A teaching renaissance
Faculty members are translating research data and theory into best practices for S.C. schools.

Also in this issue
• Fluorescent neurons
• Guess what’s coming to dinner
• Time travelers
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Cover illustration by Maria Fabrizio
K-12 education is the scaffolding upon which all kinds of accomplishments are built. That's why it's so important to constantly evaluate and improve our K-12 schools through evidence-based research. In this issue of Breakthrough, we zero in on some of the outstanding education research underway by USC faculty.

Our researchers are working to improve education from every angle, conducting long-term studies to examine the impacts of K-12 school experiences on American students, implementing innovative programs that are already bringing more physical activity and motor-skills training into South Carolina classrooms, enhancing education equality among students from different cultures and language backgrounds, and even developing tools to help schools identify and better support students with dyslexia.

By cultivating K-12 excellence in these ways and more, USC researchers are helping to create the next generation of innovators in every field, from the arts to engineering. Who knows? Someday, students participating in these USC education research programs might even find their way into the pages of Breakthrough to showcase their own discoveries.
Abigail Hoenes, an undergraduate public health major, works in the research laboratory of Francis Spinale, associate dean for research and graduate education at USC’s School of Medicine.
In brief

The Office of the Vice President for Research has named 14 assistant and associate professors recipients of the 2018 Breakthrough Star awards. Six professors received the Leadership in Research award.

“We have designed our signature awards program to honor the very best, most dedicated researchers working at every level of career achievement,” says Prakash Nagarkatti, USC’s vice president for research. “We present Breakthrough Leadership in Research awards to established faculty who have made major impacts on their fields of study and Breakthrough Stars awards to early-career faculty who have built impressive scholarly momentum in a relatively short time frame.”

In addition, 13 graduate students received Breakthrough Graduate Scholar awards for their outstanding work in their respective doctoral degree programs. The Breakthrough awards began in 2010 and include faculty from across the university.

2018 BREAKTHROUGH AWARDS COVER THE ACADEMIC SPECTRUM

LEADERSHIP IN RESEARCH

1 Subra Bulusu, School of the Earth, Ocean and Environment, College of Arts and Sciences
2 Bert Ely, biological sciences, College of Arts and Sciences
3 Kevin Huang, mechanical engineering, College of Engineering and Computing
4 Yiming Ji, mathematics and computational science, USC Beaufort
5 Mitzi Nagarkatti, pathology, microbiology and immunology, School of Medicine
6 Janice Probst, health services policy and management, Arnold School of Public Health

BREAKTHROUGH STARS

7 Mohammed Baalousha, environmental health sciences, Arnold School of Public Health
8 Matthew Ballard, mathematics, College of Arts and Sciences
9 Ryan Carlson, counselor education, College of Education
10 Parry Hashemi, chemistry and biochemistry, College of Arts and Sciences
11 Eli Jelly-Schapiro, English language and literature, College of Arts and Sciences
12 Addis Kidane, mechanical engineering, College of Engineering and Computing
13 Susan Lang, School of the Earth, Ocean and Environment, College of Arts and Sciences
14 Thomas Makris, chemistry and biochemistry, College of Arts and Sciences
15 Karen McDonnell, College of Nursing
16 Dmitry Peryshkov, chemistry and biochemistry, College of Arts and Sciences
17 Ioannis Rekleitis, computer science and engineering, College of Engineering and Computing
18 Morgan Stefi k, chemistry and biochemistry, College of Arts and Sciences
19 Brie Turner-McGrievy, health promotion, education and behavior, Arnold School of Public Health
20 Susan Wood, pharmacology, physiology and neuroscience, School of Medicine
DATA TRAFFIC CONTROLLER

As our electronic devices — from smart phones to laptops — shrink in size, the potential for information traffic jams increases.

“As the footprint of electronic hardware gets smaller, electrons traveling in different paths of a circuit start to ‘see’ each other,” says Yanwen Wu, assistant professor of physics in USC’s College of Arts and Sciences. “The problem is they are charged, and they will start to affect each other’s movement. This is bad because it can limit the speed of information flow as well as generate heat.”

Wu recently received a National Science Foundation Career grant to explore solutions to this problem. She’s specifically looking at using the photon — a particle with no electrical charge — to carry information, ultimately preventing traffic jams and accelerating data flow.

“The successful implementation of these techniques lays the path to ultrafast optical switches and transistors that can lead to a paradigm shift in information processing technology,” she says.
One of the biggest changes in airline travel in the past decade has been the “debundling” of ticket prices. It used to be that fliers chose coach, business or first class and that was about it for shopping. Sometimes fares were cheaper if you bought nonrefundable tickets in advance, but for the most part, you and your fellow passengers enjoyed the same service: free checked bags, a meal or snack and reserved seating.

Now, airlines are letting folks do more a la carte shopping. Not checking a big bag? You can avoid the checked bag fee. Willing to take whatever seat you get? No reserved seating fee.

The question is, how has all this individualization, particularly the checked baggage fee option, affected airlines’ on-time performance and customer satisfaction? That’s what management science professor Mark Ferguson and his co-researchers set out to discover.

“You would think it would take longer to load the planes, with everybody carrying on their bags and trying to stuff them into the overhead bins,” Ferguson says about their findings, published as “Do Bags Fly Free? An Empirical Analysis of the Operational Implications of Airline Baggage Fees,” in the journal Management Science.

“What surprised us when we looked at the data was that delays actually decreased.”

Ferguson says having passengers carry and load their own bags was clearly more time efficient than having the bags loaded by workers.

Researchers also thought that the loss of free checked bags or even forcing passengers to self-check their bags might lead to disgruntled passengers. But that, too, turned out to be false.

“When airlines have made it as inconvenient as possible to check a bag, folks who check their bags tend to be an airline’s most loyal customers,” Ferguson says. “These are not the frequent business travelers. The people who are paying to check their bags are more affluent, periodic leisure travelers. That signaled to airlines that maybe they want to hold off on cutting back on customer service for checked bags.”

Travelers will probably see even more differentiation in ticket pricing, targeting those who are the most price conscious, Ferguson says. This could mean buying a ticket without a guarantee of a seat on a particular flight or being willing to buy a ticket to fly out of a certain location, but not knowing the destination until a day or two before departure.

“The biggest concern with offering these new products is whether they are actually bringing in new customers or cannibalizing the existing customer base,” Ferguson says.
AMBASSADOR OF THE ARTS

The new U.S. embassy in Pristina, Kosovo, will soon have an expansive display of ceramic art straight from the kilns at USC’s School of Visual Art and Design.

Virginia Scotchie, head of the university’s ceramics department, has been selected to create a permanent installation at the embassy as part of the prestigious Art in Embassies program through the U.S. State Department.

Scotchie visited the country, which experienced years of war and strife in the 1990s. She spent eight days exploring centuries-old buildings and the city’s modern urban landscape. She also met local artists and learned how their country is embracing the arts — both contemporary and traditional.

“As an artist, it was really wonderful for me to see how these historical sites have been renovated, excavated, restored, and art is there now,” Scotchie says. “They just have a true love for their history, art and artists.”

Scotchie’s ceramic artwork — which she has planned as a large grid — will be installed at the embassy this summer. The objects in her grid are influenced by the architecture and historical elements of daily life in Kosovo as well as elements from its traditional mosques and cathedrals.

“Ceramics have historically occupied an important place within both U.S. and Kosovar cultures,” says Camille Benton, the curator of Arts in Embassies. “Virginia Scotchie’s clay forms maintain and update this ancient tradition. Their vibrant colors and whimsical shapes give them a dynamic and contemporary feel, yet they reflect familiar references that can be understood across cultures.”

This isn’t Scotchie’s first exhibit at an embassy. She has worked with the Arts in Embassies programs since the early 2000s when some of her work was on loan to the U.S. embassy in Tanzania, where South Carolinian Robert V. Royall was serving as U.S. ambassador. Last year, Scotchie was one of only seven artists from the U.S. inducted in the 2017 class of the International Academy of Ceramics.
When education research is carried out with purpose, it goes beyond mere theory and statistics. It’s hands-on work that translates data into best practices for teachers, counselors, school superintendents and other education leaders.

“To me, that’s what puts us and the schools and communities in our state on the cutting edge: knowing what works,” says Jon Pedersen, dean of the University of South Carolina’s College of Education. “The fact we’re able to translate that into the schools and into the hands of the people actually doing the work, that’s the critical part.

“As an R1 institution, the focus is on research and teaching and translating that into practice. Our research informs our practices, which impacts what students do in their classrooms.”

That means partnering with public schools, particularly Carolina’s network of 18 K-12 schools where faculty members are embedded. The partnership allows faculty members to have a direct connection to the schools and better address their needs. It means teaching educational methods classes to USC students in public schools around the Midlands, not just in campus classrooms. It also means a breadth of research topics, from improving educational equity to increasing physical activity in elementary schools.

“We have a passion and a commitment for addressing social justice, equity and poverty. That’s a theme that cuts cleanly and clearly through our college and all the work we do, whether it’s teaching, service or research,” Pedersen says. “Our commitment to our state, community and the nation is to continue to lead in that area and grow our commitment to the work in those areas.

“It’s the totality of the community that should be the focal point. It’s a big challenge, but I think we have to take this on.”
SOLVING FOR X: VARIABLES OF LEARNING SUCCESS IN ALGEBRA

At its core, Rhonda Jeffries’ research looks at ways to improve education for marginalized people. That means infusing social justice into the curriculum as she looks out for students who are in danger of being left behind.

After receiving a grant about 10 years ago to look at math instruction at the second- and third-grade level, she became interested in STEM classes and in understanding how students are tracked. Working with one of her graduate students, she began researching how to close the achievement gap for racial minority and low-income students, specifically those tracked for remedial classes.

She wanted to make sure incoming high school students who were behind in math were able to catch up to their classmates and increase their opportunity to be college ready. The algebra project was born.

Knowing that students who do not take algebra I by ninth grade fall too far behind to make attending a four-year college likely, Jeffries’ idea was to teach algebra I to all students entering high school, even if they had not taken pre-algebra in middle school. As part of the project, a Richland County high school teacher taught the lowest performing students algebra I, and 90 percent of them passed the end-of-course exam.

“It became clear to us that just because students hadn’t been formally prepared, it wasn’t too late for them to catch up,” she says.

The next step was working with the school administration and teachers to expand the program for the entire ninth grade. That involved pre-teaching some students in an algebra seminar prior to regular class time, preparing them for what they would learn that day before they stepped into the classroom.

“When you try to tutor students after the class lesson was unsuccessful, it’s hard to get past the part where they’re humiliated and made to feel incapable,” Jeffries says. “Pre-teaching in seminars cancels that out. Our previously struggling students entered class ready to engage, and often they were out-performing students who were on-track for algebra.”

The first year, the test scores were impressive, even with the algebra seminar students included in the data set. By the second year, the high school out-performed every other school in the district. Some of the students were so inspired they asked for placement in honors-level geometry.

“How do students go from the lowest level to the honors level? It tells us that there’s no reason to throw kids away because of past performance,” she says. “Our kids enter elementary school at various levels; therefore, limiting early homogeneous grouping of students and providing options
to adjust academic trajectories places all students in an atmosphere of hopefulness and expectation.”

**READING, WRITING, ARITHMETIC — AND RUNNING**

Research shows a connection between movement and academic performance, with cognitive, behavioral and test performance all improving when students are physically active.

Yet school leaders don’t always recognize physical activity as a gateway to developing the whole child, and might see it merely as cutting into class time. Even in elementary schools with robust physical education programs, students are in PE class only once or twice a week.

One of the keys to changing that, says physical education professor Collin Webster, is working with classroom teachers to integrate more movement throughout the school day.

“We need to look at what’s realistic. Physical literacy is a new idea for many classroom teachers, but there are a number of strategies and programs to get kids more active,” Webster says. “We need to figure out the best strategy for the school. It’s not a one size fits all.”

The latest national study in 2008 showed 42 percent of elementary school students met the guidelines for 60 minutes a day of physical activity. For adolescents, the number dropped to 8 percent. Webster says activity in the classroom doesn’t always have to be vigorous or even moderate; simply reducing sedentary time has benefits.

His research focuses on physical activity promotion in schools and after-school programs with emphases on physical education teachers, general classroom teachers and after-school program staff. Through the development of a new program model, Partnerships for Active Children in Elementary Schools (PACES), Webster and his team are building a program with long-term classroom sustainability. It involves pulling expertise from physical education, public health and psychology experts.

“My focus is to get kids active through schools, but the activities aren’t arbitrary,” he says. “In physical education, students learn fundamental movement skills, like throwing and catching. They can continue to practice these skills in the regular classroom, at recess and at home. If you can’t get more physical education time, you need to get other teachers, parents and community organizations involved in helping children become not only more physically active, but also more physically literate.”

The three components of PACES include strategies and activities to infuse more physical activity into class time; putting College of Education students into classrooms to lead and demonstrate physical activity promotion strategies; and developing a long-term partnership between researchers and schools to identify appropriate movement-based resources.

“There’s no question that getting kids active involves multiple disciplines,” Webster says. “Getting kids physically literate will require a multi-disciplinary approach. There’s never a silver bullet.”

**EDUCATIONAL EQUALITY FOR ALL**

Education professor Gloria Boutte has a simple goal: ensuring that all students are able to succeed in school, particularly those who are culturally and linguistically diverse.

Boutte founded the Center of Excellence for the Education and Equity of African-American Students at Carolina and has made that goal her life’s work. She has spent more than three decades training, encouraging and inspiring teachers to try to
reverse the data that shows students of color not performing as well academically.

She believes a renaissance is in order, a change that will start with teachers who understand the needs of culturally diverse students and the enthusiasm to work with students in the classroom.

“In the field, historically, there’s a high turnover among people who work with these students,” Boutte says. “There’s some trepidation among new and veteran teachers about doing this work.”

Part of her time is spent with educators of students of color — from pre-school through college level — learning why some excel and sharing examples of teachers doing exemplary work. She records their lessons and documents what happens in their classrooms. By capturing the voices of the teachers and then interviewing and reviewing the work of the students, she can tell how well the students are grasping the content.

“I try to get them excited and exhilarated about doing this work. The way I do that is to share cases of teachers from different grade levels and different content areas who are excited and want to work in these settings,” she says. “We don’t see enough models of successful classrooms and teachers and strategies.”

Her research strives to show that there are general strategies for culturally relevant teaching that can work across grade levels and subject areas. She’s found that successful teachers focus on academic achievement, making sure students learn the same content, but often by teaching in different ways. Successful teachers also focus on cultural competency, making sure students see themselves in the content but also learn about the world beyond. They also teach critical consciousness, making sure students are taught how to question, analyze and think critically.

Boutte’s work is not just theoretical; her research translates theory on culturally relevant teaching into practice so people can see how it looks. She spreads the word through publishing case studies and presenting at national and international conferences. She also holds monthly roundtables where teachers, professors and community members are invited to discuss how culturally relevant teaching can be shared in classrooms.

“In a lot of schools with children of color or children of the poor, it can become laborious for teachers,” Boutte says. “They lose joy because teaching is coupled with all the demands that schools and policymakers have put on them.

“My work tries to regenerate that joy, to build this renaissance of renewal for wanting to do this work. I see it as noble work. I see it as a challenge, and I see it as something that is mutually beneficial to society and the children we serve in South Carolina and the nation.”

A LONGITUDINAL APPROACH TO STUDYING INEQUITY
Catherine Compton-Lilly didn’t set out to conduct long-term research studies of student achievement. She was an elementary school teacher and graduate student in Upstate New York, concerned about some of the students in her inner-city school and working on her dissertation.

She found herself staying late at school many afternoons, frustrated as she tried to figure out why some of her students struggled to read and write. She knew something wasn’t working, and her dissertation turned into a larger, long-term study that tried to put the puzzle pieces together.

That study turned into a career for Compton-Lilly as a teacher and researcher, doing longitudinal studies that follow groups of children through elementary, middle and high school. She has published four books describing her experiences in a high-poverty community, following eight of her former
first-grade students through high school. She now is in her ninth year of following students of immigrant families in the Midwest.

“The thing that drives me is working to identify the kids that are underserved — the kids who aren’t getting out of schooling what they should be able to get,” she says.

Now the John C. Hungerpiller Professor at USC’s College of Education, Compton-Lilly continues her research on inequity in schools and with immigrant families, with plans for a long-term project to follow a single school.

“Inequity in our society is not something that happens in first grade or eighth grade,” she says. “It’s a cumulating process that occurs with many small challenges that kids face or situations that are difficult. Racism plays a part in it. Poverty plays a part in it. Underfunded schools play a part in it. And health services play a part in it.

“All of these things help to explain inequity. Inequity is a long-term process that eats away at children’s souls and a family’s very fabric. Parents want to be good parents, and they love their kids dearly, but sometimes their lives aren’t set up in ways that they can do all they want to do for their kids.”

Her work involves thinking about ways schools can be structured so that teachers and administrators are more aware of students’ experiences and a stronger network of support can be fostered.

“I think education is flummoxed in some ways. We’re teaching like we did 50 years ago,” Compton-Lilly says. “One of the reasons is we’re always thinking about short-term outcomes — the next test scores, the next year’s growth.

“We need to break away from that mindset and start thinking about kids as learners and thinkers and people with histories and visions of their own futures. Then we can start to redefine education as something that’s not just about meeting a set of standards or passing a set of tests, but as more about who children want to become. Then we can open opportunities for them and help them be more engaged in the educational experiences we offer them.”

DEALING WITH DYSLEXIA

Psychology associate professor Scott Decker has spent much of his career developing assessment tests for children with reading difficulties. Now he is using a three-year grant from the S.C. Department of Education to assess how each school district goes about identifying and helping students with dyslexia.

South Carolina’s 103 school districts have no uniform protocol for identifying children with dyslexia — a reading disorder that affects 6 percent to 10 percent of school-age children nationwide — and don’t necessarily use best practice interventions.

“Because there hasn’t been a lot of guidance, everyone has been crafting their own policies — it’s like the Wild West,” says Decker, program director for the school psychology program at USC. “We’ve heard that some school districts are doing a great job in this area. But others are probably not performing at high levels.”

Decker says his interest in learning and reading stemmed from his own reading problems as a child. “I eventually ended up in gifted classes, but I did terrible in the first grade,” he says. “I was a delayed reader.”
Decker is using an internal ASPIRE grant from the Office of Research to assemble an interdisciplinary team of faculty members from across campus who have expertise in literacy, language and learning.

At some point, Decker envisions creating an app that would inform parents as to what is normal reading behavior for a given age, providing prompts to seek intervention if warranted. He’s also hoping to develop training modules for future teachers and school psychologists that would guide them in dyslexia assessment.

HOP, SKIP AND JUMP

Watching a child with visual impairments confidently run or hop on one foot is more than rewarding for Ali Brian, a physical education researcher in the College of Education. “It brings tears to your eyes,” she says.

Brian helps young children and adolescents with and without disabilities improve their gross motor skills — their ability to run, jump, hop, throw, catch and bounce a ball. The common belief that kids naturally acquire those motor skills is more myth than fact, according to Brian’s research.

Two of her recent publications have shown that almost 80 percent of the preschool children tested — whether in Ohio, Louisiana or South Carolina — are exhibiting developmental delays with these skills. But after six weeks of twice weekly motor skills interventions guided by a specialist, only 5 percent of the same children showed delays.

“Nobody knows for sure why they are delayed, but it’s my hypothesis they’re not receiving any structured movement program in preschool with a specialist,” Brian says. “They only receive recess.”

There typically aren’t physical education teachers in preschools, and classroom teachers often don’t know the best ways to teach children gross motor skills. “The end game is to not only teach the teachers how to teach, but to help them conduct a motor skills intervention with me at their side,” Brian says.

While her early work focused on Head Start and rural Title One preschools, she now also looks at children with and without disabilities, particularly students who are blind or visually impaired. Her work has found that students with disabilities learn gross motor skills at the same rate as students without disabilities. All students start out delayed, but see parallel growth in six to eight weeks when intervention strategies are applied.

Children with visual impairments are more likely than their peers to be sedentary, overweight or obese. Since it’s a low-incidence disability, there is only a small amount of data, and the numbers suggest children with visual impairment lag far behind in gross motor skill development.

Brian works with Camp Abilities, a sports camp for blind and visually impaired children, the S.C. School for the Deaf and the Blind and parents of visually impaired children. In her work with parents of blind or visually impaired children, she provides a talking pedometer and a guide wire for running, and she suggests family activities that focus on motor skills. Although students with visual impairments are farther behind at the start, they moved from the fifth percentile to around the thirtieth percentile after a six-week intervention. Her next project will look at ways to assess gross motor skills of children with autism and develop interventions to improve their skills.

“To see the change, it’s powerful,” Brian says. “You think, ‘I can make a difference in their lives.’”
Your recent research concerns retail opportunities and the related privacy issues associated with personalized health care products derived from human DNA.

We’ve always had custom products. We’re now talking about the extraction of human DNA from saliva, blood or breath to create a hyper-individualized product. That could be an individualized meal, cosmetics, a vitamin — it could be a pharmaceutical drug. We’re now tying the customer and the company in a way we’ve never seen, and it’s a whole new area in terms of legal ramifications. Who controls the DNA? Where is it stored? Who can access it? We don’t know. And there isn’t a pending court case yet. Companies also make mistakes. What if a mistake is made at the DNA level? Hyper-personalization is a blessing and possibly a curse. At the same time, is it quack medicine?

Are you also concerned that a person’s DNA could be used against them? Say, if an insurance company uses your biomarkers to deny coverage?

It’s something that keeps me up at night as a retailer. Although companies say they take security precautions, we still don’t know. But let’s also look at it from a different perspective. Many companies now use breathalyzers to analyze health. A pharmacist could potentially see the results of a breathalyzer and provide a diagnosis. But should they? What’s the role of a pharmacist? Or can you imagine an employee at a GNC store or a Vitamin Shoppe taking our breathalyzer, and saying, “Here’s your ideal vitamin, and by the way, we think you’ve got cancer”? These are the challenges — making mistakes with biomarkers, empowering employees to give feedback that consumers may not want, the legal gray areas.

But consumers could also develop a strong relationship with the company.

Loyalty is no longer an issue. Hyper-personalization is a sort of glue. The customer provides DNA in order to receive a product that can’t be obtained anywhere else. In the past, loyalty was always achieved through value or human bonds. Now we’re
Can a hyper-personalized product then be copyrighted or trademarked? Can a company trademark your vitamin? In agriculture, a company like Monsanto creates a novel seed and that seed is trademarked.

That’s a good question. At the end of the day, the consumer would not have the copyright. The company would have that, along with the long-term holding of the customer’s DNA.

Not to sound dystopian, but could that also preclude a customer from taking their DNA elsewhere? Is that too far-fetched?

I don’t see an organization trademarking a unique formula, simply because there would be too much similarity between products, but you bring up a good point. There’s an opportunity cost to giving another company your DNA. This isn’t simply a matter of going to a different mall, or clicking another website. It’s a major effort to provide more biomarker data to another company. That’s why I think hyper-personalization is a win-win situation for retailers.

Now, the next phase of all of this will be where the product tells the consumer what they need. Let me give you an example. A customer who has diabetes uses a device to measure blood sugar on a daily level. It will be possible for the device to also manage one’s level of Glucerna in a household, then suggest that the consumer is running low. A smart device may play a role in encouraging consumption.

The consumer then forsakes part of the decision making. That’s exactly the point of my article. Consumer decision-making in the future may actually be given over to a smart device — to artificial intelligence based on household data, consumer habits and biomarkers. “Do you want to order more? Press this button.” The consumer may be removed from the decision as the devices take over to manage products that are essential to the consumer’s health. Many of us who are Amazon shoppers already receive emails that it’s time to repurchase. The next step is to have the device do it for you.

In many cases, that re-order is automatic. It’s programmed and we just opt in.

Exactly. Now we’re looking at sensory patch technology. That may tell customers, “This is where you’re deficient in terms of nutrients, here are the products we recommend.” Decision making will change dramatically in the health and nutrition industries. That’s the future.
What drives a population to stop going about their daily lives and protest their working and living conditions?

For geography professor Jessica Barnes, it is the basics: bread and water. Barnes, who also teaches in the School of Earth, Ocean and Environment, has looked at both in her two books on Egypt.


“I had been thinking about wheat for a while,” says Barnes. “Then when the 2011 Revolution protesters were calling for ‘Bread, Freedom, and Social Justice,’ I felt that a book needed to be written which linked the wheat and the bread.”

Bread has long been a flashpoint of protest, in Egypt and in other parts of the world. “Insufficient or poor-quality bread is often seen as emblematic of ruling regime’s shortcomings,” Barnes says.

Think French Revolution and the infamous comment about cake. In Egypt, bread is subsidized by the government. A loaf can be had for about a half-cent. But producing all this bread requires large amounts of wheat, some of which is grown in Egypt, some of which is imported. “Bread and wheat are a central part of food security,” says Barnes.

Barnes’ interest in the Middle East began in 2001 when she first lived in the region and started learning Arabic. She initially hoped to do dissertation research in Syria for her Ph.D. in sustainable development from Columbia University, but had to switch field sites due to the political difficulties of working in Syria. “It is not always easy to work in a politically unstable region, but I have always felt safe in the Middle East. People are so welcoming and always look out for you.”

For this book, Barnes conducted research in Egypt in 2015 and 2016, involving ethnographic observation and interviews in both Cairo and the rural area where she’s been working since 2007. “I hope I can offer a more nuanced understanding of how bread and wheat shape relations of power in Egyptian society,” she says.

She has been at Carolina since 2013 and teaches courses on water as a resource, environment and development, global food politics, and environmental policy.

A native of London, Barnes earned an undergraduate degree in geography from Oxford and a master’s in environmental management from the Yale School of Forestry and Environmental Studies.
South Carolina has one of the highest rates of new HIV infections in the country, and national estimates show that up to half of HIV-positive individuals don’t continue regular medical care after diagnosis.

Without consistent medical supervision, HIV patients remain infectious and often have dire health outcomes. But two Arnold School of Public Health professors and an interdisciplinary team at USC are working to turn the tide in the ongoing campaign to reduce HIV infections and make medical care more responsive for those diagnosed with HIV/AIDS.

Xiaoming Li, a health promotion, education and behavior professor, and Bankole Olatosi, a clinical associate professor in health services policy and management, are co-principal investigators on a project that will use big data science and predictive analytics to better determine HIV medical care utilization and identify gaps in HIV medical treatment. The team will analyze health information data from Health Sciences South Carolina, DHEC and the S.C. Revenue and Fiscal Affairs Office.

The project is part of a five-year, $3.1 million grant from the National Institutes of Health.

“It’s well known in the HIV and research communities that it is cheaper and easier to prevent someone from falling out of care than to try to get them back into care,” Olatosi says.

Keeping HIV-positive individuals enrolled in a regular regimen of medical care helps to ensure they are receiving anti-viral medication necessary to control their viral load, which is important for their own health as well as the health of others with whom they are in intimate contact. DHEC has used a laborious manual program called Data-to-Care, analyzing HIV surveillance data to identify and reengage HIV patients back into care.

“By using data mining and predictive analytics, this study can significantly improve linking patients back into HIV medical care by working in tandem with the Data-to-Care program in providing real-time, population-based information about health utilization patterns and predictors,” Li says. “That will allow DHEC to focus on deploying staff and resources to bring each patient back into HIV medical care. And by developing risk profiles for HIV/AIDS patients at risk of dropping out of care, health authorities might be able to better prevent that from happening.”

By Chris Horn

Bankole Olatosi (left), a clinical associate professor in health services policy and management, and Xiaoming Li, a health promotion, education and behavior professor
GUESS WHAT’S COMING TO DINNER

Law professor examines FDA regulations and insect-based food.

By Chris Horn

Unless you have an unusually adventurous palate, it’s a safe bet that crickets, termites and meal worms are not a regular part of your diet. Western cultures tend to take a dim view of entomophagy — human consumption of insects — and U.S. regulatory policies don’t exactly encourage the presence of insects in food.

Insects are regularly consumed by an estimated two billion people, a practice that has its roots in culture and sometimes necessity — insects can be a cheap or even free source of protein. Marie Boyd, a School of Law assistant professor at USC, got interested in studying the regulation of insects as food as part of her research on the Food and Drug Administration. She says insect-based food has a long way to go, both from a cultural and regulatory standpoint, in the United States.

“A lot of people in the U.S. don’t think about insects as food even though many people eat insects around the world,” Boyd says. “Insects are used in other cultures as both a delicacy and a way to address food insecurity, but in the U.S. you have to look at how the FDA has dealt with insects in the context of food.”

The Food, Drug and Cosmetic Act prohibits the introduction of adulterated food into interstate commerce, and adulteration can mean either food produced in unsanitary conditions or outright contamination with filth. “And there’s a lot of law saying that insects are filth,” Boyd says. “The FDA’s current regulations define insects among those pests that need to be excluded from food production.”

So what’s a food producer to do when the main ingredient in its product is whole insects or insect parts — technically
defined as “filth” by the FDA? Boyd filed an FOIA request to find out what FDA staff are saying in an official capacity about insects as food. She found that a few employees have addressed the topic in speeches and articles, noting some of the issues that could arise in that context.

“But there has not been a formal recognition that insects can be food under the federal Food, Drug and Cosmetic Act, which would be an important first step,” Boyd says. “The fact that there hasn’t been that affirmative recognition leads to a lot of uncertainty for food companies that are thinking about going into this area. You have all of this law on one side saying insects are filth, and a few informal statements in speeches or articles acknowledging insects as food but, otherwise, largely inaction on the other side.”

There are a couple of instances in which the FDA has regulated insects in the context of food, though not as an actual food ingredient. Two insect-derived color additives — carmine and cochineal extract — are harvested from scale insects. But because of reports of allergic reactions to these color additives in food and cosmetics, the FDA now requires labeling to warn consumers of potential allergic effects.

Boyd thinks that there is a need to take a closer look at insects as a potential way to meet the demand for food and address food insecurities. Recognizing insects as food requires a framework for distinguishing between, say, meal worms that have infested stored grain versus meal worms intentionally grown as a food product.”

“There are different issues that come up in those two contexts because if you think about the meal worms that infest grain, they haven’t been produced under any environmental controls,” she says. “If meal worms are intended as food, they could be produced under current good manufacturing practice just like any other food.”

Boyd’s students have supplied her with a small collection of insect-based products, including several snack bars made with cricket flour, but she hasn’t become a connoisseur of insect foods.

“There are lots of things that are edible that we don’t eat. What we see as food really is a cultural perception,” Boyd says. “Think about horse meat or how lobsters previously were not treated as a delicacy. I think tastes and food practices can change fairly quickly — sushi is a good example of that.

“If the FDA were to recognize and regulate insects as food, it may help to change the perception of insects in the U.S. by countering the perception of insects as filth.”
FLUORESCENT NEURONS

Fluorescent motor neurons from a transgenic zebrafish embryo are pseudo-colored in blue, pink and yellow — part of Fabienne Poulain’s foundational research on neuronal development in vertebrates. The assistant professor in biology is especially interested in how nerve axons grow along particular pathways to innervate muscles or connect with other neurons, and how errors in this directed growth can lead to defects in brain wiring. Her lab uses zebrafish embryos as a model because their transparency and fast development allow direct visualization of their nervous system, which is very similar to the human brain. Poulain’s laboratory colony has about 4,000 zebrafish, some bred for their mutations or fluorescently labeled neurons under study by her team. Her research findings will likely have important implications for scientists studying human neurodevelopmental and neurodegenerative disorders such as motor neuron or Alzheimer’s disease.
HOW PURE IS YOUR WATER?

Chemist studies unintended effects of disinfectants used to purify drinking water.

By Chris Horn

For the past century or so, water treatment plants around the world have added chlorine, chloramine and similar disinfectants to water intended for human consumption, a protocol that has saved millions of lives in the modern age.

USC chemistry professor Susan Richardson says there are many more byproducts that have been discovered that aren’t monitored — and some of them are more toxic than the “dirty 11” that are currently watched.

Richardson’s research team is studying more effective ways to remove harmful contaminants using granular activated carbon. By removing natural organic matter before using disinfectants, the number of disinfection byproducts can be dramatically reduced.

But the chemicals added to kill the germs responsible for waterborne illnesses can have unintended effects. These “disinfection byproducts” can themselves create serious health risks. The Environmental Protection Agency monitors U.S. water systems for 11 such byproducts.
TIME TRAVELERS

By Chris Horn

A USC astronomy faculty member and his doctoral student are assisting with a new generation of space telescopes that could take astronomers to the edge of the universe.

If you have even a passing interest in astronomy, you’ve almost certainly seen high-resolution images captured by the Hubble Space Telescope since its launch into Earth’s orbit nearly 30 years ago. Those other-worldly pictures of spiral galaxies, bubble nebulae and globular clusters inspire awe and wonder about the Milky Way and beyond.

The Hubble is still in orbit and might very well last another five to ten years. But NASA, in partnership with the European Space Agency and the Canadian Space Agency, is getting ready to launch a new generation of space telescopes that will allow astronomers to look back deep in time, to the very dawn of the universe.

USC astronomy assistant professor Steve Rodney and doctoral student Justin Roberts-Pierel are laying the groundwork now to make the most of these new observatories in the 2020s. They are part of a NASA-funded project that is hoping to locate stellar explosions so far away that their light has taken more than 13 billion years to reach the Earth, not long after the universe came to be.

“We’re looking ahead to the next generation of space telescopes after the Hubble that will allow us to look much deeper into space. One of the results of that is finding rare and peculiar stellar explosions that exploded so far away that it’s taken the photons most of the age of the universe to reach us,” says Rodney.

The James Webb Space Telescope is expected to launch in 2019, and it will scan a fairly narrow range of sky but with the ability to look very deeply to the edge of the universe. Rodney and Roberts-Pierel have NASA funding to develop software that will simulate what the James Webb will see when it first opens its eye to the early universe and helps astronomers to understand what they are seeing when those faraway stellar explosions appear.

NGC 634, a spiral galaxy 250 million light years from Earth in the constellation Triangulum, imaged by the Hubble Space Telescope. Courtesy of ESA/Hubble & NASA
Rodney and Roberts-Pierel will also study a phenomenon known as gravitational lensing, which occurs when light from distant celestial bodies is bent by the warping of space. This distortion is caused by a massive object, a planet or galaxy cluster, for example, that lies between Earth and the distant target object. Light from the distant body becomes visible to astronomers because the massive body between it and the Earth acts like a gravitational magnifying glass. The mass of the intervening body bends the fabric of space, forcing light to follow a curved path and focusing many disparate light paths to converge at Earth. Einstein first predicted this effect, and it has now expanded into a vibrant subfield of astrophysics.

For modern astronomers, gravitational lensing effectively supertizes a telescope, making faint bodies brighter and making light visible from more distant bodies. Rodney was part of a team that, using the Hubble telescope, discovered rare supernova explosions a couple of years ago that appeared as multiple images of the same source, a result of the gravitational lens effect.

“We will soon be able to reach back even farther in time to see even more distant stellar explosions,” Rodney says. “To get ready we are studying what we can expect to find, and getting our analysis tools ready so we can get the most out of these very early stellar systems when we find them.”

“We shouldn’t ever get too comfortable with these kinds of concepts because it really is mind-blowing to think about the scope of the universe on these grandest of scales. It’s a privilege that we get to play in this sandbox.”

So what’s the point of being able to look so deeply into space? It will allow us to answer some fundamental questions about the universe and the Earth’s place in it, Rodney says. “When we look back at the very earliest epochs of the universe, it doesn’t have a direct impact on our day-to-day lives on Earth, but it contributes to the larger tapestry of our understanding of the universe as a whole,” Rodney says. “Partly we are driven by natural curiosity, wanting to understand our origins and the whole grand scope of the cosmos. But it’s also true that the more we can build up a complete understanding of the way the universe works, the better we can understand our little corner of it.”

“We’ve been building up that story over time, and it’s a very complex picture. We’re now reaching back to the very first chapter, the beginning of that story.”

“The Hubble Space Telescope has been like a Swiss army knife for astronomers. It can do a little bit of everything,” Rodney says. “The James Webb is like a whole toolbox. It can do everything the Hubble can do and with many more options.”

Rodney and Roberts-Pierel are doing similar work on the WFIRST (wide-field infrared survey telescope), another NASA-sponsored telescope that will be able to scan large swaths of the sky though not as deeply as the James Webb. The WFIRST won’t launch until the early 2020s — it’s still under development — so Rodney and Roberts-Pierel’s work could play a significant role in optimizing the telescope’s ability to see new objects in space.

“Like the Hubble, both of these telescopes will be deployed in space,” Rodney says. “The James Webb and the WFIRST will be able to make detections that are completely inaccessible to us now. They will revolutionize what we’re able to see from the ground, even with enormous modern telescopes.”
With its second year in the history books, DISCOVER USC is fast becoming a new tradition at the University of South Carolina. This annual spring showcase event draws more than 1,000 presentations per year from scholars at every level throughout the USC System.

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