Spring 2012

Research Frontiers, Spring 2012

University of Arkansas Fayetteville. Office of University Relations

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Tracking the Cretaceous

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Scholarship and Creative Work Thriving at the U of A

Sharon Gaber
Provost & Vice Chancellor for Academic Affairs

The Carnegie Foundation for the Advancement of Teaching recently placed the U of A in its highest research classification based on the number of doctoral degrees awarded and grants received. Confirming this status, research expenditures topped a record $120 million for 2011. By any measure, research is thriving at the University of Arkansas. However, just as research is a fundamental part of our mission, so is scholarship and creative work.

What differentiates research from scholarship and creative activity? Clearly, they overlap. I'm far less concerned with defining the differences between them, than with encouraging, stimulating and supporting all of our campus researchers, scholars, artists, musicians and creative writers.

Last year university faculty published more than 60 books, whether as monographs or as editors. One of the most productive departments has been the history department, which has published 23 books since 2007. This has included highly regarded work from Elliot West, a Cherry Award Finalist, and Benjamin Grob-Fitzgibbon, who was recently elected a Fellow of the Royal Historical Society for demonstrating "an original contribution to historical scholarship in the form of significant published work." Joining Grob-Fitzgibbon as Royal Historical Society Fellow is Steven Sheppard, professor and associate dean for research and development in the School of Law. Sheppard has received high praise for his work in expanding and updating The Bouvier Law Dictionary, a resource based on the first dictionary of American law.

The outcome of scholarship and creative activity is not only measured by publications. A good example of this is the TEXT Project, an oral history program designed to record the stories of elderly Tibetans living in India. This project is overseen by English professor Sidney Burris and Geshe Dorjee. It was this work that brought them into contact with the Dalai Lama, and following several invitations, resulted in the Dalai Lama's visit last spring. His visit reinforced the university's commitment to being a destination where significant ideas and issues of the day are addressed and explored.

Other recent examples of important creative work and scholarship include the work of Laura Terry, associate professor of architecture, with a mixed-media piece in the 54th Annual Delta Exhibition and Claretha Hughes, associate professor of workforce development, who published a paper, with one of her doctoral students, that won the Nonprofit Management Track Award from the North American Management Society. Additionally, the drama department staged productions of *Othello*, *A Christmas Carol*, and *Arcadia*, among others and the art department, in collaboration with other units, displays works at the university's sUgAR Gallery in Bentonville.

The University of Arkansas also supports and promotes scholarship and creative activity through the University of Arkansas Press, which publishes around 20 titles a year, covering topics related to Southern history, civil rights, poetry and Middle Eastern literature. While the press is not obligated to publish faculty work, it does periodically support faculty interests, and in recent years has published work by faculty members such as history professor Charles Robinson, higher education assistant professor Suzanne McCray, and political scientists Angie Maxwell and Todd Shields.

To do justice to all the great work being done by faculty across the colleges on campus, I would need to compile a multi-volume book. My purpose here is to reaffirm the university's commitment to all forms of research, scholarship and creative activity, not just those tracked by the National Science Foundation. As usual, this issue of *Research Frontiers* demonstrates that commitment by highlighting the breadth and depth of work and scholarly activity being done on campus. I hope you will support their efforts by learning more. ■

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Image submitted

Stage design for University Theater's *A Christmas Carol*, winter 2011, by Michael Riha.

No Detail Too Small ~ No Idea Too Large

By Barbara Jaquish

It's one of the oldest stories on Broadway: talented guy from the hinterlands succeeds on the Great White Way only to discover what is so special about home. Michael Riha reprised this story in 2011 when he spent one harried month as the assistant designer for a Broadway play and a Met opera.

Riha, who teaches set design in the drama department at the University of Arkansas, signed on with Tony Award-winning designer Christine Jones to help with set design for a Broadway revival of *On a Clear Day You Can See Forever* and for a staging of *Rigoletto* at the Metropolitan Opera. During a month of designing, drafting, soldering, gluing, cutting, coordinating and revising, Riha saw that he'd been teaching his students much of what Broadway professionals do every long, demanding day.

"No detail is too small to be concerned with, and no idea is too large to consider," Riha said.

For example, the design team for *Clear Day* was working on a short scene that included only two lines of dialogue. The designers had not seen the lamps, furniture and cocktail glasses needed for the scene until the set pieces were wheeled in, just nine days before the preview performance. Discussion ensued about the look, down to the cocktails.

"When the prop artist began to talk about the choices she made, everything was based on the story and made to enhance and support the characters and that particular moment," Riha recounted in his blog. "Eventually, some minor adjustments – trim details, new cocktails and scaling down the chairs a bit – were made to help the set pieces 'live' in the world of the moment better. The changes were small, by most accounts, but absolutely necessary to bring them into the vocabulary of the rest of the design."

Riha, who has been designing scenery and lighting for more than 20 years, both at the university and in professional theaters throughout the Midwest, has developed a style "rooted in the characters rather than simply providing location." One factor: he'd started his theater career as an actor.

"My training emphasized the importance of people who are telling the story, and my scenic style reflects that approach," he said. "I value the relationship between the designer and his peer designers as well as the director. Open communication, sharing of visual information and an understanding of the importance of a unified vision are all priorities when I approach any design."

So, what did Riha discover in Manhattan that made him appreciate his work in Arkansas? He worked with committed professionals, people who design sets and lighting and costumes – when they can get the work.

"They don't know from show to show when they'll get to work again," Riha said. "I learned to respect the fact that I get to do theater 10 times a year at the university."

Back in Arkansas, immersed in another season of the University Theater, Riha hasn't left Broadway completely behind. He has a book coming out in 2012 of interviews with 10 top designers, all in scenery and lighting. He hopes his book will be an inspiration for students who wonder whether they have what it takes to design at the highest level.

"Oh, yes, it is possible to get to New York from Arkansas," he said. New York designers, he found, are looking for assistants who have a good spirit, unflagging energy and the kinds of skills he's teaching his students.

For more about Riha's design in New York and beyond: http://michaelrihadesign.blogspot.com/. ■

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Research Frontiers

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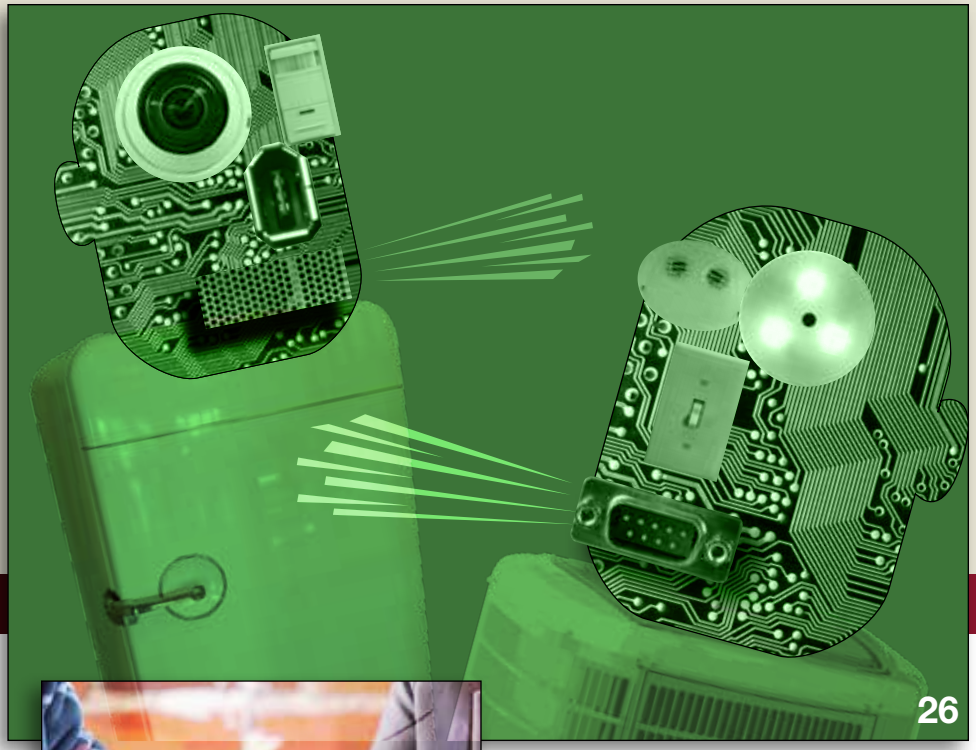

Departments

Features

▼ Dino Trackers!

See scientists suffer in the sun to expose a 115-million-year-old world where dinosaurs strode along Arkansas beaches. Learn why footprints tell us more than bones can.

Visit http://www.youtube.com/watch?v=fFbZ7_n9-Gw

▼ Cocoa by the Numbers

Undergraduate Mike Norton has applied his data management skills to improving cocoa yields for Ghanan farmers. More cocoa sold can raise families out of poverty and open school doors to their children.

Visit http://researchfrontiers.uark.edu/16996.phpedu/16996.php

◀ Light – and Easy – Rail

Two industrial engineers and two architects discuss the advantages of light rail transportation and a new computational tool that can help a city determine how many stations are needed and where to put them.

Visit http://www.youtube.com/watch?v=Z6NgNuvFqbs

▲ En Garde!

A master teacher – and University of Arkansas alumnus – teaches drama students to wield a sword on stage.

Visit http://www.youtube.com/watch?v=6QVN3KRR4OI

▲ Profiteroles and Punching Bags

Poet Michael Heffernan reads "The Art of Self Defense," a poem that "is not simply about things as they are."

Visit http://www.youtube.com/watch?v=z2eGeW-1HlM

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Professor Fights Pollution in Cameroon

On a trip to Yaoundé, Cameroon, in 2009, Christophe Bobda, associate professor of computer science and computer engineering, noticed that the roads were crowded with old cars. The emissions from these vehicles were filling the air with pollution, and Bobda became concerned about the health of the people living in this environment.

He also recognized that, in order to convince the government that pollution was a problem, he needed scientific evidence.

To get this data, he led a team that designed and built a set of devices that can monitor air quality. Each seven-inch by three-inch device contains three sensors, which can detect carbon dioxide, carbon monoxide and liquefied petroleum gases. It also incorporates a processing board, which prepares data from these readings, and a modem, which can send that data to a central server.

In June 2011, Bobda traveled to Cameroon with the 25 sensors built by his group. After teaching a course in which he demonstrated the technology involved in the sensors, Bobda presented them to the Ecole Nationale Superieure Polytechnique. Researchers there will install the devices around the city, rotating them among 60 intersections to collect data about pollution levels.

This data will be incorporated in a geographical information system designed by Emamuel Toyne, a professor in Cameroon. Researchers can then use the data to study the correlation between air pollution and lung diseases, which are a growing problem in Yaoundé.

Water + Biodiesel + Emulsifier = Lower Emissions

Researchers have found a low-cost way to lower hazardous emissions in diesel equipment manufactured before the advent of more stringent emissions regulations. Just add water to biodiesel, plus a little bit more.

Donald M. Johnson and Don W. Edgar, professors of agricultural and extension education, and former graduate assistant Jason A. Davis realized that traditional biodiesel fuel does not decrease nitrogen oxides, which are regulated by the EPA. Nitrogen oxides pollute the atmosphere and pose a threat to human health.

To encourage the switch to biodiesel fuel, which comes from renewable sources such as beef tallow and soybeans, the researchers knew the fuel would have to perform just as well as regular diesel fuel and be inexpensive to use. Reduced nitrogen oxide emissions would be an added bonus.

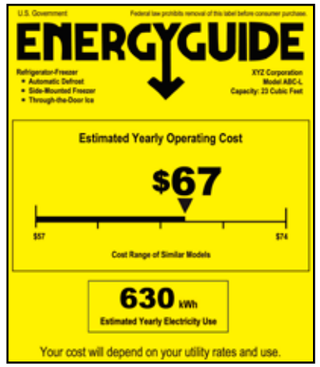
Adding an emulsifier to biodiesel fuel helps the water and biodiesel mix in much the same way creamer mixes with coffee. They found that using 10 percent water, 86.5 percent biodiesel and 3.5 percent emulsifier not only reduced nitrogen oxide emissions in off-road diesel engines, but the engines also ran better on the biodiesel mixture than on 100 percent biodiesel. Next: they'll look at different percentages of water to fuel and try different types of engines.

Photo submitted

Immediate Effects of Living Green Have More Influence

A University of Arkansas study suggests that "lifetime" savings claims on product labels are not the most effective method to reach consumers regarding the benefits and potential savings from using energy-efficient products.

The study's authors – Ronn Smith, assistant professor of marketing, and his colleague Andrea Tangari of Wayne State University – found that messages that boast of more immediate benefits will influence more people.



Smith and Tangari assessed the effects of temporal frames – "distal" measured in years or lifetime and "proximal" measured in months – on attitudes about product choice, purchase intentions and perception of savings. They conducted two experiments on consumer attitudes about compact fluorescent light bulbs. According to U.S. Department of Energy estimates, if every person in the United States replaced one incandescent light bulb with a compact fluorescent light bulb, consumers would collectively save more than $600 million in annual energy expenses and would reduce greenhouse gas emissions equivalent to that of approximately 800,000 automobiles.

The researchers found that the best temporal frame to use in messages regarding potential savings was one that focused on benefits that consumers experienced soon, stated usually as "months" rather than years or the lifetime of a product. The findings held even when savings figures on packaging were significantly less, including amounts less than a dollar, than the temporally distant figures.

Future-oriented people were much more likely to buy a compact fluorescent bulb based on the lifetime savings message. However, they did not discount near-temporal frames. In other words, they considered the savings benefits, stated in smaller amounts, on a monthly basis as did the present-oriented consumers.

Smith said he hopes their findings will help manufacturers consider more effective ways to communicate savings and efficiency of products and to motivate consumers to purchase items that are more efficient and better for the environment.

Election-Year Blogging Examined

Blogs have become a key part of presidential campaign strategy. An analysis of political blogs leading up to the 2008 presidential election finds differences in the use of blogs by Democrats and Republicans.

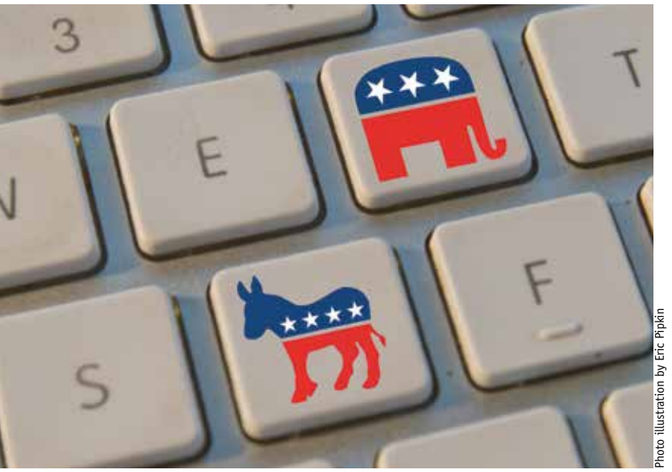


Photo illustration by Eric Pipkin

Robert H. Wicks, communication professor at the University of Arkansas, worked with a team of graduate students to analyze the content of four politically aligned blogs and six nonaligned blogs. They looked at blog posts from the day that Joe Biden was announced as the first vice presidential candidate to Election Day. Their results were published by the journal *American Behavioral Scientist.*

The two parties differed in the frequency of blogging on candidate and party websites. In the 2008 election, the researchers found, the Democratic Party deployed blogs on its candidate and party websites 11.6 times as often as the Republican Party. By and large, the GOP blogs used text with some video, while the majority of the Democratic blogs offered images, video or slideshows along with text.

Nonaligned blogs attacked more often than they praised. Five of the six nonaligned blogs posted attacks in 30 percent to 50 percent of their entries, while they posted acclaims from 8 percent to 26 percent of the time. Rebuttals were few from any source, making up only 4.4 percent of the total.

The researchers point out that blogs tend to present a black-and-white world. They both "expand the opportunities for healthy debate in a free society" and "enable people to avoid information that may be unpleasant or unwelcome."

Portal to the Point Generates Inventive Design

Marlon Blackwell, head of the architecture department, is a member of one of five multidisciplinary creative teams selected to participate in Portal to the Point: A Design Ideas Exploration. The teams will focus on public art and design at Point State Park, the most visible landmark in Pittsburgh, Pa. The 36-acre Point State Park is a popular recreational area on a triangular tract at the confluence of the Allegheny and Monongahela rivers, which form the Ohio River.

This idea generation project is funded by Colcom Foundation, whose mission includes "intervening in the urban landscape in positive ways," said Paul Rosenblatt, a principal with Springboard Design and the project adviser. Rosenblatt said that, rather than tie things to a construction budget, the foundation board wanted to develop ideas to generate a fresh perspective on the park.

Blackwell's architectural firm is the leader of an impressive team that also includes Kendall Buster, a nationally renowned sculptor and a professor in the department of sculpture and extended media at Virginia Commonwealth University; Guy Nordenson and Associates; dlandstudio of Brooklyn, N.Y; and Renfro Design Group of New York.

Marlon Blackwell Architect

Innovation Pays Off

During the dedication of its new Nanoscale Material Science and Engineering Building, the University of Arkansas received a check for $375,000 from NanoMech, an innovative small business that uses nanotechnology to manufacture products with broad applications. The check is not a gift, but rather payment for intellectual property owned by the university and successfully commercialized by NanoMech.

NanoMech was founded in 2002 and is the commercial result of research by Ajay Malshe, Distinguished Professor of mechanical engineering. Malshe and his research team's breakthroughs in nanomaterials and manufacturing include coating of nanoparticles, the first cubic boron nitride coating for machine tools, advanced nano-engineered lubricants and novel nano-electro-machining. NanoMech's products have applications internationally in machining and manufacturing, lubrication and energy, packaging for fresh produce, biomedical implant coatings and strategic military applications.

As part of a 2005 agreement, the university licensed technology and patents to NanoMech so the company could commercially develop the technology. The agreement required NanoMech to pay the university royalties for sales or sublicensing fees covered by the patents.

"NanoMech is a vibrant example of what happens when research is nurtured and supported," said Chancellor G. David Gearhart. "The commercialization efforts taking place within the Arkansas Research and Technology Park continue to play an important role in producing success stories like this one."

Forty percent of the cocoa used by companies such as Hershey and Mars comes from just two countries, the Ivory Coast and Ghana.

Photos submitted by Mike Norton

Going Cocoa

By Will Bryan

In the West African country of Ghana, millions of dollars are being poured in to train the government and farmers to help pull the country out of poverty. Thousands of miles away in Fayetteville, Ark., University of Arkansas student Mike Norton applies his skills and experiences to supporting programs to increase crop yields and improve lives. Norton, a junior in the Dale Bumpers College of Agricultural, Food and Life Sciences, has recently been awarded a Student Undergraduate Research Fellowship grant to continue this research.

In the fall of 2010, Norton attended a lecture about development in low-income countries by the CEO of Hormel Foods. His interest in doing international work was sparked. Lanier Nalley, assistant professor of agriculture economics and agribusiness, helped Norton become affiliated with the World Cocoa Foundation, an organization for which the professor had previously done research. They found that the organization was in need of intelligent volunteers with the very skills that Norton possessed.

"We got connected with the board of directors and the president and that turned into the internship, which then turned into the actual research project," Norton explained.

The following summer Norton traveled to Ghana and spent eight weeks doing an internship for the Monitor and Evaluation Team. The team documents progress being made from the money invested in the World Cocoa Foundation by the Bill and Melinda Gates Foundation and private industry companies such as Hershey, Kraft Foods and Mars. The information is put into reports that are sent back to the organizations as well as prospective donors.

In the third year of the five-year Cocoa Livelihoods Program the team performed the first annual impact study. They visited 15 villages while traveling through the Western, Ashanti, Central and Eastern Regions, an area about half of the size of Oregon, collecting data about crop productivity.

"In Ghana, they have cocoa on their currency, and it's a really important crop. It's vital to the success of the agriculture economies," Nalley said. Forty percent of the cocoa used by companies such as Hershey and Mars comes from two countries, the Ivory Coast and Ghana."

Norton took the data they collected and put it in a data management system for the program. For his research project, using data from the impact study, he will analyze the difference between farmers who took part in the program versus those who did not.

"You want to get the benefits in cocoa yield and turn that into an actual dollar amount and that's the benefit of the program, and then estimate the cost of the program with WCF figures, so we can do a cost-benefit analysis to figure out if the program is worth the money being invested into it," Norton explained.

The Cocoa Livelihoods Program has three main instructional programs that teach the farmers how to take care of their crops and their business. Once the steps are complete, the farmers are able to get loans, in the form of "input" such as fertilizer, fungicide, herbicide and pesticide. The inputs increase the yield of their farm, which then increases the profit for the farmer.

"Just looking at this year's data, if you look at the people who just did the first program, they were getting one to two bags an acre, but if you look at the people who did all three programs and were part of the micro-finance program – an additional program – their yield was six to eight bags an acre," Norton explained.

Photo courtesy of World Cocoa Foundation

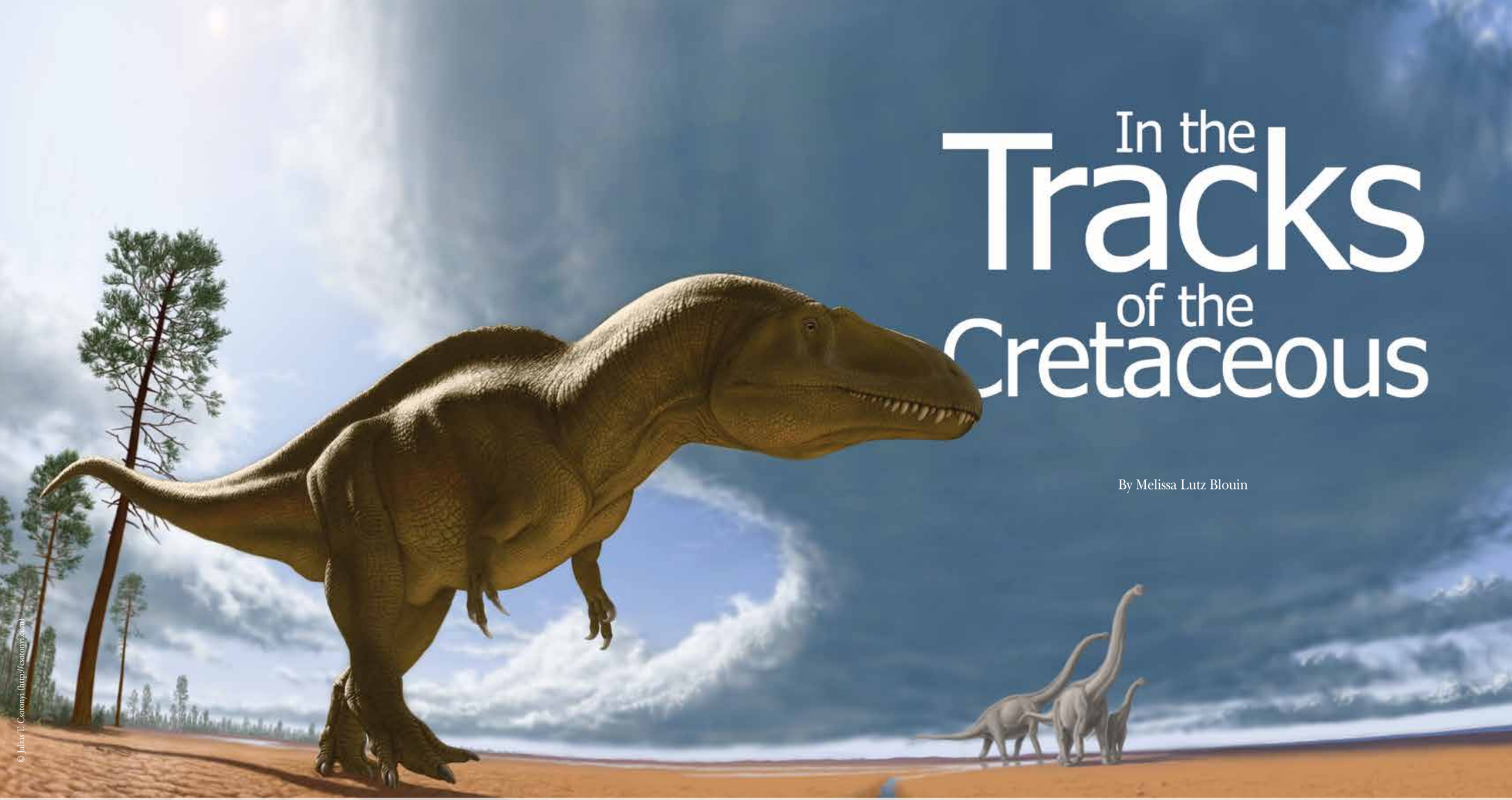
Mike Norton analyzed cost and yield data to help cocoa farmers in Ghana increase their crops and profit.

For the farmers, the increased profit is not negligible. The increase could be as much as a few hundred dollars a year for each farmer. While in the United States an increase of a few hundred dollars a year is something that might not be noticed, in poverty-stricken countries such as Ghana, it can make a significant impact.

"I think that's what's neat about small projects like this. Small investments can increase yield by 15 percent or 20 percent , which if that's $300 and you're making $2000 a year, that's 14 percent of your income. That's a big increase. That pushes a lot of people from being below the poverty line to being able to send their kid to school," Nalley said. ■

In the Tracks of the Cretaceous

By Melissa Lutz Blouin



Newly discovered dinosaur footprints in southwestern Arkansas offer scientists a peek back in time.

Beads of sweat form on geoscientist Steve Boss's face and trace tracks through sunscreen as they travel down his neck. From beneath his hard hat and behind his safety glasses, he surveys the grey field of rock surrounding him, heat radiating off bleached limestone in the southwest Arkansas landscape under the midday sun. He and his colleagues have been laboring since before sunrise at the research site, and the thermometer now reads 106 degrees Fahrenheit. He takes a swig of water from a plastic bottle, working hard to stay hydrated; yesterday one of the researchers almost succumbed to the heat, so the team has redoubled its efforts to stay cool.

As they did the previous day, the scientists will work for another six or seven hours in the humid, hot temperatures of a July day. But the scientists aren't thinking about the uncomfortable conditions or the long hours – their minds are focused 115 million years in the past, back when dinosaurs walked through Arkansas.

Previous page: A giant, meat-eating dinosaur called *Acrocanthosaurus atokensis* left its tracks on a muddy coastal plain in southwest Arkansas. The tracks are mingled with those of large plant-eating dinosaurs similar to the ones depicted here.

Left: Researchers for the Center for Advanced Spatial Technologies used a laser scanner placed on a cherry picker to create high-resolution images of the dinosaur tracks imprinted at the site. Inset: Researchers Malcolm Williamson and Jackson Cothren make adjustments to the machine.

Right: Researchers Steve Boss of Arkansas, standing, and Brian Platt of the University of Kansas use simple tools such as a pole, a tape measure and a notebook to measure the size of tracks and the distance between them. They will use these measurements with the information from the laser scanner to gather information about these animals and their surroundings.

Photos by Russell Cothren

"This looks like a claw," says graduate student Brian Platt. He points to the end of one of three distinct grooves in the rock as he and Boss lean closer to the giant impression in the chalky ground. The footprint is large enough that a collie could curl up in the center of it. It is one of hundreds of footprints of different shapes and sizes that pepper the terrain around the now prone scientists. The tracks face in all directions, criss-crossing back and forth, some on top of one another.

Boss sets the scene, for the writer, his hand sweeping to encompass the barren landscape: 115 million years ago, this area bordered the edge of the continent, and the whitish ground we stand on was part of a shallow coastal mud flat. Boss likens the climate and surroundings at that time to the Persian Gulf today – hot and arid conditions with very salty water and no real vegetation to speak of.

"It was a place that you wouldn't want to spend much time in," Boss says.

Despite the harsh conditions, many dinosaurs walked through this area. Prints found include those of sauropods – giant, long-necked plant-eating dinosaurs – as well as predatory theropods, probably *Acrocanthosaurus atokensis,* one of the largest carnivorous dinosaurs to ever walk the earth.

"We're not sure what the animals were doing here, but clearly they were here in some abundance," Boss says. "There is a remarkable diversity of tracks here. We have some large predatory dinosaurs that have never been described in Arkansas before. We've speculated for a long time what kind of dinosaurs lived in this area, and now we have direct evidence."

The discovery of dinosaur footprints provides as much excitement to scientists as skeletons do, says Platt. Scientists can use footprints to learn about animal behavior as well as biology – where did an animal go, how did it walk, how much did it weigh.

"Tracks are trace fossils. They represent the behavior of ancient organisms," Platt says. "An animal has only one body to donate to science, but it can make thousands of tracks in its lifetime. Tracks represent a page in history that tells about what was going on here 115 million years ago."

How can scientists guess the height and weight of an animal that lived so long ago? To do this, Platt and others study modern-day living creatures.

"I've worked with elephants walking in different types of sediments to see how they deform the sediments," Platt says. "This is a good model for the sauropod dinosaurs."

While Platt examines the print of a plant-eater, Boss follows a set of three-toed tracks made by a giant predator. The space between the tracks spans such a distance that a person can't jump from one footprint to the next. After following the steps for a few hundred yards, Boss stops and points to two tracks side by side.

"It looks like this animal stopped here," he says.

The researchers' excitement at seeing the tracks firsthand is tempered by the need to act quickly. Their access to the site is limited to two weeks, and they will not be able to return. The team of researchers, which includes scientists from the University of Arkansas, the University of Kansas and Boise State University have a fast-track grant from the National Science Foundation to collect as much information from the site as they can before time runs out.

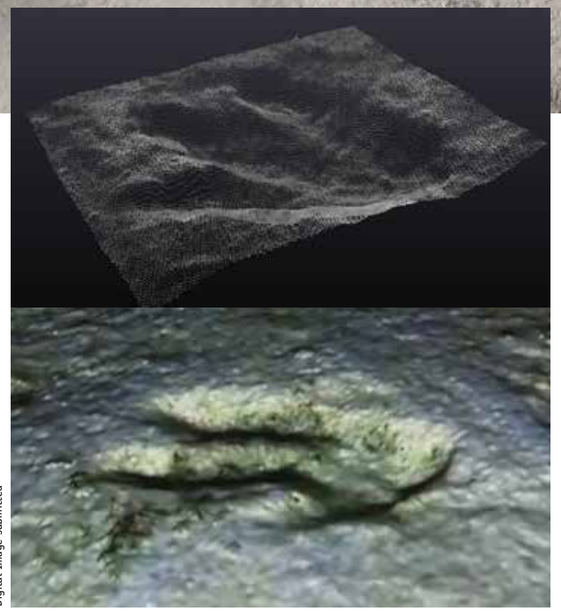
To accomplish this, the researchers have brought an array of tools with them: picks and whisk brooms, measuring sticks, notebooks and pencils, and laser scanners.

Wait – why bring a laser scanner to a field of footprints? Cue Jackson Cothren and Malcolm Williamson of the Center for Advanced Spatial Technologies at the University of Arkansas. Boss asked Cothren and Williamson, who have used laser-scanning technology to map World Heritage sites including Machu Picchu, to apply their work to the dinosaur tracks. The researchers are using a high-resolution scanner perched atop a cherry picker to create a precise digital map of the location of the prints within the landscape. The technology not only allows measurements of the prints themselves within six millimeter accuracy, but it also maps the prints in relation to one another – something that could take months to do using old-fashioned techniques.

"If you are trying to understand where the tracks go and the relationship between the various tracks, it is better to see everything at once," Cothren says. "The laser scan will give you the ability to look at the entire site from an aerial perspective, zoom in on the areas that you are interested in and map out features that you may have missed because they are too difficult to see in the monochrome limestone here."

The scans will be made available to paleontologists and other interested individuals wanting to study the site so they will be able to make a virtual visit to the site without having to travel to the site itself.

Photos by Russell Cothren



Digital Image submitted

Top: University of Arkansas geosciences majors Alex Hamlin and Ryan Shell paint a dinosaur track with grease to prepare it for plaster casting.

Inset: Laser scans taken by researchers in the Center for Advanced Spatial Technologies show details that may not be visible to the naked eye.

Top right: Plaster casts of a series of theropod tracks attributed to *Acrocanthosaurus atokensis*. Researchers from the University of Arkansas and their colleagues spent two weeks in southwest Arkansas characterizing the site where these tracks were found.

Inset right: From left, Boise State University researcher Celina Suarez and University of Arkansas researchers Terryl Daniels, Stephen K. Boss and Joann Kvamme lift a dry plaster cast of a side-by-side sauropod and theropod print.

"Scientists can use these data to look at how the animals were moving through the area," Boss says. "These scans will produce a comprehensive map with precise measurements of the whole site." From this, the University of Arkansas researchers and others will be able to study various aspects of the site related to the movement of the animals over time and in relationship to one another.

A glance at the computer screen under the shade of a tent reveals a surprising array of prints – more than are seen looking at the site through safety glasses. The scan on the screen confirms that the site contains layers of tracks from different generations of the animals.

"The computer images of the site show detail not visible to the naked eye," Cothren says.

While the scanner takes images, the researchers remove dirt from the footprints and record their observations in field notebooks. They create a grid and photograph the site for a future photo mosaic. They sketch some areas with a marker and a plastic sheet, looking at the size of the footprints, the distance between footprints and the angles of the tracks themselves.

"We don't always know what data might be the most important," Boss says.

Later they also will take plaster casts of the footprints, a messy process, but one that will allow them to preserve the imprints back in the laboratory. Together, these processes will give the scientists a comprehensive set of data to work with.

In addition to learning more about the dinosaurs that walked through this area from the footprints, the scientists will be able to learn more about the environment they lived in. The researchers will take small samples of the rock bed where the footprints were found and look at the chemical composition of these rocks to learn about the Cretaceous.

"These tracks were made in shallow water, so we know that 115 million years ago this surface was exposed," says Celina Suarez, a postdoctoral researcher at Boise State University who will begin working as a faculty member at the University of Arkansas in the department of geosciences in fall 2012. She points to a rock covered in wavy lines that look like ripples in the sand that have been frozen in time. "By looking at the chemical composition of rocks like these, we can learn about the climate at that time."

By determining the temperature and the intensity of evaporation in this region by looking at the chemical composition of the rocks, scientists can compare the information found in these rocks to those found at other sites and develop a global "snapshot" of the climate during the early Cretaceous.

"There's a lot of post analysis that needs to be done," Boss says. But before that can happen, the researchers must finish the tasks at hand under the scorching July sun.

To accomplish this, research associate Joann Kvamme plunges her arms elbow-deep into white plaster. She moves rapidly, together with geosciences graduate student Terryl Daniels, to mix the powdery plaster with water in a bucket, stir the mixture and transport it to the designated print. Once they have it there, Honors College student Alex Hamlin and geosciences major Ryan Shell dip strips of burlap into the gooey white liquid, pull them out and slop them into the greased dinosaur tracks before the plaster begins to harden. The researchers repeat this process until they have plaster casts of about 30 different tracks. They choose these tracks on the basis of particular characteristics of the track – its size, shape or location, for instance.

Once the plaster casts have dried, a team of four or five people carefully pries them up. Finally they load the back of the research van with the plaster casts, the tent and the other equipment. The two weeks are over, and it is time for the hours-long drive back to campus. For the researchers, these two weeks of hot, sweaty work in the sun represent just the beginning of the work. Back at the laboratory, they will begin to find out what they can learn from the information they collected.

Even as they leave the site, excitement about the find remains high among the scientists. This particular site expands the knowledge about the geographic range and biodiversity of dinosaurs during the early Cretaceous and provides additional insights into the puzzle of global climate change. ■

Dating or Dangerous Liaisons: How Do We Choose?

By Barbara Jaquish

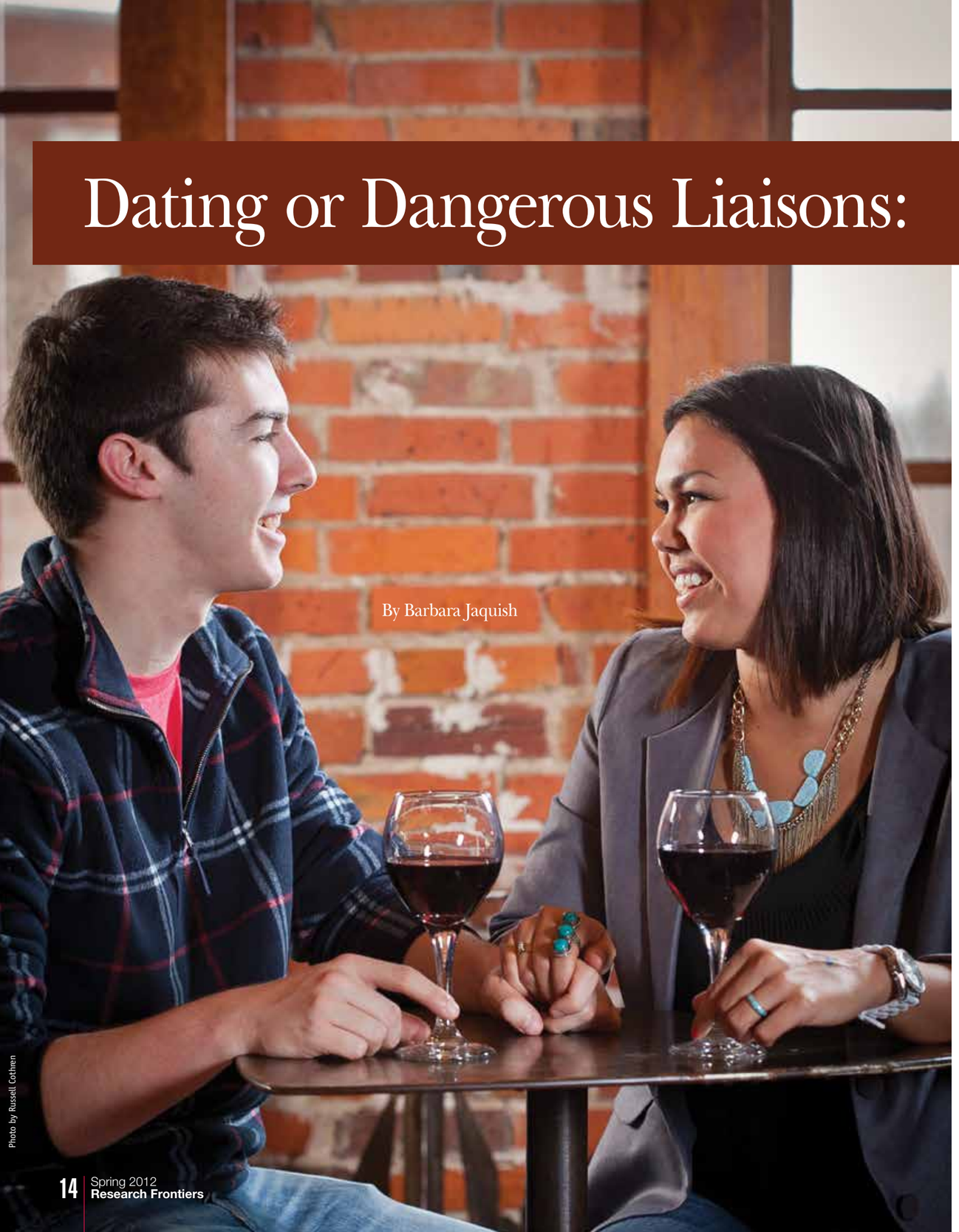


Photo by Russell Cohnen

Jacquelyn Wiersma wants to know why people select a certain person as a romantic partner. She can't answer that question yet, but on her way to the answer, she has learned some important things about the lives of teenagers and young adults.

Teenagers are famous for experimentation. To figure out who they are and how they fit into the world, they try on adult independence and experiences. Whether it's dating, drinking or drugs, they make choices that have consequences, some fleeting and some lifelong. They explore behaviors that may become memories or lessons or a lifestyle.

Underage drinking at a party may be a one-time bit of rebellion or the beginning of a life centered on alcohol. Dating may be a pleasant, though sometimes anxious, activity that helps an adolescent learn about relating to a potential mate. Or it may be a training ground for relationships based on mutual support for risky behavior. The choices they make as adolescents may well influence the decisions they make as young adults, including their selection of a life partner.

Wiersma, an assistant professor of human development and family sciences, has examined existing research results and found little that focuses on mate selection and drinking. She hopes to identify the shape of factors and decisions that go into the complex task of mate selection by looking at the choice of a romantic partner in the context of risk taking and by tracking behaviors as adolescents transition to young adulthood. Wiersma has been involved in a series of studies, most often with colleagues from Texas Tech and Penn State, which have approached the question from the angles of drinking or violence in romantic partnerships.

By the Numbers

Thus far, Wiersma's research has drawn from data in the National Longitudinal Study of Adolescent Health – also known as Add Health – a nationally representative, longitudinal study of health-related behaviors of adolescents and their outcomes in young adulthood. Funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development and other federal agencies, Add Health was originally designed to study how teenagers' health and behaviors are influenced by social context – their families, friends, schools and communities. Among the health behaviors studied were tobacco use, sexual activity, sun exposure and drug and alcohol use.

Add Health is an ambitious and complex project that initially involved researchers from seven institutions, led by principal investigator J. Richard Udry of the University of North Carolina at Chapel Hill. The researchers were assisted by an advisory board of scientists and adolescent health specialists as well as specialists from the National Institutes of Health and the Public Health Service.

The first phase of the study in 1994 involved surveys of 90,000 teenagers from 145 schools around the country. The second phase involved in-home interviews with 20,000 students and their parents. In addition to input from parents, the data from surveys of school administrators and information collected about community characteristics provide an independent measure of the context adolescents live in and the factors that could influence them. In Wave III of the study, researchers again surveyed participants at ages 18 to 26. Wave IV touched the next phase of life, ages 24 to 32. The resulting rich trove of data is available to researchers worldwide and has resulted in hundreds of published results and scholarly articles.

Most studies that have examined alcohol use in relationships have only looked at married couples, and the Add Health data has been useful in the initial stages of Wiersma's quest to understand partner selection with dating and cohabiting partners as well.

"Mate selection is based on a few variables, such as the influence of peers and religion," she says, "but in young adults, drinking is also prominent and shouldn't be ignored."

Little research has examined couple-level substance abuse within young adult romantic relationships. For those who start

Photo by Russell Cothren

Jacquelyn Wiersma has learned that drinking behaviors may be an important factor in choosing a romantic partner. In the future she hopes to identify aggressive processes in couples' interactions as a step towards violence prevention.

young adult life with higher education, in general, during those four years of college, people date more and drink more than during other stages of life.

Romance and Drinking

In a 2010 study, Wiersma and colleagues used Add Health data on drinking and romantic partnerships in adolescents and young adults to look at the experiences of 852 couples, including couples who were dating, cohabiting and married. They found that drinking in adolescence carried through to partners' drinking in young adulthood. Six years had passed between the adolescent and young adult surveys, suggesting that "drinking behaviors may be important when choosing a potential romantic partner, even beyond demographic similarities."

For males, there was a strong association between their drinking and their partner's drinking. That is, the researchers wrote, "The more men's female partners drank, the more he drank, more so than for women with their male partners." In the transition from adolescence to young adulthood, men's drinking tended to increase, whether dating, cohabiting or married. Married women showed the smallest increase in drinking, a result meriting further investigation, the researchers wrote.

In another study of 741 young adult couples, Wiersma identified four types of drinking partnerships among young adult heterosexual couples. The vast majority of the couples had congruent drinking behaviors; that is, the males and females drank about the same amount and with the same frequency. The majority, 417 couples, reported being both light and infrequent drinkers, while 147 couples frequently drank moderately to heavily.

The remaining couples had discrepant drinking behaviors. In 90 couples, the males drank more heavily and more frequently than the females. In another 37 couples, the females were the heavy and frequent drinkers.

"There are important implications for young adult individuals who drink discrepantly within their romantic relationships," Wiersma said.

For example, intimate partner violence: Whether the man or the woman is the heavy, frequent drinker, the more discrepancy in drinking behaviors, the greater the level of conflict and violence in the relationship.

The researchers emphasized that the majority of couples they studied did not report experiencing intimate partner violence. Just 26 percent of young men and 26 percent of young women reported initiating violence against their current partner, and the violence was more often minor. In the Add Health studies, minor violence includes threats, pushing, shoving and throwing things that could result in a strain, bruise or light cut. Severe violence includes slapping, kicking and forced sexual relations. These forms of violence are not the same as "intimate terrorism," which is less common and is predominantly perpetrated by men.

What's next?

So far, Wiersma's research has involved large data sets that have told her intriguing things about the romantic relationships of adolescents and young adults. Much of what's been learned from examining the Add Health data makes sense, but she says, "no one has looked at the mechanisms involved with an eye to developing prevention programs."

For example, why did the data show so many women initiating violence in their relationships with husbands who drink heavily and frequently? It's possible that the wives' violence is a defensive response to husbands acting aggressively or using verbal or psychological abuse, she suggested. Right now she can't say for sure, because the necessary data wasn't collected in the Add Health surveys.

Wiersma would like to conduct qualitative research to hear from the participants first-hand. Another possibility is using diaries to identify the sequence of events and aggressive processes that occur in couples' interactions, results that could inform prevention research.

Additionally, the Add Health database only offers data on hetero-sexual couples. While understanding heterosexual relationships is complicated, and there is still plenty to learn, Wiersma would like to know more about the experiences of same-sex couples. In the absence of an existing pool of data, she would have to collect her own data on drinking and drug use of gay couples.

Portions of Wiersma's research were supported by a grant from the National Institute on Drug Abuse. ■

Hands On

by Kendall Curlee

Do the words “Honors College research” conjure an image of footnote-dotted research papers? Think again: research by Honors College students, all of them undergraduates, can take many forms, from a mobile game app to a chemical reaction that may help treat Alzheimer’s disease to, yes, a thoroughly vetted paper that features original (and in some cases, publishable) work.

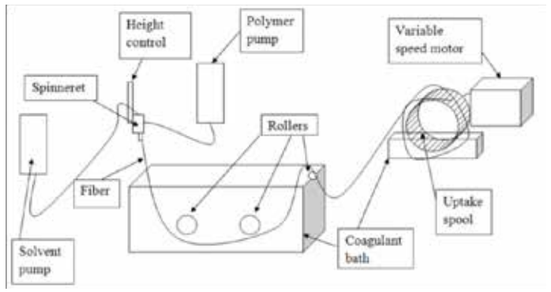
Some days the research is independent, and some days it’s one-on-one, in-the-trenches work with a faculty mentor.

Here, we present some snapshots of hands-on undergraduate research being carried out by Honors College students across campus – and around the world.

Photo by Russell Cothren

Ali McAtee turns on the nitrogen gas that will pump polymer through an apparatus that she designed.

Photos by Russell Cothren



McAtee's diagram for the hollow fiber membrane spinning apparatus.

The Lab

Ali McAtee, a senior chemical engineering student and Honors College fellow, pulls on blue gloves and snugs safety glasses into her blonde ponytail: she's ready to roll. A glass beaker spins, creating a polymer from 11 grams of cellulose acetate and 89 grams of acetone, the same solvent used in nail polish remover. Nearby, a large stainless steel tub is filled with soapy water. It's fitted at one end with a special chrome fixture called a spinneret that is attached by tubing to two "bombs" - pressurized canisters. McAtee carefully pours the polymer into one canister, and then measures acetone into the other. She turns on two cylinders of nitrogen gas to pump the fluids out from the canisters through the spinneret into the tub. If all goes well, a tube thinner than a strand of angel hair pasta, formed by the polymer and hollowed by the solvent, will emerge into the tub.

And … no go. A milky drool oozes out, and McAtee's face falls. She fiddles with the spinneret, lowering it closer to the water, and adds another capful of Dawn dishwashing liquid to decrease surface tension. Slightly thicker lumps of polymer fan across the water. Tom Potts, a member of her team who jokingly refers to himself as "the world's oldest grad student," stops by to check her progress.

"I think we're going to have to start again, with a different mix in the polymer," McAtee says. "It's hitting the water and turning to mush."

"It's not dense enough," Potts opines. "I'm thinking your polymer is not heavy enough to sink."

"Yeah, it wants to float," McAtee agrees. "Would wet spinning help – if I lowered the spinneret into the water?"

"It might," Potts says.

Both of them lean in over the tub, McAtee starts to pull, and suddenly a gossamer thread shimmies out of the spinneret. "You're making headway kid!" Potts says, as McAtee, beaming, gently lays the translucent strand in a hexagonal tray for a long, firming-up soak in water. It doesn't look like much, but it's a big step forward for her honors thesis.

Since the spring of her freshman year, McAtee has been working with Jamie Hestekin, a chemical engineering professor, on a team effort to convert algae into butanol, a type of biofuel. She has focused on developing hollow fiber membranes – that tiny tubule produced in the lab is one – that can be used to pump carbon dioxide into algae, making it grow more quickly. The hollow fiber membranes release miniscule bubbles that can be readily absorbed by algae. Typically they're packaged into plastic cartridges, but Hestekin's team wants to spread them out in a thin mat under the algae, increasing absorption. The problem? The thin, fragile fibers are broken when the algae is harvested by vacuum suction, and they're not cheap. That's where McAtee comes in: her goal, and the subject of her thesis, is to develop a stronger hollow fiber membrane.

It's graduate-level work, Hestekin is quick to affirm. "Ali's leading in an area, and that's why it can be so frustrating at times," he said. Fortunately she's had some help. Every week McAtee meets one-on-one with Hestekin and takes part in a team meeting. The team, which ranges in age from freshmen to Ph.D students, is tight-knit, "kind of like a family, really," said Lauren Woods, a graduate student. They edit each other's papers, help track down missing equipment, and lend a hand in the lab. McAtee has also benefitted from six Honors College research and research travel grants and one Student Undergraduate Research Fellowship.

Last year McAtee accompanied Hestekin to the National University of Singapore, where she met Neil Chung, a world-renowned hollow fiber membrane expert. She observed and worked with graduate students in his lab, presented her work to the group, and came home with a present: the spinneret that separates the polymer and solvent solution, creating the hollow membrane structure.

The opportunity to see Chung's lab was invaluable, but his sophisticated set-up is costly. With Hestekin cheering her on, McAtee designed the no-frills apparatus in his lab. Now, with the primary goal of producing a hollow fiber membrane met, she can begin to manipulate the polymer solution to move forward in her quest.

"It's really awesome to see something that I designed on paper, here in the lab," she said. "The research has definitely been a great ride."

Success! McAtee and graduate student Tom Potts examine the gossamer-thin hollow fiber membrane. Tiny tubules like this one will help transform algae into biofuel.

Knox weaves baling wire into a snarling wolf.

The Studio

A cloud of acrid-sweet fumes wafts down the stairs but dissipates as you enter Luke Knox's studio apartment, thanks to numerous windows thrown open to a cool November twilight. In one corner, a bulbous plasticine bluebird head perches atop a torso woven from baling wire and lithe, spray-painted mannequin legs. A six-foot-high by four-foot-wide painting of gamboling, cartoonesque mares dominates one wall; a blank canvas waits on another. Paint-smeared rags and computer printouts of Paolo Uccello's Battle of San Romano and Walt Disney's Bambi hang from a clothes wire strung along one side of the room; shelves crammed with power tools and battered volumes of Capote, Dostoyevsky and Whitman line the other side of the room.

"Sorry about the spray paint!" Luke Knox, a tall, shaggy-haired art student dressed all in black, points toward a ram sculpted from tight, calligraphic whorls of baling wire that is suspended from a wreath of fake flowers, its legs frozen in a mad scramble. "I decided to paint the ram's head black."

"I like the black," says Kristin Musgnug, a painter and art professor who is mentoring Knox's research. "Why this posture?" she asks, circling around the ram.

"I want it to look like it's reacting to the wolf," Knox says, referring to a completed piece that will be included in the installation he's preparing.

"So … is it a victim?" Musgnug asks. "We're looking for clarity here. Is it jumping to get away? A carcass? Dancing?"

"Yes, dancing!" Knox responds. "It represents the joviality of Pan, I want to bring that into play …."

And they're off on a discussion of the ram's association with fertility and harvest rituals, the darker symbolism of Pan, the frenzied dance of bacchantes. Interlaced with the abstract are some quiet suggestions from Musgnug to help Knox refine the concept: lowering the ram slightly to reinforce the idea that it's dancing; placing the wreath on its head to push the connection with bacchantes. It's a dance that they're doing, the student leading, the professor questioning, correcting, affirming. Perhaps Musgnug's most important role is to help Knox select from an abundance of ideas and images and refine them.

The ram, the bluebird-headed harpy and the painting in Knox's studio are all fodder for his honors thesis, which uses mythical animal archetypes to explore the relationship between civilization and nature. Under Musgnug's guidance, he's spent the last year creating work informed by the writings of Joseph Campbell, Edith Hamilton and Carl Jung, and artwork ranging from the ancient bronze Capitoline Wolf to the contemporary watercolors of Walton Ford. Knox's research will culminate in a series of installation pieces using both crafted and found objects that will be exhibited in spring 2012.

"It's been a long path to this project," Knox said. "Animals play such a huge role in myth, especially in Aesop's Fables, and I've always wondered why people use animals to represent themselves. It's been a process of narrowing down – if you discuss one thing enough, you discuss many different things."

Photos by Russell Cothren

Faculty mentor Kristin Musgnug discusses a sculpture-in-progress with Luke Knox.

Knox's research and creative work were funded in part by a Student Undergraduate Research Fellowship, which covered materials such as oil paint, baling wire, power tools and books. He also makes a point of noting the impact of Musgnug, with whom he's worked steadily since he took her class on alternative drawing processes two years ago. "We've definitely formed a kinship," he said. "She's the most supportive and liberating teacher I've ever had."

Knox is still struggling to nail down a precise plan for the exhibition – a question about what, exactly, will be included doesn't get answered – but he's clear on what he's trying to do. "I want to create a world, with the things I make, and that culture makes, that indicates how animal myths have survived in our culture. It's about taking the immense power of nature and showing how it's soft now, commercialized." He picks up a winsome porcelain piggy bank in the form of a bear, a completely denatured object with a polka dot tie and a parrot on its shoulder. "This is silly, goofy – and it speaks volumes about our attitude towards nature," he said. "A lot of people will never see a bear now, except maybe on TV."

Photo by Kareem Jack

Arkell and Ibrahim discuss strategies for designing on the hillside site in Kigali, Rwanda.

The Crit

Nine architecture students, two of them members of the Honors College, crowd into a former bank vault lined with three-and-one-half-foot-wide by five-foot-high sheets of paper – "boards" in architecture's parlance. The sketches and plans on the boards outline their proposals for new housing for a neighborhood in Kigali, the capital of Rwanda, which is rapidly recovering from the ravages of civil war and genocide. The Rwandan government plans to tear down the current maze of houses on the steeply sloped site, and the students are charged with developing flexible housing solutions that can accommodate rapid population growth while remaining culturally sensitive.

On this afternoon Peter Rich, a South African architect who is co-teaching the studio with architecture professor Korydon Smith, and Tomà Berlanda, a guest critic from the Kigali Institute of Science and Technology (KIST), critique the students' work, on display in downtown Fayetteville.

"How do you as a designer provide the basics so that the people can take over?" asks Rich, gesturing at the students' boards. "There's no way the government can do it – and people do it so much better anyway. How do you preplan the infrastructure – not just the water and sewage, but the terraces as well?"

Hanna Ibrahim, a senior Honors College fellow, steps up to present her work. "I asked myself, how do you make the most of the retaining wall provided by the government? My solution is to build buildings off of the wall." Rich praises her concept, which revolves around two housing types and pockets of outdoor space: "It's what you might see in Italy – a very basic house type, where the staircase and courtyard creates the delight."

Berlanda, sharing general impressions of all of the students' work, comments: "Your drawings are beautiful, but we need more information. How are the buildings getting their feet in the ground, and what are the elements of the Rwandan house that you've incorporated into these concepts?"

The exhibition distilled 10 weeks of work that began with a two-week trip to Rwanda. There, each student partnered with a student from KIST, who acted as interpreter, and together they spent time with individual families – interviewing them, eating meals with them, and sketching. Hanna Ibrahim was among the students who spent time with rural families, who have ample outdoor space – the preferred site for socializing in Rwanda. "We really got to know the people we're designing for," Ibrahim said. "We've been in their homes, we've played with their children, we've eaten their food. The question is, how to increase density while preserving the private exterior space that they value?"

Andrew Arkell, the other honors student in the studio, worked with families living in the Kigali neighborhood slated for rebuilding. He was struck by the beauty of the ad hoc drainage systems developed by the community: "There are concrete steps that cascade down the hill; when the water flows over them, they look like onyx," he said, flipping to a sketch he'd made. "The spaces were small, the materials rough, but there's some subtle moves that are really quite beautiful," he added. Arkell's scheme, which centers housing around private water courts where families could bathe, launder clothes and socialize, was guided by a new appreciation for what he described as "practical, simple, honest building."

Both Arkell and Ibrahim are excited by the possibility that their designs may have a life beyond the studio. Smith is working on a book about the studio, and Rich will select the most promising work for further development by Rwandan architecture students. Eventually these designs will be presented to the government officials in charge of rebuilding the neighborhood. Though officials have expressed a preference for Western-style schemes with steel and glass, the students hope that their designs using mud brick and cross breezes will suggest an alternative vision, shaped by traditional materials and cultural preferences, that can be further developed by the people of Kigali over time.

"Architecture is about the people who use it," Arkell summed up. "Getting to know these people made me want to be an architect more than ever before. As students, we can start to have an impact."

Arkell is right. Whether it's a clever design idea that will help a Kigali family manage stormwater runoff or an honors thesis that opens up a new area of research for a professor, undergraduate research by honors students does have an impact. Most certainly, it shapes the students themselves, preparing them for graduate school and real-world jobs and building relationships with professors and other students that continue long after they leave campus. ■

Editor's Note: One-third of the Honors College alumni who completed a recent survey emphasized the value of undergraduate research, commenting on this aspect of the honors experience more than any other. To learn more about survey findings, visit honorsblog.uark.edu/2011/11/28/alumni-survey-results-are-in/.

Photo by Russell Cothren

Hannah Ibrahim's design calls for pockets of outdoor space, the preferred site for socializing in Rwanda.

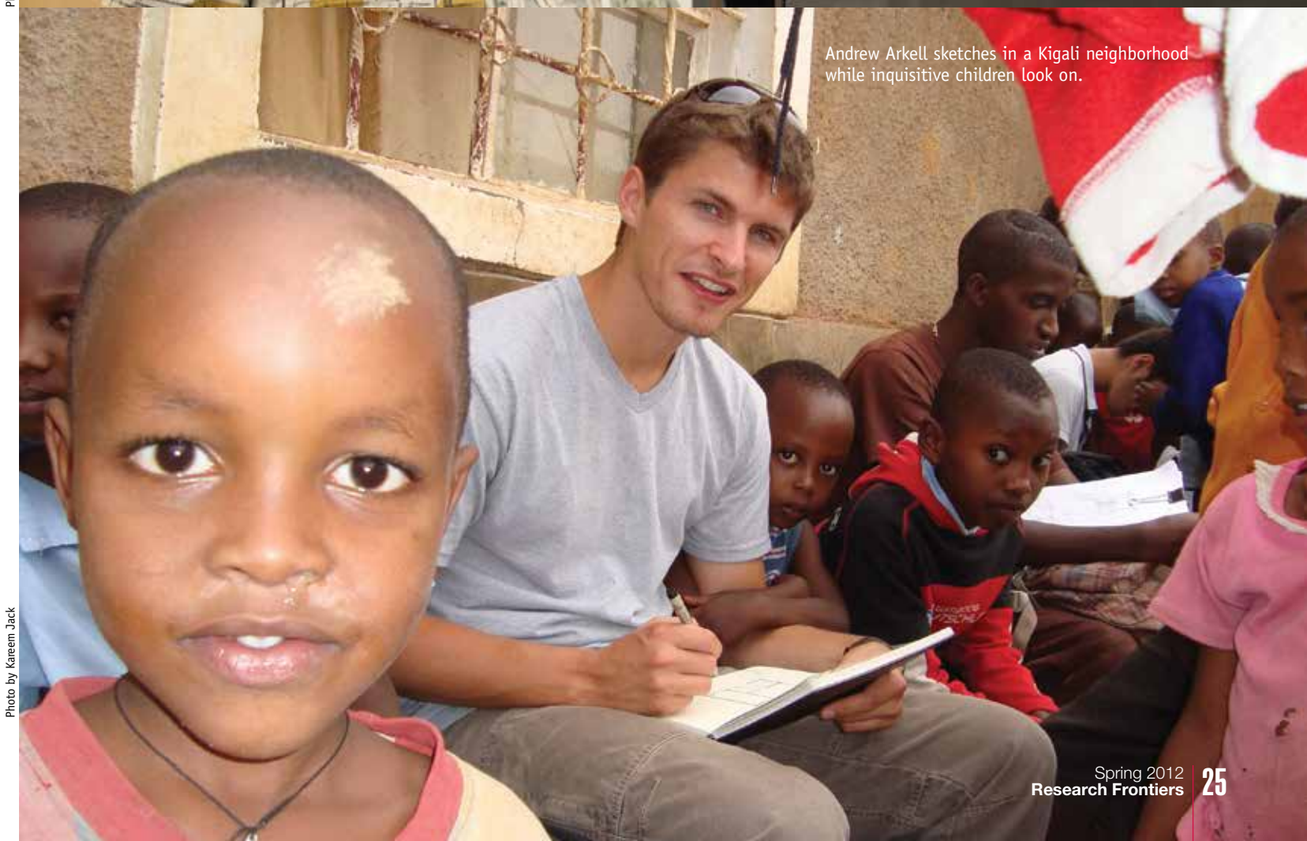


Photo by Kareem Jack

Andrew Arkell sketches in a Kigali neighborhood while inquisitive children look on.

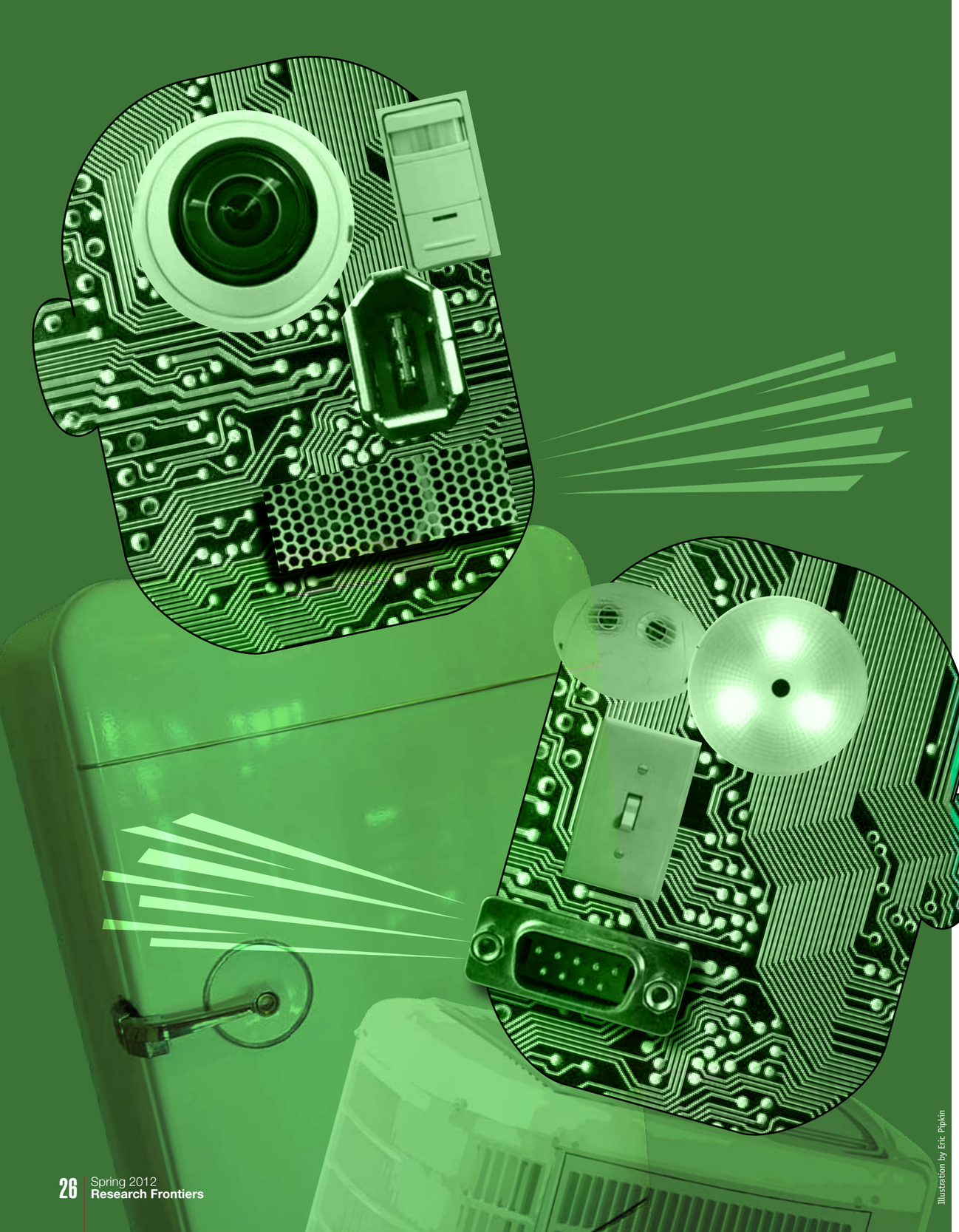


Illustration by Eric Pipkin

Where Objects Talk to Each Other

By Matt McGowan

Inside the Mobile, Pervasive and Sensor Systems Laboratory at the University of Arkansas, among the wires and the circuits and the chips and batteries and quarter-sized solar panels, Nilanjan Banerjee and Pat Parkerson toil in that nebulous environment where man and machine seamlessly converge. It is a world in which computers have intelligence, electronic environments are sensitive and responsive to the presence of people, and information processing has been integrated pervasively into everyday objects and activities. In short, it is a world in which, as their colleague Craig Thompson puts it, "everything is alive, and objects talk to each other."

It sounds like science fiction or a world of the future, but it is neither. All of this is already happening, especially with mobile phones, global positioning systems, laptops and tablets, all types of sensors, and retail systems that gather mountains of data about products and consumers. Banerjee and Parkerson, assistant and associate professors of computer science and computer engineering, respectively, devote their time to improving and enhancing these systems, making them faster, more efficient and especially capable of performing new tasks. They focus on three areas: renewable energy-driven systems, health-care systems and mobile phone-based systems, popularly referred to as apps. Their designs and products include small, sound-powered sensors that read and store medical data, solar-powered sensors used for disaster relief and large monitoring systems for "green" homes. These will help paramedics find an unobstructed route to tornado victims, empower parents with sick infants and enable homeowners to monitor and more efficiently control energy.

An App for Green Homes

Although expensive to build, green homes have many personal and social benefits. Because many green homes rely on clean energy sources such as sun and wind, they decrease reliance on fossil-fuel energy production and do not harm the environment.

Green homes can be "off-grid," that is, not connected to the U.S. power grid, or "grid-tied," relying on the grid for only some of their power. If they are set up and function properly, both off-grid and grid-tied homes can create significant tax rebates for the homeowner and in some cases can lead to rebates through consumers selling energy back to power companies.

Currently, off-grid homes account for only 1 percent of all dwellings in the United States. However, as the federal government focuses attention on clean energy sources, the number of grid-tied homes with solar power has increased significantly in recent years. In 2009, the number of grid–tied homes grew by 40 percent.

Image submitted

In the green home project, an iPhone-based recommendation system uses information collected by the measurement system to give users advice regarding energy consumption, including warnings in advance of critical battery situations, recommendations for the best times to execute high-power tasks and opportunities to adjust the power states of specific devices to reduce energy consumption.

In 2011, lab director Banerjee, a self-professed software guy, received grants totaling $450,000 from the National Science Foundation to further investigate energy generation and consumption in off-grid and grid-tied homes and to develop a business model to commercialize the work. Collaborating with Sami Rollins, a usability and mobile-systems specialist and professor at the University of San Francisco, Banerjee had already designed software and an iPhone mobile application to perform such a task. To build the system, the two researchers partnered with Parkerson, a hardware guy from the university's High Density Electronics Center, who has more than two decades of experience with electronic circuits and sensors.

With help from students, Parkerson is designing hardware circuits and indoor-light-driven sensor boards compatible with Banerjee's software. Together the researchers developed an automated energy-management system that monitors generation

Image submitted

This prototype measurement system in an off-grid home in Arkansas helps the researchers understand how energy is generated and consumed in homes powered by renewable sources.

and consumption of energy in homes that rely on sun or wind for power.

"We are building a system that strikes a balance between totally automated control, which might irritate homeowners by turning off the television while they're watching a program, and reactive or manual techniques that really are not sufficient to prevent critical battery situations or energy outages," Banerjee said. "Our system simply will alert the homeowner of critical situations and then suggest which appliances to turn off. From anywhere, as long as they have their smart phone, homeowners can then use the software to direct the system."

In early 2011, the researchers installed a suite of monitoring tools in an off-grid, solar-powered home in Fayetteville. They collected generation and consumption data for 55 days, 14 days during the summer and 41 days in November and December. In addition to monitoring the photovoltaic system's power-generation devices, the system also tracked individual appliances, including a refrigerator, washer and dryer, hot-water heater and even a television and lamps.

Data collected by the monitoring system demonstrated that energy harvested from the solar panels and energy consumed by the house were both highly variable. This was true within a single day, across several days and across seasons. Although generation and consumption varied greatly, they did so in a predictable manner.

Their findings also provided evidence that traditional energy-management techniques are insufficient in off-grid homes. For example, the widespread assumption is that the ideal time to run appliances that require a lot of energy is between 7 p.m. and 7 a.m. However, the researchers discovered that because the battery was receiving and storing more energy during the day, it was better to run appliances from 10 a.m. to 8 p.m.

Finally, the data showed that manual and reactive methods to manage energy consumption do not prevent critical battery situations. The homeowner in the study was conservative with energy consumption and carefully monitored battery voltage, but he still had to rely on a backup generator approximately 25 percent of the time, because he could not predict times in which harvesting solar energy was low.

"All these findings point to the need for a feasible, automated and proactive energy-management scheme," Banerjee said.

The automated system will include important control functions, which perform three important tasks. First, the system predicts when energy storage is likely to be critically low and will notify homeowners in advance so that they may take proactive measures to reduce consumption. Second, by predicting when energy harvested is at its peak, the system will advise homeowners of ideal times to execute tasks that require a lot of power, such as running a dishwasher or washing machine.

Finally, relying on information collected on each appliance, the system will suggest energy conservation techniques. For example, it can recommend users adjust or reduce the temperature of the refrigerator by a few degrees without negatively affecting its performance. All of this information reaches the homeowner via the iPhone application, which can then be used to send commands to specific appliances.

More recently, to strengthen monitoring and control functions, the researchers have expanded the project to sharpen their understanding of the performance of specific appliances, which they hope will explain why the appliances consume energy the way they do. When all the data is in, Banerjee and Parkerson predict nuance in performance will be related to ambient light and temperature, both inside and outside the house.

The Sound of Flu

Who knew you could hear the flu? Banerjee and Parkerson have modified HiJack, a hardware and software system developed at the University of Michigan, to fabricate a sensor- and mobile-phone-based system that captures specific nuances of sound within a child's cough, for example, that signify the coming of flu or strep throat.

HiJack uses sensors to harvest power and bandwidth from a mobile phone's headset interface. The modified system includes a harvester that scavenges sound-wave energy emitted from recordings on a smart phone. Because the "sweet spot" for harvesting energy from sound varies from phone to phone, Banerjee and Parkerson built a feedback-based system that converges to a frequency in which energy is harvested optimally.

Future work will focus on augmenting the harvester with biological assays and enzyme sensors to further detect viruses, Banerjee said. They are also building software that uses machine-learning techniques to screen further. Combined, these tools will provide early, point-of-care diagnostics for non-medical personnel, such as parents at home with infant children, or doctors and nurses in third-world countries or other areas lacking medical services.

"For adults, early detection of the flu isn't critical," Banerjee says. "But it doesn't hurt, and it can be a matter of life and death for infants. This tool could give parents real peace of mind when their baby develops a cough."

Providing Emergency Information During Natural Disasters

A bizarre phenomenon of the massive tornado that struck Joplin, Mo., in 2011 was that people in California or Hawaii or anywhere else in the world that receives CNN or the Weather Channel knew more about the storm than people living only a few miles from its path. More importantly, because power and communication systems, including the Internet, shut down due to damage caused by the tornado, victims did not know where or how to seek aid, and emergency responders struggled to find clear routes to reach victims. Unfortunately, this was not a unique experience.

To address this problem, Banerjee, Parkerson and Jack Cothren, associate professor of geosciences and director of the university's Center for Advanced Spatial Technologies, are working on a system that could provide seamless geographic information to mobile phones or laptops within areas that have experienced disaster-related loss of wireless communication. This technology also could be used in other scenarios, such as hiking in extreme wilderness areas or military operations in deserts or other remote locations.

Photo by Matt McGowan

Top, a sensor- and mobile-phone-based system captures specific nuances of sound within a child's cough that signify the coming of flu or strep throat. Bottom, the solar-powered emergency communications system would provide continuous, uninterrupted service during tornadoes and other natural disasters.

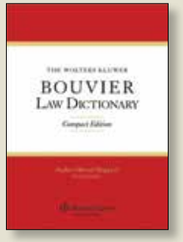
In September 2010, the researchers received a $485,000 National Science Foundation grant to develop what they call a solar-powered emergency mesh. The mesh can be thought of as a network of nodes that blanket a geographic area. Similar to a server, each solar-powered node contains data – geographic information – that can be downloaded to a user or communicated node-to-node, if necessary.

Because it relies on renewable energy and is not dependent on the power grid or Internet service providers, the system provides continuous, uninterrupted service. If a node fails due to variability inherent in renewable energy scavenging or extreme environmental conditions during the aftermath of a natural disaster, the mesh will automatically redistribute data on the failed nodes to maintain service.

A system demonstration displays a disaster area in red and an unobstructed or optimal route by a green line to an aid station or hospital. This information reaches the user through a web browser on a smart phone, laptop or tablet.

There are several issues that must be resolved before a practical and fully functioning system could be deployed. For sustainable operation on small solar panels, the nodes must operate on extremely low power yet still have enough power to serve map-based information to users. Parkerson and his students are developing and testing hardware in an effort to strike this balance. Another challenge is the geographical placement of nodes to ensure that optimal connectivity can be maintained regardless of topography. Additionally, Cothren's group must investigate and test sophisticated GIS software that can function well on a device that has low power and limited resources. To address these obstacles and test a combination of hardware and software, the researchers plan to deploy a 40-node mesh in Fayetteville toward the end of 2012. ■

Check out more cool stuff at the Mobile, Pervasive and Sensor Systems Laboratory. (http://www.csce.uark.edu/~nilanb/research/Research.html#)



The Bouvier Law Dictionary

Steve Sheppard, General Editor
Wolters Kluwer

A University of Arkansas law professor has created an indispensible tool for legal practitioners and students. Steve Sheppard, the William H. Enfield Professor of Law, edited *The Bouvier Law Dictionary,* which is based on the first major dictionary of American law.

"John Bouvier wrote the dictionary read and used by John Marshall, Daniel Webster and Abraham Lincoln," said Sheppard. "The great lawyers of American history loved this book because it was thorough, clear and authoritative. I was very proud that Wolters Kluwer asked me to rewrite this great American classic."

This iteration of Bouvier has been completely rewritten. What differentiates it from other law dictionaries is not only the number of terms it defines, but also the extensive, useful context it provides for each term. The dictionary adds to its accessibility through its contemporary writing style and its availability in print, in digital format and as a mobile application.

"Given its accuracy and usefulness, and the obvious care and hard work that professor Sheppard put into it, *Bouvier* is poised to retake its place as the go-to law dictionary," said Stacy L. Leeds, dean of the School of Law.

Women's Roles in Latin America and the Caribbean

Kathryn Sloan
ABC/CLIO

Kathryn Sloan, associate professor of history, has published *Women's Roles in Latin America and the Caribbean* as part of ABC/CLIO's series "Women's Roles through History."

From Queen Isabella of Spain to "Hispanic Barbie," Sloan explores a diversity of topics and geographical spaces over a 500-year period. She finds that the women of Latin America and the Spanish Caribbean islands pushed back against the limitations on their rights and commonly acted "somewhere between conformity and rebellion." In the end, she writes, "Latin American women played instrumental roles in the development of their societies."

Sloan surveys women's labor, spirituality and economic power in Latin America and the Spanish Caribbean island nations by drawing on eclectic sources: hagiography, chapbooks, newspapers, films, literature and archival documents. She examines techniques of surveillance aimed at women's bodies, from studies of female criminality to prostitution to discourses on honor and shame.

Sloan writes about the multi-religious cultures of the region, from the cult of the Mesoamerican female deity Tonantzin to the heretical female adherents of the a*lumbradismo* – the "illuminists" – to modern female practitioners of Vodou and Santería.

Dearest Letty: The World War II Love Letters of Sgt. Leland Duvall

Ernie Dumas, ed.
University of Arkansas Press

Dearest Letty is a collection of love letters written by Leland Duvall to his sweetheart, Letty Jones, during World War II. Duvall, who became a well-known journalist in Arkansas after the war, was a now-and-again farm worker near Moreland with a grade-school education when he received his World War II draft notice in 1942. He trained in California, where he began to write to Letty Jones, a Pottsville girl he'd had a crush on for several years. Throughout the war, Leland wrote Letty a torrent of letters, falling in love with her – and with writing.

The letters, discovered after his death, were organized and edited by Duvall's longtime friend and colleague, Ernie Dumas, who provides facts about where Duvall was and the perils he endured, information that was often missing due to wartime censors and Duvall's concerns over worrying or boring Letty.

"The beautiful and poignant wartime letters of Leland Duvall are utterly fascinating," said former U.S. Sen. Dale Bumpers. "They are all the more remarkable for their serenity, for the daunting conditions under which they were written, and for Duvall's meager preparation — an eighth-grade education and a life of hardscrabble farm labor."

Greening China: The Benefits of Trade and Foreign Direct Investment

Ka Zeng and Joshua Eastin
University of Michigan Press

In *Greening China: The Benefits of Trade and Foreign Direct Investment,* Ka Zeng and Joshua Eastin explore the influence of international economic integration on the environment in China. Their results surprised Zeng, who had not expected to see such a strong beneficial effect of trade and foreign direct investment.

However, not all foreign trade or direct investment has an equal impact. It matters who the trading partner is and where the foreign direct investment originates.

"Chinese provinces that either export to or receive most of their foreign investment from countries with more stringent environmental standards are also more likely to exhibit superior environmental performance," Zeng and Eastin wrote.

The researchers suggest that if trade and foreign investment are not responsible for China's environmental problems, then "it may be necessary to strengthen domestic environmental governance in China by expanding the participation of public and private actions in the environmental policy process."

Greening China: the Benefits of Trade and Foreign Direct Investment is published by the University of Michigan Press as part of the series Michigan Studies in International Political Economy.

Stress Physiology in Cotton

Derrick Oosterhuis, ed.
The Cotton Foundation

Stress Physiology in Cotton, edited by University of Arkansas professor Derrick Oosterhuis, takes an in-depth look at one of the world's most important crops. In order to keep cotton sustainable and profitable, how it reacts to stresses, diseases and changes in environmental conditions must be understood.

Oosterhuis called on experts from around the world to explain how the plant reacts in different conditions. The book opens with a discussion of the effects of high temperature on the crop. Temperature, which is one of the most important ecological factors that determines the growth and productivity of cotton, is key to understanding the crop.

"Increased temperatures from global climate change are projected to cause substantial losses in crop productivity by the end of the twenty-first century," Oosterhuis said.

In addition to the issue of temperature, the book addresses how humidity, water deficiency and different lighting conditions affect cotton. The final chapters examine various stresses and diseases in the plant from the root system to geminiviral diseases as well as abiotic stress and cotton fiber development.

Stress Physiology in Cotton is published by The Cotton Foundation and is part of The Cotton Foundation Reference Book Series.

Delta Empire: Lee Wilson and the Transformation of Agriculture in the New South

Jeannie Whayne
Louisiana State University Press

In *Delta Empire,* University of Arkansas historian Jeannie Whayne uses the history of a powerful plantation owner in the Arkansas Delta to recount the evolution of southern agriculture from the late 19th century through World War II.

In 1870, Robert E. "Lee" Wilson inherited 400 acres of land in Mississippi County, Arkansas. Wilson transformed the landscape. He drained tens of thousands of acres of land, in order to create a vast agricultural empire, a lumber operation and cotton plantation.

Wilson employed the tenancy and sharecropping system to his advantage while earning a reputation for fair treatment of laborers, a reputation Whayne suggests was not entirely deserved. *Delta Empire* traces the transition from the labor-intensive sharecropping and tenancy system to the capital-intensive plantations of the post-World War II era.

Historian Michael Honey describes Whayne's book as a "remarkable portrait of how the Lee Wilson family created a plantation empire of over 50,000 acres and 2,500 workers in the eerie sunken lands of white supremacy of the Mississippi River Delta of Arkansas — and how African Americans, poor whites, and plantation owners struggled over the consequences."

What Makes a Good Teacher?

Sandra Stotsky, the Twenty-First Century Chair in Teacher Quality in the College of Education and Health Professions, replies:

At a time when the states are trying to develop a far more effective teacher corps than they now have, this question becomes one of the most important for policymakers to answer. It is a question that many researchers have sought to answer empirically. And what educational research tells us consistently is that the chief characteristic of effective teachers is knowledge of the subject they teach. In other words, academic proficiency is the key element in teacher quality. There may well be other characteristics of effective teachers, but they have not yet been identified by a credible body of research. This is a matter of common sense as well. How can a teacher teach what he or she doesn't know — or know well?

However, it takes more than a deep knowledge of a subject to be good at teaching. Good teachers try to stimulate curiosity about the subject they have chosen to teach as well, rewarding effort but praising learning only when it has clearly taken place. Good teachers are sensitive to differences in students' interests, attention spans and talents and do not ignore other aspects of their students' lives. Above all, good teachers know they are responsible for their students' intellectual growth, and if their growth in understanding, knowledge and independent thinking does not take place in school, it may not take place anywhere else. ■

What is a floodplain?

Carl A. Smith, assistant professor of landscape architecture, replies:

As the name suggests, a floodplain is a flat plain in the landscape that contains a river or stream and receives the floodwaters when the river or stream over-tops its usual channel. The floodplain extends either side of the river or stream, from the top of the bank to the toe of the surrounding valley-sides.

The floodplain can be thought of as containing two primary areas: first the floodway that contains the river or stream itself, as well as areas either side that are covered by moving flood waters, and then, second, the flood-fringe where water will pool beyond the flowing water in the floodway during times of flood.

Due to the different flow regimes and successive erosion, transportation and deposition, soils within floodplains — alluvial soils — can contain a mix of different grain sizes. The finer clay particulate provides a large surface-area on which soil nutrients like nitrogen and potassium can adhere, whereas the larger grains of sand and gravel are well drained. Alluvial soils, therefore, provide a loam-like combination of nutrient availability and good drainage that is excellent for agriculture, which in turn attracts human habitation.

Floodplains are excellent habitats for wildlife too: the different levels of water inundation and soil types lead to a rich ecological mosaic. Unfortunately the flatness and, therefore, highly developable nature of floodplains can lead to overdevelopment, destroying natural habitat, altering the natural flow regime of the floodwaters by adding increased impermeable surfaces such as roofs and roads, and leading to loss of property to floods. Floodplains are a rich, diverse and beautiful part of the landscape that should be respected and protected through conservation and sympathetic development. ■