ithaca, N.Y.</td>
</tr>
<tr>
<td><strong>Pennsylvania</strong></td>
<td>State University of New York</td>
<td>SUNY-CESF</td>
<td>Environmental Resources and Forest Engineering</td>
</tr>
<tr>
<td><strong>NORTH CAROLINA</strong></td>
<td>North Carolina University</td>
<td>Agricultural and Technical State University</td>
<td>Biological Engineering</td>
</tr>
<tr>
<td><strong>NORTH DAKOTA</strong></td>
<td>North Dakota State University</td>
<td>Agricultural and Biosystems Engineering</td>
<td>Fargo, N. D.</td>
</tr>
<tr>
<td><strong>TENNESSEE</strong></td>
<td>The University of Tennessee Biostystems Engineering and Soil Science</td>
<td>Knoxville, Tenn.</td>
<td><a href="http://bioengr.ag.utk.edu">http://bioengr.ag.utk.edu</a></td>
</tr>
<tr>
<td><strong>TENNESSEE</strong></td>
<td>Tennessee Technological University</td>
<td>School of Agriculture</td>
<td>Cookeville, Tenn.</td>
</tr>
<tr>
<td><strong>TEXAS</strong></td>
<td>Texas A&amp;M University</td>
<td>Biological and Agricultural Engineering</td>
<td>College Station, Texas</td>
</tr>
<tr>
<td><strong>UTAH</strong></td>
<td>Utah State University</td>
<td>Biological and Irrigation Engineering</td>
<td>Logan, Utah</td>
</tr>
<tr>
<td><strong>VIRGINIA</strong></td>
<td>Virginia Polytechnic Institute and State University</td>
<td>Biological Systems Engineering</td>
<td>Blacksburg, Va.</td>
</tr>
<tr>
<td><strong>WASHINGTON</strong></td>
<td>University of Washington</td>
<td>Forest Resources</td>
<td>Seattle, Wash.</td>
</tr>
<tr>
<td><strong>WASHINGTON</strong></td>
<td>Washington State University</td>
<td>Biological Systems Engineering</td>
<td>Pullman, Wash.</td>
</tr>
<tr>
<td><strong>WISCONSIN</strong></td>
<td>University of Wisconsin</td>
<td>Biological Systems Engineering</td>
<td>Madison, Wis.</td>
</tr>
<tr>
<td><strong>WISCONSIN</strong></td>
<td>University of Wisconsin-River Falls</td>
<td>Agricultural Engineering Technology</td>
<td>River Falls, Wis.</td>
</tr>
<tr>
<td><strong>CANADA</strong></td>
<td>University of Alberta</td>
<td>Department of Agricultural, Food, and Nutritional Science</td>
<td>Edmonton, Alberta</td>
</tr>
<tr>
<td><strong>MANITOBA</strong></td>
<td>University of Manitoba</td>
<td>Biosystems Engineering</td>
<td>Winnipeg, Manitoba</td>
</tr>
<tr>
<td><strong>NOVA SCOTIA</strong></td>
<td>Dalhousie University</td>
<td>Biological Engineering</td>
<td>Halifax, Nova Scotia</td>
</tr>
<tr>
<td><strong>ONTARIO</strong></td>
<td>University of Guelph</td>
<td>School of Engineering</td>
<td>Guelph, Ontario</td>
</tr>
<tr>
<td><strong>QUEBEC</strong></td>
<td>Laval University</td>
<td>Soil Science and Agri-Food Engineering</td>
<td>Quebec, Quebec</td>
</tr>
<tr>
<td><strong>QUEBEC</strong></td>
<td>McGill University</td>
<td>Bioresource Engineering</td>
<td>Ste. Anne de Bellevue, Quebec</td>
</tr>
<tr>
<td><strong>SASKATCHEWAN</strong></td>
<td>University of Saskatchewan</td>
<td>Agricultural and Bioresource Engineering</td>
<td>Saskatoon, Saskatchewan</td>
</tr>
<tr>
<td><strong>SASKATCHEWAN</strong></td>
<td>National University of Ireland, Dublin</td>
<td>Biosystems Engineering</td>
<td>Dublin, Ireland</td>
</tr>
</tbody>
</table>

© www.edebe.de/Fotolia.com
Michigan State University
Biosystems & Agricultural Engineering
216 Farrall Hall
East Lansing, MI 48824
517-355-4720
www.egr.msu.edu/age/BE

Your Future, Your Choice

Food Engineering
- Food Processing
- Food Safety
- Food Packaging

Agricultural Engineering
- Machinery Systems
- Soil and Water
- Structures and Facilities

Biological Engineering
- Ecological Engineering
- Bio-Environmental
- Pre-Vet/Pre-Med

Our wide range of choices offers you exciting and satisfying educational and career opportunities.
Schedule a visit soon to learn more.

THE DEPARTMENT OF
FOOD, AGRICULTURAL, AND BIOLOGICAL ENGINEERING

Contact:
Ms. Beverly J. Barrick
E-mail: barrick.3@osu.edu
Phone: (614) 247-6735
Web Site: fabe.osu.edu
Biological Systems Engineering

University of Nebraska—Lincoln

Home of Nebraska Tractor Test Lab

Agricultural Engineering

- Applies engineering to agriculture—designing machines for agricultural and off-road applications, testing machines and technologies, and conserving soil and water resources.

Biological Systems Engineering

- Brings engineering to life—working with living systems and the environment, using biology, mathematics, and engineering to improve peoples' lives and our world.

Mechanized Systems Management

- Managing machines, natural resources, people, and assets in engineered systems for agriculture and associated commodity handling industries.

Here's How

We can help with questions about college costs and financing your education. Contact the Office of Scholarships and Financial Aid or the UNL Office of Admissions.

OFFICE OF SCHOLARSHIPS & FINANCIAL AID
17 Canfield Administration Building
PO Box 880411
Lincoln, NE 68588-8411
(402) 472-2030
800-742-8800, ext. 2030
finaid2@unl.edu
www.unl.edu/scholfa

OFFICE OF ADMISSIONS
Van Brunt Visitors Center
313 N. 13th Street
Lincoln, NE 68588-8256
(402) 472-2023
800-742-8800, ext. 2023
admissions@unl.edu
www.admissions.unl.edu

APPLY NOW!

Biological Systems Engineering Department
223 L. W. Chase Hall
Institute of Agriculture and Natural Resources
University of Nebraska - Lincoln
Lincoln, NE 68583-0726
(402) 472-1413
FAX (402) 472-6338
Web: bse.unl.edu
email: ryester2@unl.edu

The University of Nebraska—Lincoln is an equal opportunity educator and employer with a strong commitment to diversity.
AGRICULTURAL & BIOLOGICAL ENGINEERING
limited resources... unlimited solutions

Agricultural and Biological Engineering
Biological Engineering
Land and Water Resources Engineering
Agrisystems Engineering

Agricultural Operations Management
Production Systems Management
Agricultural Construction Management
Sustainable Systems Management

Packaging Science

UF | UNIVERSITY OF FLORIDA

Graduate programs available in all program areas.
Agricultural and Biological Engineering, P.O. Box 110570, Gainesville, FL 32611  |  PHONE: 352.392.1864  |  EMAIL: abeinfo@ufl.edu  |  www.abe.ufl.edu