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*Climate Changes
We Respond*



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— THE YOU OF A —

Power electronic circuits that control charge-discharge cycling of the batteries to a power grid.

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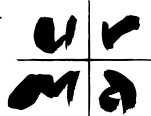
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Photo by Russell Cothren

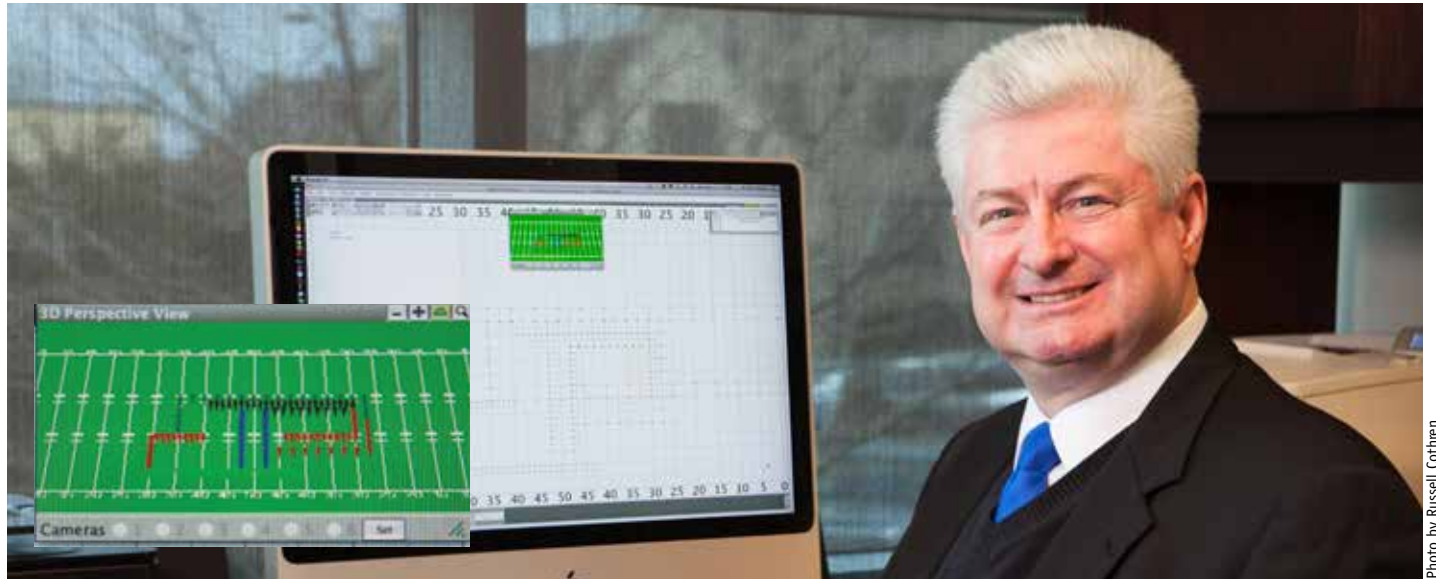


Photo by Russell Cothren

It's Opera, It's Theater, It's Ballet ... On A Football Field

By Darinda Sharp

When watching a good marching band morph from one figure into another during halftime, it's easy to forget all of the work that goes into making an intricate art and science look effortless.

"That's what makes it fun," said W. Dale Warren, professor of music and senior wind band conductor. "When it's done well, the marching drill becomes an extension of the music. We enhance and interpret the music for our audience."

Warren has been helping people "see the music" since he was a sophomore in high school.

"I stumbled into it, really," he said. "My high school band director was looking at these huge pieces of paper that were laid out across his desk. He was shaking his head and saying 'I just can't make it work.'"

The problem was getting the students from figure A to figure B in 12 counts, and when Warren told the director that he had a solution, the director was ready to give him a chance.

"It worked. And I was hooked."

Since then, Warren has designed marching drills for bands and drum-and-bugle corps across the county, including high schools and colleges in almost every state.

The process changed dramatically in the mid 1980s when it began to move from a manual craft to a computerized one. Warren was on the frontier of the transformation, serving as a beta tester for the first software programs.

"It's a different world now," said Warren. "We used to write the drills out with pencil and paper. You'd carry the pages onto the field and often wouldn't know if there was a problem until the students started moving through the drill."

Technology made it possible to see the entire show on screen before teaching it to students. The 3-D images and various

perspectives allow the writer to see the drill from every possible angle. Some programs are so advanced that you can dress the virtual band or corps in the appropriate uniforms and see individual steps.

"Now we teach drills from an iPad, which is a lot less cumbersome than the 35-50 pieces of oversized paper that we used to carry around. Plus, we can print out personalized directions for each band member. They can see the whole drill performed in animation mode before even setting foot on the field."

While the computer has streamlined some parts of the process, others remain unchanged.

"Every drill begins with the band and the music," said Warren. "You want the show to enhance the best parts of the group. If you have a killer trombone section, then they become a feature. If you have some exceptional soloists, then you write a drill where they can stand out."

As far as deciding what looks good on the field, Warren says it's a matter of trial and error. He's had ample opportunity to perfect his eye for what does and doesn't work after working with so many bands with such varied skill levels—including bands that have competed in the annual Bands of America Grand National Championships.

"The travel can be good. I get to see and hear a lot of really talented young musicians, and it helps us recruit some outstanding students from other states as well as within Arkansas."

When considering which bands he will work with on any given year, Warren says it comes down to scheduling.

"This is something I only do on my off-time, so schedule matching is important," Warren said. "My first priority is the students here at the University of Arkansas. I have to bring my A-game to them everyday."

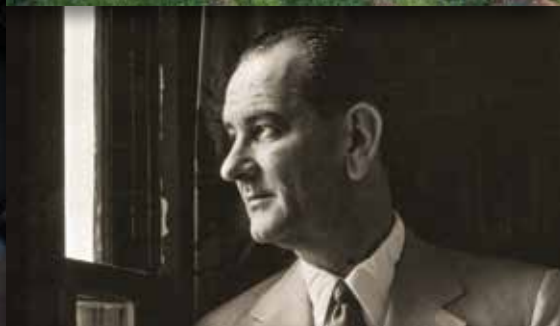


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As the planet warms, researchers from diverse disciplines have considered what a hotter future will mean and what can be done now.



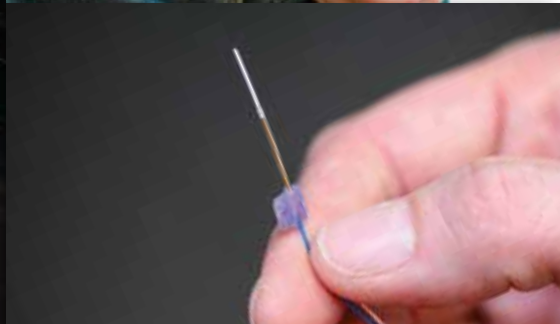
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In his biography of Lyndon Baines Johnson, historian Randall Woods revealed a man of vision and omnivorous intelligence who supported the most marginalized Americans — poor people and racial minorities.



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What happens when juvenile accomplices to murder receive the same sentence as the murderer? Brian Gallini examines the collision between mandatory juvenile sentencing and the Eighth Amendment.



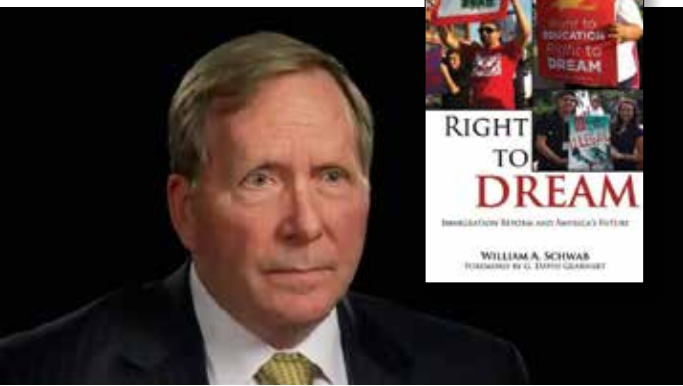
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The quest: to produce reliable implantable glucose sensors for diabetics. A major obstacle: the hostile reaction of the immune system's macrophages. Julia Stenken's research group is learning to guide these cells into a healing state.

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Right to Dream ▶

In *Right to Dream: Immigration Reform and America's Future*, sociologist William A. Schwab explores the key issues surrounding the DREAM Act and immigration reform. Throughout, he weaves in the personal stories of undocumented youth, and he advocates for the economic, political and social benefits of the DREAM Act. righttodreambook.uark.edu



Sustainable Lives

Abigail Brumfield and Logan Webster visited faculty and staff active in sustainability efforts to see what they do in their personal lives to live lightly on the earth. The resulting photo essay is a glimpse at some sustainable practices. <http://researchfrontiers.uark.edu/>



Drum on! ▶

The drum line of the Razorback Marching Band shows off their shiny new Yamaha drums and explains what a big difference a good drum makes. <http://bit.ly/DrumOn>



Warm is Cool ▶

Yes, warm-mix asphalt is sustainable, more energy-efficient and less costly than traditional hot-mix asphalt, but will it stand up to freezing, thawing and pounding traffic? In Stacy Williams' lab, researchers are learning what it takes to produce a warm mix that performs under stress. <http://bit.ly/UAAphalt>



Around the World, Solar Powered

Robert Saunders, instructor in electrical engineering, is designing an auto-pilot system for a completely solar-powered airplane called Solar Impulse. The plane will attempt to fly around the world using nothing but the sun's energy.

A team at the Ecole Polytechnique Federale de Lausanne, or Swiss Institute of Technology, created the first solar airplane and is working on a second plane capable of using solar energy to fly around the world in 2015.

The wings and horizontal stabilizer of Solar Impulse will be covered with cells to collect the sun's energy during the day, which powers the plane and charges the batteries that keep it flying through the night.

Saunders' auto-pilot system is crucial. Since the craft holds just one pilot, the pilot will have to fly the plane with only 20-minute rest breaks. During the 20-minute breaks, the auto-pilot will control the airspeed and direction of the plane. The auto-pilot system, the team at mission control, and the single pilot in the cockpit must work simultaneously to achieve success.

For the full article please visit <http://bit.ly/UASolarPowered>.



Solar Impluse on a test flight before attempting to circle the globe.

Green Traveling via the Physical Internet

Russ Meller, professor of industrial engineering, has assisted in developing the Physical Internet – a concept, in which goods are handled, stored and transported in a shared network of manufacturers, retailers and the transportation industry. Once in place, the Physical Internet would benefit the U.S. economy and significantly reduce greenhouse gas emissions.

Currently, the transportation industry is mostly a segmented enterprise with roughly three-fourths of manufacturers or retailers transporting their own goods without integrating or combining logistics with other carriers, manufacturers or retailers. This system has a significant impact on the U.S. economy and the environment.

In 2007, road-based freight carriers consumed nearly 30 billion gallons of fuel, and

from 1990 to 2008, carbon dioxide emissions associated with road-based freight carriers increased by nearly 15 percent, up to 517 trillion grams per year.

As a potential solution, the Physical Internet proposes an efficient method characterized by an open, intermodal system that moves over land, rail, ship or barge. Shippers would use standard, modular and re-usable containers, real-time

identification and coordinated routing through shared logistics facilities.

The models showed that the Physical Internet would increase stakeholder profits by \$100 billion annually and would reduce annual carbon emissions from road-based freight by more than a half.

A final report can be downloaded at the project's website, <http://bit.ly/PhysicalInternet>.



Scientist Finds Six New Slime Molds in Panama



Image submitted

Laura Walker, graduate student in biological sciences, is the first scientist to collect slime molds from Panama’s Barro Colorado Nature Monument. She has identified six species of slime molds never before recorded in Panama. Her work was supported by a Smithsonian Tropical Research Institute short-term fellowship.

Walker studies a group of slime molds known as myxomycetes. Relatively little is known about their exact ecological role in terrestrial ecosystems, and this is especially true for the soils associated with tropical forests. She works with research professor Steve Stephenson, one of the world’s leading experts in slime molds. Walker’s research is important, he said, because it represents the first major investigation of myxomycetes in the soils of tropical forests.

Slime molds are not plants or animals, but they share the characteristics of both. Although found all over the world, they remain mostly a mystery to scientists. The more Walker has learned about myxomycetes, the more amazing she finds them.

“They eat bacteria and fungi, and we know there are a lot of them in the soil,” she said. “Bacteria and fungi are what decompose everything in the forest, so if myxomycetes are keeping that population checked, they are really important for nutrient cycling and forest productivity. The fascinating thing about them is they have a really complex life cycle. It’s just one cell that keeps getting bigger and bigger. It can be three meters long, and it’s still just one cell.”

For a fuller story, go to <http://bit.ly/SlimeMolds>.

The Red Planet has Water Flow?

Vincent Chevrier of the Arkansas Center for Space and Planetary Sciences and former graduate student Edgard Rivera-Valentin, created a model that could well explain how water could produce the flow patterns seen by spacecraft orbiting Mars.

The researchers studied small flow features, which appear and disappear with the seasons and show a strong preference for equator-facing slopes, indicating the possible presence of liquid on the Red Planet. Chevrier and Rivera-Valentin have constructed the most comprehensive model to date of the behavior of water-and-salt combinations called brines to show that frozen water could melt, flow and then evaporate, creating these flow features on Mars.

Salts can lower the melting point of water, so the researchers used different forms of salt known to form on Mars to calculate what would melt, how much would become liquid and how long the liquid would last from the time it went from freezing to evaporation. They based their model on soils up to 20 centimeters deep, because beyond that depth the seasonal temperatures would not affect the freezing and melting aspects of the salt-water mixtures.

Their model fits with the seasonal change in flow observations, with the flows occurring on equator-facing slopes and with seasonal changes. Also, high-surface evaporation rates as demonstrated in their model explain why, if there is water, it would disappear relatively quickly and why imaging spectrometry on Mars has not identified water marks.

For the full article visit <http://bit.ly/UARedPlanet>.



Photo by Russell Cothren

Tartar Tells ... 2 Million Years Later

Two-million-year-old tartar reveals what at least one pair of early hominins ate: plants.

In 2010, anthropologist Lee Berger of the University of the Witwatersrand in Johannesburg, South Africa, and colleagues discovered the remains of an elderly female and young male that had been covered in sediment almost 2 million years ago.

A team of scientists has studied these remains, specifically the teeth, which proved to have unique properties because of how the hominins died.

“We have a very unusual type of preservation,” according to Peter Ungar, Distinguished Professor of anthropology. “The state of the teeth was pristine.” Since the individuals were buried and quickly encased in sediment, parts of the teeth were preserved with a pocket of air surrounding them.

Researchers performed dental analysis on these well-preserved teeth and discovered areas of tartar buildup and plaque. They found phytoliths, bodies of silica from plants eaten almost 2 million years ago.

“It’s the first time we’ve been able to look at these three things in one or two specimens,” Ungar said.

The phytoliths, dental microwear, and isotope analysis gave an even clearer picture of what the hominins were consuming: bark, leaves, sedges, grasses, fruit and palm. This result differs from other evidence seen in australopiths, because, Ungar said, “a lot of the other creatures there were not eating such forest resources.”

Additionally, he said, “These findings tell us a really nice story about these two individuals. It’s fascinating that we found something that went into the mouth of these creatures that was still in the mouth of these creatures.”



Peter Ungar

Photo by Russell Cothren

When is the Same Thing Too Much of a Good Thing?

In today’s dynamic global economic environment, companies or countries consider everything when it comes to expanding their economies. But when can global trade be too much of a good thing?

A team of researchers, led by Raja Kali and Javier Reyes in the Sam M. Walton College of Business, examined the relationship between products in global trade and the characteristics of a country’s product specialization pattern and discovered that having a multitude of similar products can be beneficial to growth — up to a point, after which the benefit declines.

The researchers found that interaction between products plays an important role in economic growth. In the early stages, these synergies allow for a quick growth rate. Specialization in a certain area, such as electronics, establishes the base for similar products to be developed and exported.



Raja Kali



Javier Reyes

Photos by Russell Cothren

Yet specializing in related products can also cause an adverse effect, the researchers found. They developed a way to measure the interaction between products to predict when the beneficial effects begin to promote an inertia that makes the jump to new products more difficult.

“Essentially, one could say that too much of a good thing makes you fat and happy, and that ultimately is not so good for a country,” Kali said.

For this study, Kali and Reyes worked with Josh McGee, vice president of public accountability at the Laura and John Arnold Foundation and Walton College doctoral graduate in economics; and with Stuart Shirrell, a former Bodenhamer Fellow and 2011 graduate of the U of A.

The study was published in the *Journal of Development Economics* and is available online at <http://bit.ly/SameThing>.

Climate Changes We Respond

By Will Bryan

Looking back on the record heat of 2012, Research Frontiers asked a cross-section of University of Arkansas faculty to look forward to the mid-21st century. How is climate change affecting their field of study and their own research? Taken together, their responses offer a glimpse at how diverse disciplines are addressing a more turbulent future.

Photo by Russell Cothran



Jean Henry

associate professor of community health promotion

department of health, human performance and recreation

While physical impacts of climate change can be clearly observed, one impact that is often overlooked is the link between climatic and environmental change and emotional and mental health and well-being. For example, recent research has explored how changes in the local and regional

landscapes around Inuit communities in northern Canada are disrupting the ability of Inuit to continue to practice and participate in culturally — and socially — important land activities such as hunting, fishing, foraging, trapping, and traveling on snow and ice. Conditions that have previously supported the health and well-being of Inuit populations, such as spending time on the land, have been changing so rapidly in recent years that individuals and communities are being negatively affected. Peoples closely relying on the natural environment for economic, spiritual, social,

and cultural reasons, such as the Canadian Inuit, develop profound attachment to the land and a heightened sense of place. *The loss, or dramatic alteration, of places can have profound effects, both physical and mental, on the people who inhabit them.*

Public health professionals assert that effective response strategies for mitigating the effects of climate change will pair top-down advocacy on health and climate at a global level with bottom-up public health actions that bring health and climate co-benefits.

Alan Mantooth

Distinguished Professor and the Twenty-first Century
Endowed Chair in Mixed-Signal IC Design and CAD

department of electrical engineering

Looking at NASA imagery of the polar ice caps melting, it is clear that global climate change is occurring. As the summers get warmer, our environmental controls, such as air conditioning, are used more, which requires more energy. When extreme winters occur, we require more heat to keep us warm and comfortable. These power demands, coupled with the growing population, mean power generation is something that we must take a serious look at.

As the power grid is further strained by increasing demands due to climate change, it will become less reliable. Outages will become frequent, and rolling brownouts and blackouts will be common. Eventually, aggressive power management schemes, including rationing, will be used. Hospitals will take the top priority and residential areas will have among the lowest.

We need to work now to develop and implement better power generation, storage and use strategies. All options should be considered. Distributive generation systems are viable systems. Small generation points are interconnected, such as in a computer network, each taking up part of the load. The systems, capable of

supporting large-scale operations, are more reliable and robust, because if one goes out, the entire system does not collapse.

We have to avoid cookie-cutter answers; not all areas are going to be suited for the same power generation techniques. Here in northwest Arkansas, for example, wind power isn't viable, but out on the plains, it is. The best solutions for each location are based on the available resources.

While the solution may not be the same everywhere, the problem is. The increasing demands on the power grid will soon surpass the supply, and if new solutions are not found, then the standard of living we have grown so accustomed to will no longer exist.



David E. Longer

professor

department of crop, soil and environmental sciences

We have experienced more frequent and intense levels of rainfall and more serious and prolonged drought events, coupled with dramatic temperature fluctuations. Many agronomic crops in the United States and worldwide have experienced serious crop yield losses in recent years, and 2012 will prove costly as well, once final harvest numbers are in.

The good news in all this is that most plant species have a broad base of genetic diversity that can be, and is being, utilized to bring about changes at the physiological

level through genetics and molecular biology. The department of crop, soil and environmental sciences is using this science to improve water-use efficiency in soybeans, to reduce the need for excessive pest control applications and to develop crop growth systems that minimize carbon dioxide emissions.

Longer added that the Crop Sciences Society of America's position on the influence of climate change on global cropping forecasts includes strategies to enable crops to respond, adapt and survive a wide range of varying growth environments. Researchers will gain greater understanding of plant response and adaptation, develop new agricultural production systems, and quickly disseminate breakthroughs to prevent extreme yield losses and economic disasters.



Photos by Russell Cothren



Kim Smith

University Professor

department of biological sciences

Global climate change is having a variety of effects on birds around the world. The impacts appear greater as one moves from the tropics toward the poles. ***The most serious problems are in the Arctic, where warming of the waters is disrupting the link between food and breeding in many marine birds.*** Most seabirds depend on cold-water prey to feed their young, and warmer waters mean that those prey items are greatly reduced or replaced with often lower-quality prey items during the feeding period. In the Antarctic, the melting of sea ice is affecting populations of penguins, which depend on sea ice for breeding sites. Concerns have also been raised for birds that nest at high elevations in mountains of tropical and temperate regions. As climate change causes vegetation changes, those high elevation habitats may disappear, leading to extinctions of animals associated with mountain tops.

Climate change also seems to be affecting the phenology, or timing, of migration in many species of birds. In Fayetteville, Jacob M. N. Smith was a florist who kept track of the annual arrival of birds in his garden from 1844 to 1878. Similarly, William Baerg, an entomology professor who was

also an ornithologist, recorded the arrival of birds in Fayetteville in the 1920s. Compared to those two studies, ruby-throated hummingbirds and whip-poor-wills are arriving about two to three weeks earlier today. In the case of the hummingbird, this would suggest an earlier timing of flowering plants, and, in the case of the whip-poor-will, an earlier timing of emergence of flying insects, both possibly due to rising spring temperatures. This earlier arrival of migrant hummingbirds is reflected in earlier arrival on the breeding grounds farther north.

John R. Clark
University Professor
department of horticulture

The improvement of plants through breeding is a combination of science and art, which uses genetic variation for important traits combined in a complementary manner to create a “better” plant for society. The environment can have a tremendous effect on trait expression. The U of A Division of Agriculture fruit-breeding program focuses on varieties to benefit Arkansans, but has activities in multiple states in the United States and other continents. The environments in these locations change from year to year, and major changes are to come over the substantial time between now and 2050.

How will this affect plant breeding? Substantially, because as environments change, the plants being worked with perform in a different manner. As areas of the world develop more moderate winter temperatures, cold hardness of the plants will not be as critical, and a crop variety might be grown in an area, although thirty years prior it would not have been considered “adapted.” Further, if temperatures in the growing season increase, heat tolerance will be a top priority. Plant breeders will work with this shift in a number of ways, including broad testing of breeding products in multiple environments to identify the best plants for the targeted climate. Genetic variation for future improvement will need to be maintained or introduced into the breeding effort to allow introgression of adaptation traits.



The basic art and science of plant breeding will not change with climatic shifts, but the approach will evolve.

Molecular techniques to more precisely identify adaptation and other important genes will play a role in future plant improvement. Climate change will be a challenge that will provide for an exciting time for plant breeders.

Hoyt Purvis
professor
Lemke department of journalism, and former director,
Fulbright Institute of International Relations

International relations are at the center of climate change issues, and climate change is very much an issue in international relations. That may sound like a riddle, but it is a reality.



In an ever-more interdependent world, traditional diplomacy is not always effective in tackling global threats. Established alliances and procedures are not necessarily suited for dealing with a threat such as climate change, when the cause is not the ambition of an “enemy” power or ideology. Addressing the climate change challenge will require thinking beyond national environmental effects and considering the broader international impact. It’s an issue that is not going to go away, and a major part of the challenge is bridging the divide between rich and poor countries and recognizing that a global response is required.

It is not just an opportunity for international cooperation, but also a compelling rationale for such cooperation, a need that will become more obvious in the years ahead. Effective international agreements are imperative because of the global scope of the challenge, and the United States will need to play a leading role. Shifting geopolitical alignments may emerge and rising nations – China, India, South Africa, Brazil – will have to take a more pro-active role.

Climate change is an inherently international issue and one of the century’s greatest challenges for the international community.

Despite the inertia that sometimes characterizes international relations when competing national interests are involved, the accelerating problems related to climate change will make cooperative efforts among governments and non-state actors inevitable.

Photos by Russell Cothren

Jeannie Whayne
professor
department of history

Over the next 50 years, as government, industry and individuals deal with floods and droughts, agricultural historians will grapple with the implications. Climate change has the potential to greatly speed the trend toward the concentration of land ownership and intensify “scientific agriculture,” the use of chemicals and experimentation with genetically modified organisms. Even if the planet warms only slightly, the need to adapt will work to the benefit of entities capable of adjusting quickly, serving those with the resources to develop new technologies to aid farmers in new drought areas, for example.

Agriculture will assume a grander scale while, paradoxically, becoming much smaller. Landholding patterns and the size of farm machinery will increase in size, but fewer individuals will be involved. The current trend toward “portfolio” plantations, ones in which large investment companies purchase

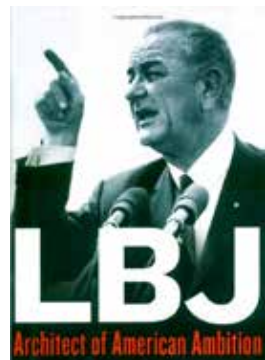
agricultural lands, will intensify because only the largest entities will find it cost-effective to purchase the expensive machinery and chemicals necessary to farm on such a wide scale. Because many small investors who have funds in agricultural lands in their portfolios will be unaware of their connection to a given agricultural community, they will be unlikely to concern themselves with the environmental impact of pesticides on farmlands or with the erosion of farm communities as a result of population decline.

On the other hand, the sustainable agriculture movement will become more popular and more viable as consumers demand alternatives to chemically treated foods. Consumers will demand products they consider safe, and small producers will expand their niche market.

In the end, trends developing in the late 20th century will continue, including the tension between feeding the world and the methods used to accomplish that laudable goal. In this context, agricultural historians will be charged with the responsibility of assessing the consequences and charting a path through the complex world of late 21st century agricultural expansion. ■



Intelligence and Complexity: Another View of LBJ



By Jeff Worley

Randall Woods leans back in his desk chair in Old Main, surrounded by books, journals and numerous stacks of paper. Some of these piles are impressively high — one rises about three feet off the floor. Another has taken what looks to be the exact angle of the Tower of Pisa. An avalanche of paper — documents, notes, some hunks of The Congressional Record — seems to be mere seconds away.

“This is what my mind looks like,” says Woods, laughing, and gesturing at the stacks. “But believe it or not, this is a really orderly mess.”

Woods, the John A. Cooper Professor of History, looks to be very much at home with this evidence of thousands of hours of scholarly research. I’ve come to ask him about his Lyndon Johnson book, a nearly 1,000-page biography titled *LBJ: Architect of American Ambition* (2006), which was 10 years in the making and garnered excellent reviews in both scholarly journals and the popular press. It is immediately obvious that Woods loves talking about Lyndon.

LOC, O'Halloran, Thomas J., photographer



LBJ Library photo by Yoichi Okamoto

Left: President Lyndon B. Johnson meets with Civil Rights leaders in 1964 in the Oval Office. (L-R) Martin Luther King Jr., President Lyndon B. Johnson, Whitney Young and James Farmer. (Roy Wilkins and Lee White were also present but do not appear in this frame.)

Right: President Lyndon B. Johnson signs the 1964 Civil Rights Act as Martin Luther King, Jr., and others look on.



LBJ Library photo by Cecil Stoughton

“Lyndon Johnson was an extremely complex man,” Woods begins. “He was intelligent, despite having a limited formal education. He was bipolar. Born in a small farmhouse in the Texas hill country, he became involved with some of the most powerful people in this country, like the Roosevelts. A Southerner, he pushed through the Civil Rights Acts of ’64 and ’65. Johnson loved Lady Bird but at the same time had long-term relationships with other women, which she knew about.”

Woods became interested in LBJ when the historian was researching and writing a biography of Arkansas Senator J. William Fulbright, which was nominated for both the Pulitzer Prize and the National Book Award in 1996. Fulbright, perhaps the most powerful man in the Senate, was known for his criticism of U.S. military involvement in Vietnam during his tenure as chairman of the Senate Foreign Relations Committee, a position that frequently put him at odds with President Johnson.

Woods also wanted to write a comprehensive biography of LBJ because he thought the available biographies of Johnson were “unsatisfactory.” Especially problematic for Woods is the multi-volume Johnson biography being written by Robert Caro.

“His basic approach to Johnson has been an ongoing indictment,” says Woods. “Caro believes that anybody who seeks power is automatically suspect, that they have selfish motives. Well,

if you take that approach to Johnson, you’re going to inevitably demonize him. I had a real problem with the myth that Caro has created and that the Kennedys have created—that Johnson wasn’t a man of principle or value, but was mostly in love with wielding raw power.”

But isn’t it common knowledge that when Johnson was trying to get commitments for a vote and would meet one-on-one with a congressman or congresswoman in the oval office or at his Texas ranch, a trial-by-fire termed the Johnson Treatment, that he would say anything or do anything to get that person to support him?

“This is what Robert Caro would have you believe. It’s all part of the Johnson myth that’s been fabricated,” Woods says. “There was—and still is—the widespread notion that for LBJ the ends justified the means. And look where this has led. Just over a decade ago the History Channel was running a program that included the accusation that Johnson was implicit in JFK’s assassination! Mrs. Johnson stepped forward when she found out about this and said ‘enough,’ so the History Channel backed down and stopped running the program.”

The Lyndon Johnson that emerged for Woods through his research wasn’t without faults, but was, above all, a man of vision and a strong supporter of the most marginalized Americans, the poor and the black.

“Probably the most interesting thing I found out about Johnson

was how intelligent he was,” says Woods, his tone softening. “McGeorge Bundy, dean of the college at Harvard, said Johnson was the smartest man he’d ever known. He had a voracious ability to acquire and retain information, and may have been the greatest intelligence gatherer Washington has ever known. LBJ wanted to know everything — attitudes, prejudices, philosophies, history, as well as just raw data.”

Civil Rights: LBJ’s Landmark Legacy

At the core of Johnson’s attitude toward African Americans was the bedrock belief that blacks must be part of the body politic. He strongly believed that if some fair degree of justice and opportunity were not offered to blacks, our republic might not survive.

“During Kennedy’s administration, the Civil Rights Act, along with several other progressive measures, was introduced into Congress, but the bills were stalled,” Woods says. “Johnson knew that Kennedy’s death created an emotional window of opportunity to move the civil rights bill along, so he built on that.”

In trying to push civil rights legislation, Johnson faced a major obstacle — Sen. Richard Russell, a powerful legislator from Georgia. Russell, a white supremacist, had repeatedly blocked

and defeated civil rights legislation by using the filibuster and had co-authored the Southern Manifesto in opposition to civil rights.

“Johnson knew Russell couldn’t vote for civil rights legislation, but in several long one-on-one discussions finally convinced him to at least not obstruct the bill,” Woods explains, “and to try to convince other segregationists in Congress to not obstruct the bill. ‘I’d only take this from you, Lyndon,’ Russell said. This was a *huge* moment in civil rights history in this country. Only a Southern president with the persuasive powers of Lyndon Johnson could have gotten this bill through Congress.”

Woods says it’s worth recounting the provisions in the Civil Rights Acts of 1964 and 1965. These measures compelled access to hotels, motels, places of entertainment, stores, restaurants and other public facilities without regard to race, religion or national origin. The act established programs to desegregate public schools; required federal agencies to withhold funds from state and local programs that discriminated; and established a permanent Commission on Equal Employment Opportunity.

“Johnson’s social achievements in five years were monumental,” Woods adds. “Voting rights, fair housing, Medicare, Medicaid, the poverty program, environmental protection, federal aid to education and the wilderness program. But to put his presidency in full perspective, you have to also consider the nightmare of Vietnam.”



LBJ Library photo by Yoichi Okamoto

Left: President Lyndon Baines Johnson meets with Senator J. William Fulbright in 1965.

Right: While visiting Cam Ranh Bay, South Vietnam, in 1966, President Lyndon B. Johnson decorates a soldier as General William Westmoreland, other soldiers and the press look on.



LBJ Library photo by Yoichi Okamoto

“Walking a tightrope” in Vietnam

Woods states in the biography that as America’s involvement in Vietnam deepened, Johnson increasingly tied the war to the civil rights movement and to the Christian idealism that was driving it. No Christian could deny equal opportunity and political freedom to another human being whether in the American South or South Vietnam. So, like his predecessor, LBJ was determined to do everything in his power to make sure that the communist Vietnamese, who would deny such basic human rights, would be defeated.

Johnson’s decision to escalate the war in Vietnam was also strategic, Woods points out.

“There was pressure, after the failed Cuban invasion [of 1961], for the U.S. to take a stand somewhere, especially against the spread of Chinese communism. And in addition, LBJ believed that if he didn’t fight a limited war, there would be a cascade of events leading to a wider war with the Soviet Union. The Chinese threatened intervention in the event of a U.S. invasion of North Vietnam or bombing of supply lines. It was projected that this could lead to the involvement of the Soviet Union, which had a defensive treaty with China and possessed intercontinental ballistic missiles. So we fought a war that Johnson perceived — and he anguished over it — was the lesser of many evils.”

When it came to Vietnam, “Johnson was walking a tightrope,” Woods says.

Johnson also believed, in terms of the domestic political scene, that withdrawing from Vietnam was not an option. He made the argument that given the strength of anti-communism in this country, pulling out of Southeast Asia would produce a conservative backlash that would destroy the coalition supporting the Civil Rights Movement.

“Johnson’s decisions to escalate in Vietnam were made in the spring and summer of 1965, at precisely the time he was trying to push through the Voting Rights Act in Congress. He understood the delicate balance with Richard Russell and other Southern senators, who were not only segregationists but also very hawkish. LBJ knew he couldn’t ask Southerners to support a lesser commitment in Vietnam and, at the same time, support desegregation.

As casualties mounted during the next three years and success in Vietnam seemed further away than ever, Johnson’s popularity plummeted. College students and others protested and burned draft cards. Johnson could scarcely travel anywhere without facing protests. The Secret Service would not allow him to attend the 1968 Democratic National Convention, where hundreds of thousands of hippies, yuppies, a wide range of moderate to liberal college students, and other antiwar activists chanted and screamed their opposition to Johnson’s Vietnam policy. By 1968, with Johnson’s popularity at a low point, his party divided into factions and his health deteriorating, he decided not to seek another four years in the White House.

“LBJ’s legacy is double-edged, at least for liberals and progressives,” Woods says. “The reforms of the Great Society advanced the cause of social and economic justice in the United States in dozens of significant ways: civil rights, health care, education, anti-poverty and anti-pollution programs, and immigration reform. But these achievements will always be overshadowed by the failed experiment in Vietnam. He inherited the conflict, but it was he who was responsible for Americanizing it. Under the circumstances that existed at the time, there may not have been an alternative, but as he observed on more than one occasion, the responsibility was primarily his.”

A Decade of Scholarly Research



Randall Woods

In talking about his research for the biography, Woods tosses out some numbers.

“I took more than 50 research trips over 10 years to eight different libraries and archives, including 30 trips to the LBJ library. I read 1,100 oral histories — papers of all Johnson’s cabinet members, all of his correspondence, plus his family’s correspondence. Overall, I probably

looked at 4 to 5 million documents and made photocopies of around 750,000.” He takes a deep breath and slowly exhales. “If I’d known how time-intensive this was going to be, I’d probably never have done it.”

Woods points out that his biography of Lyndon Baines Johnson was the first to be published after the release of the presidential tapes.

“The tapes are a biographer’s dream. They are just unbelievable as a resource,” Woods says. About 15 percent of Johnson’s telephone conversations had been transcribed; the rest Woods had to listen to and take notes directly. “The 800-plus tapes took me a year to go through.”

In writing such a comprehensive and detailed biography, Woods says the most difficult thing was organizing the mass of information.

“After I collected all the material for this book, it took me a year to organize it in a way that would allow me to begin to write,” he says, gesturing toward half a dozen large, brightly colored plastic bins crammed with documents. “Once I figured out the organization, it took me 11 months to write the first draft.”

When asked what he’s proudest of about his LBJ book, Woods says he’s pleased that it’s a professional biography based on hard research and that it is an interesting and readable story.

“I think historians should be writing more for an intelligent, lay audience than, as too often in the past, writing for each other.” ■



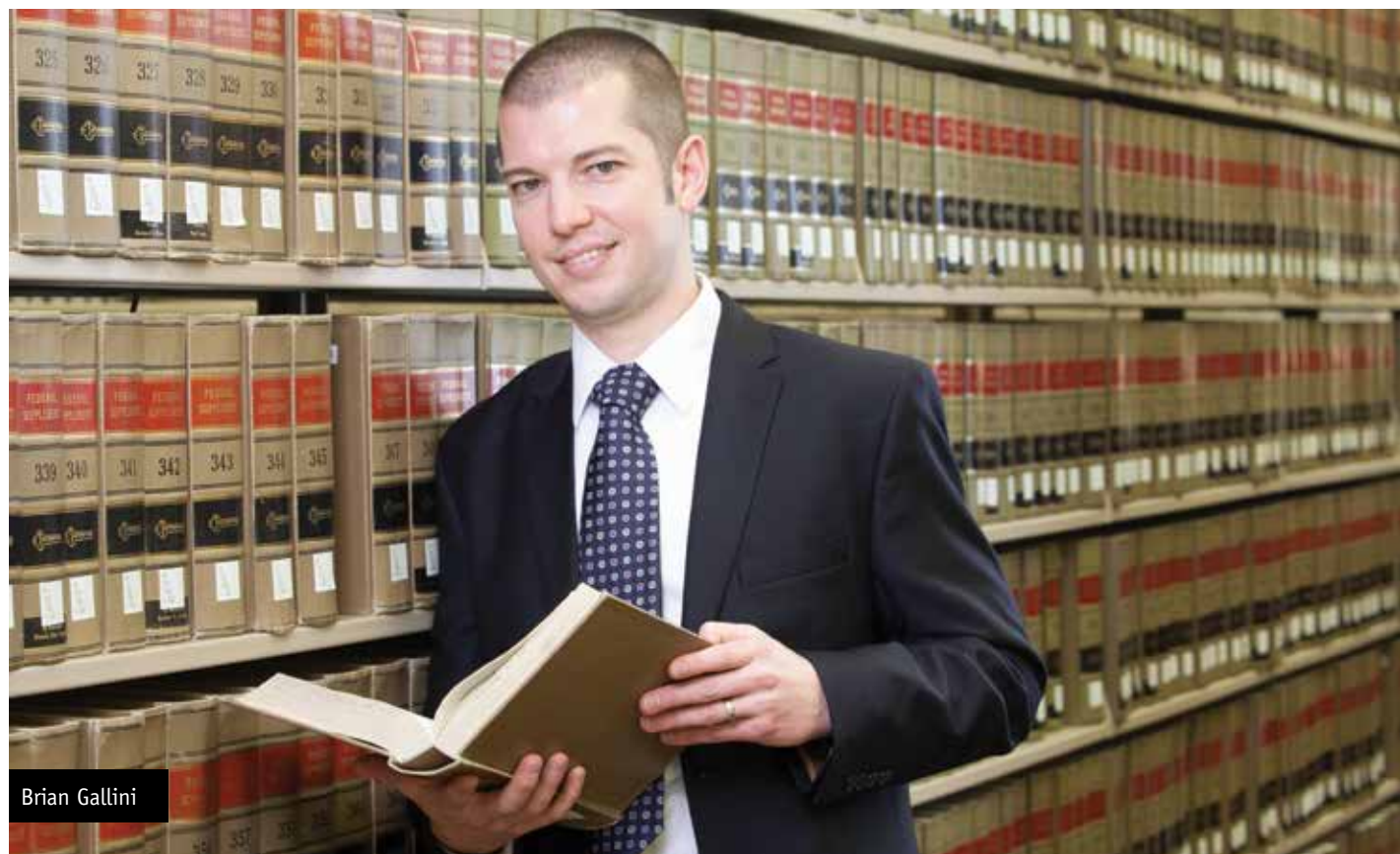
Cruel & Unusual EQUAL SENTENCES FOR UNEQUAL ACTIONS

By Matt McGowan

These facts are the same: They were both 14 years old, and they were both present when the murders happened. Everything else is different.

In 1999, Kuntrell Jackson, after initially serving as a lookout, was standing next to his friend when the latter shot and killed Laurie Troup, the Blytheville, Ark., video store employee who refused to give the boys money during a robbery. In Alabama in 2003, Evan Miller, also 14, bludgeoned Cole Cannon with a baseball bat and then set Cannon's trailer on fire.

But there is one more similarity. Convicted of capital murder, both boys were sentenced to life in prison without parole.



Brian Gallini

Photo by Russell Cothren

"I can't think of a better example, a better contrast of cases, in terms of the facts, to illustrate this problem," says Brian Gallini, associate professor at the University of Arkansas School of Law.

For the past several years, Gallini's research has focused on the sentencing of juveniles, specifically those convicted of murder and sent to prison without an opportunity for parole. More specifically, his work has examined how courts have handled the complicated issue of juvenile murder accomplices who played a minimal role in the crime and yet still received life without parole. On this warm December afternoon, he is sitting in his sun-drenched office on the third floor of the law school, and he is poring over the facts from the original *Jackson* and *Miller* filings.

"Here you have one kid who was essentially the lookout," he says. "I'm not saying he wasn't culpable for the shopkeeper's death. But the other kid, Miller, before he took one more swing with the bat, looked down on the victim and said, 'I am God. I've come to take your life.' So I think it's really important that the court consolidated these two cases, because the facts are radically different."

This consolidation, as Gallini puts it, refers to the U.S. Supreme Court's packaging and review of the two cases in 2012. The court used *Miller* and *Jackson* as an opportunity to decide whether mandatory sentences of life in prison without parole for juvenile murderers constitute a violation of the cruel and unusual punishment clause of the Eighth Amendment. The court had

already abolished the death penalty for those under 18 who had been convicted of murder. That decision came in 2005.

On June 25, 2012, upon review of *Miller* and *Jackson*, the justices ruled that judges and juries in lower courts must consider a defendant's youth and the nature and circumstances of the crime before sentencing the defendant to life in prison without parole. The 5-4 decision struck down laws in 28 states, including Arkansas, that had mandated life terms for all convicted murderers, including those under 18. These mandatory laws, the court decided, were in fact cruel and unusual punishment and therefore violated the Eighth Amendment of the U.S. Constitution.

But the ruling applies only to the use of *mandatory* life sentences without parole for juveniles; it does not address the constitutionality of those sentences more broadly. The justices merely stated that states must consider the age and nature of the crime before handing down a life sentence. In other words, lower courts now must individualize sentencing based on the defendant's age and nature and circumstances of the crime. Therefore, Gallini says, it is reasonable to expect sentencing of life without parole for juvenile killers regardless of age – those such as Miller who actually commit the act of murder – and perhaps for others with a high level of culpability in a victim's death.

This distinction, that of limiting use of the sentence instead of abolishing it, is significant, says Gallini, who monitored

Miller and *Jackson* as they moved up through the appellate process. Historically the Supreme Court and lower courts have struggled with what to do with juveniles convicted of murder. If this problem were not enough, the courts have wrestled even more mightily with juvenile murder accomplices or co-conspirators.

A 40-year survey of cases demonstrates that the Supreme Court, the highest tribunal in the United States and the judicial entity that lower courts look to for direction on matters such as federal law, constitutionality, jurisdiction and sentencing, among others, is primarily responsible for the confusion and ambiguity. In "Equal Sentences for Unequal Participation: Should the Eighth Amendment Allow All Juvenile Murder Accomplices to Receive Life Without Parole?" published in the *Oregon Law Review*, Gallini

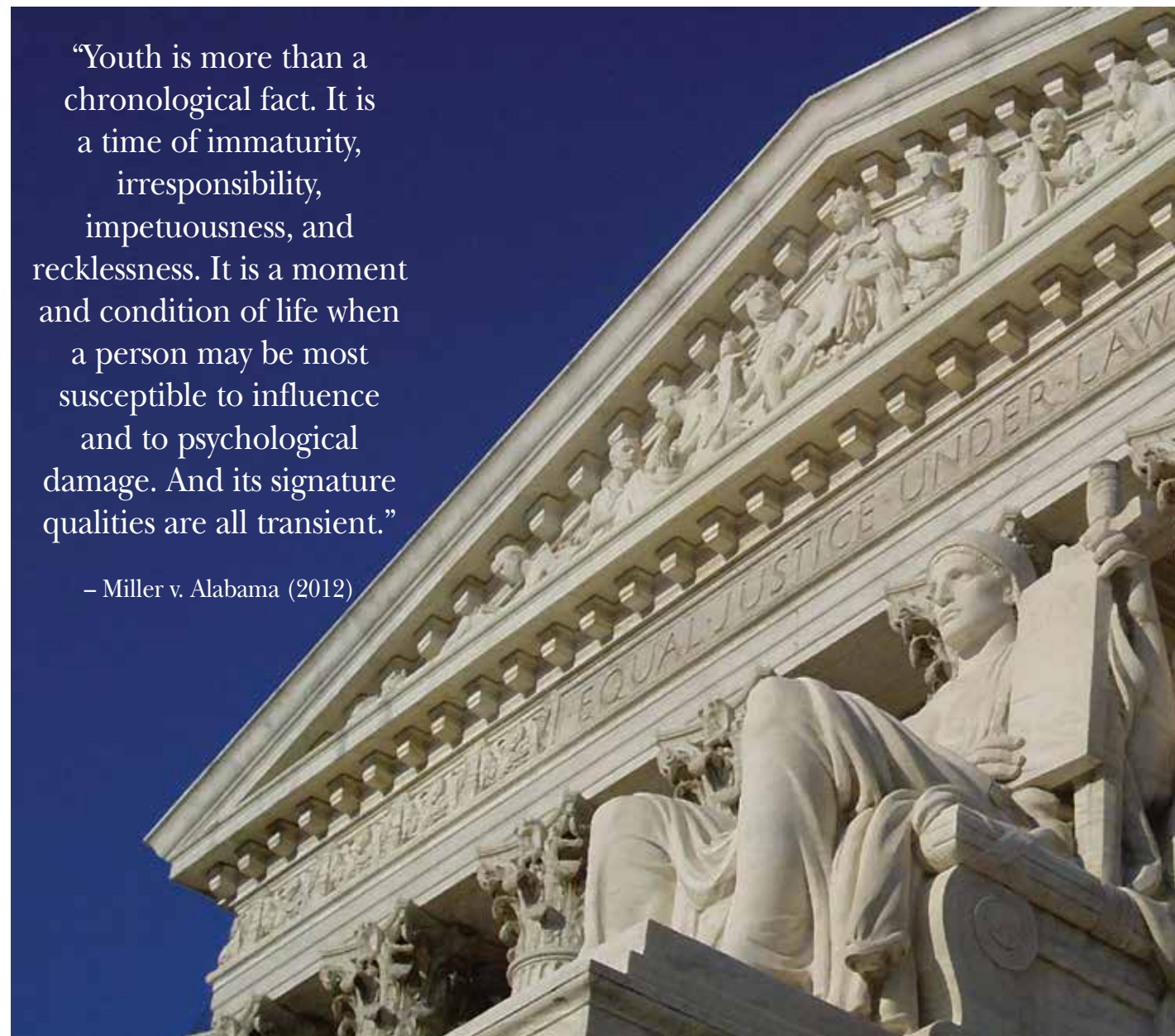
argues that the Supreme Court and the Eighth Amendment – the section of the U.S. Constitution that addresses "cruel and unusual punishment" – have failed to provide direction to lower courts on sentencing juvenile accomplices in murder cases.

"Eighth Amendment standards, as interpreted by the court, have not provided sentencing courts with the analytical tools necessary to account for stark differences in fact scenarios," Gallini says. "Simply put, the court's Eighth Amendment jurisprudence has not resolved a juvenile non-killer's constitutional challenge to a life-without-parole sentence."

To illustrate the problem, Gallini studied many cases in which sentences were similar or identical for juveniles whose roles were dramatically different in their respective crimes. For example,

"Youth is more than a chronological fact. It is a time of immaturity, irresponsibility, impetuosity, and recklessness. It is a moment and condition of life when a person may be most susceptible to influence and to psychological damage. And its signature qualities are all transient."

– *Miller v. Alabama* (2012)



CC-BY-SA-3.0/Matt H. Wade at Wikipedia

one juvenile defendant, not entirely unlike Kuntrell Jackson, participated in the killing of a shop employee by helping the shooter enter the shop under false pretenses (the defendant's father owned the shop), robbing the shop after the shooter killed the victim and manipulating the crime scene so that it appeared that someone had forcibly entered the shop. In a different case, a 14-year-old defendant, who had a history of physical and sexual abuse, was forced by her boyfriend to lure a man into their house to rob him. After doing so, the defendant left a room in which the boyfriend stabbed the man to death. In both cases, the defendants received sentences of life without parole.

It is important to understand how often this occurs, Gallini says. "The prevalence of this phenomenon cannot be underestimated. This can happen with any number of juvenile defendants waived into adult court. These are not exceptions."

The Gallini article covers the history and evolution of the Supreme Court's interpretation of the Eighth Amendment's cruel and unusual clause and its application to juveniles. Originally, the clause – "excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted" – had a narrow application, only to prohibit barbarous forms of punishment. Fortunately, the authors of the U.S. Constitution deemed torture a bad thing. However, as Gallini explains, the meaning of the clause and the court's interpretation of it evolved over time to mirror modern standards of decency for a changing society. The court itself has stated that the 8th Amendment's scope "is not static" and "must draw its meaning from the evolving standards of decency that mark the progress of a maturing society."

One way the court has done this is through proportionality, a simple test that asks this basic question: Is the sentence commensurate with the crime for which a person was convicted. As early as 1910, the court recognized that "it is a precept of justice that punishment for crime should be graduated and proportioned to offense." But since then and especially in the past 40 years, the court has vacillated on the proportionality analysis. For example, in 1977 the court ruled that a death sentence is not proportionate to a conviction of rape of an adult woman. But after that, in 1980, the court upheld a sentence of life in prison with the possibility of parole for a Texas man who was convicted of credit card fraud, forgery and theft involving a total sum of

\$229.11. (The severity of this sentence was based on a Texas recidivist statute.) Then, three years later, the court demonstrated favor for the proportionality analysis when it affirmed an appellate court's holding that a sentence of life without parole for a man who was convicted of his seventh nonviolent crime constituted

cruel and unusual punishment. The court reasoned that the crime – the man had tried to cash a \$100 hot check – was "one of the most passive felonies a person could commit" and that the original conviction had violated the Eighth Amendment. Through all of this, Gallini says, the court has never precisely defined "cruel and unusual."

Gallini discusses many other cases in which sentencing was identical but the participation of the defendants varied greatly. Examining three legal rules that deal with juvenile sentencing – felony-murder doctrine and both accomplice and co-conspirator theories of liability – he found no precedent clarifying whether it is cruel and unusual

punishment to impose life in prison on juvenile offenders with minimal involvement in a victim's death. The felony-murder rule imposes first-degree murder liability on a defendant who causes a death while committing a felony, and accomplice and co-conspirator theories of liability address degrees of participation, from minimal to substantial.

This lack of direction,

Gallini argues, has eroded the ideals underlying punishment of juveniles in the United States. It subverts the conventional ideology that juveniles, who presumably are too young and immature to understand the gravity of their behavior, deserve a shot at rehabilitation. Lack of guidance from the highest court also reflects a growing trend over the past 25 years of trying and sentencing juveniles as adults.

"The determinate sentencing of juvenile accomplice non-killers is inconsistent with the rehabilitation-based approach to juvenile criminal justice," Gallini says. "And the trend of punishing more minors like adults for a growing number

of crimes reflected a philosophical shift in juvenile punishment ideology from rehabilitative to punitive. This shift, I think, inappropriately exposed less-culpable juvenile non-killers to mandatory life without parole."

Gallini says it's too early to understand all of the ramifications of the Jackson/Miller decision. He and many other legal scholars are waiting to see how states will implement the ruling procedurally. At the very minimum, the holding will affect three

areas: charging, sentencing and transfer, which is the process of moving juveniles from juvenile court to adult court. With charges, the ruling could change whether prosecutors pursue capital, first-degree or felony murder. Also, relevant to Gallini's scholarship, the decision goes a long way toward drawing constitutional lines between murderers, co-conspirators and accomplices. And finally,

the Supreme Court's decision with Jackson/Miller is a clear indication that the pendulum is swinging, Gallini says, that the court is saying it is time to move away from a deterrent, punitive mode and back toward a more rehabilitative approach to juvenile criminal justice. ■



Kuntrell Jackson

The court itself has stated that the 8th Amendment's scope "is not static" and "must draw its meaning from the evolving standards of decency that mark the progress of a maturing society."



Evan Miller

Juvenile Defense Clinic pursues Life Without Parole project

The Supreme Court's Miller/Jackson ruling gives hope to Kuntrell Jackson and more than 2,000 other inmates nationwide who, as juveniles, were convicted of a crime and given a mandatory sentence of life without parole. But that's all it gives them. There is no guarantee that they will leave prison.

So what does the court's ruling mean for states and inmates already convicted and sentenced to life without parole? Procedurally, each state will handle the issue differently, says D'lorah Hughes, associate professor and director of the School of Law's Juvenile Defense Clinic. It is likely that most inmates will be given an opportunity for re-sentencing.

In Arkansas, however, the path to re-sentencing is more complex because Jackson originated here. The U.S. Supreme Court remanded the case back to the Arkansas Supreme Court with the specific instruction that determinate sentencing for juveniles convicted of murder and sentenced to life without parole is unconstitutional. Determinate sentences are generic sentences that do not consider youth and the individual facts and circumstances of the crime. Now the Arkansas Supreme Court must decide whether Kuntrell Jackson's sentence was

appropriate and whether it deems his case retroactive.

If his case is deemed retroactive, as Hughes and other legal experts expect it will be, then Jackson-eligible inmates can ask the court to rule that the original sentence was not valid.

"So it's complicated," Hughes says, "but it's entirely possible that they will be eligible for re-sentencing. Everyone's waiting for the court's decision."

Hughes is talking about the 55 men and one woman, who range in age from 21 to 56, living in Arkansas state prisons for crimes they committed as juveniles. There may be more, she says.

In November, Hughes and several students traveled to four Arkansas prisons and talked to the inmates about the possibility of re-sentencing. She said most of them understand the stakes, and many of them agreed to be represented by the Juvenile Defense Clinic.

"Many of these clients, especially the older ones, just aren't the same person they were when they committed their crimes," Hughes says. "Some could provide closure to victims' families, closure that they weren't able to provide as juveniles."



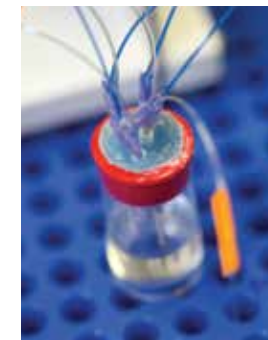
From left to right, law students Kristin Ries, Timothy Alexander, Celeste Kinney and Kendra Pruitt prepare their cases for the Life Without Parole project.

Photo by Russell Cochren

Probing for Answers

Improving Sensors for Diabetics by Re-directing Macrophages

By Chris Branam



It's easy to measure glucose in a beaker.

But the simple sugar is hard to quantify directly in the human body, which is why long-term glucose monitoring for people with type 1 and type 2 diabetes through implantable devices has proven to be extremely difficult. Leland Clark of Cincinnati Children's Hospital, considered the "Father of Biosensors," first suggested the use of electrodes for measurement of glucose in humans with diabetes in 1962. But a half-century later, diabetics still do not have ways to better manage their diabetes other than finger sticks or implanted sensors that have to be replaced every five to seven days.

The challenges scientists have faced in developing reliable implantable glucose sensors are two-fold: the sensors must deal with the foreign-body reaction, where a person's body attempts to wall off the implanted material from healthy tissue, and just as importantly, blood chemistry and tissue vary from person to person. After a week, these natural phenomena cause erratic glucose readings from sensor implants, said Julie Stenken, professor of chemistry and biochemistry.

"The whole foreign-body reaction drives a series of immune responses that then serve to encapsulate the sensor away from healthy tissue," Stenken said. "This sensor is measuring glucose in an encapsulated 'bag' around the sensor rather than being able to sense what is out in healthy tissue. That becomes an extremely dangerous situation clinically, because if you dose with

insulin when you don't need to, the person can go into diabetic coma or eventually death due to an inaccurate reading from the sensor."

Stenken is a leading expert in the area of *in vivo* (in the body) collection of proteins known as cytokines using a technique called microdialysis sampling. Her aim is to understand the inflammatory response caused by cells called macrophages to implanted foreign materials. But first she must ask the question: How can we change the way these cells communicate with each other?

THE HOST RESPONSE

Understanding the underlying biochemistry that occurs at the site of an implanted biomaterial is important in a wide range of clinical contexts, from reconstructive surgery to implantable glucose sensors. Many of the problems that scientists have encountered in the development of implanted sensors into living things have been due to the lack of understanding of the host response to implanted materials, said Stenken, the Twenty-First Century Chair in Proteomics in the J. William Fulbright College of Arts and Sciences.

"In this whole process, the macrophage cells that are ultimately encapsulating this device communicate with each other through protein signals," Stenken said. "These messenger proteins, called

Photos by Russell Cothren

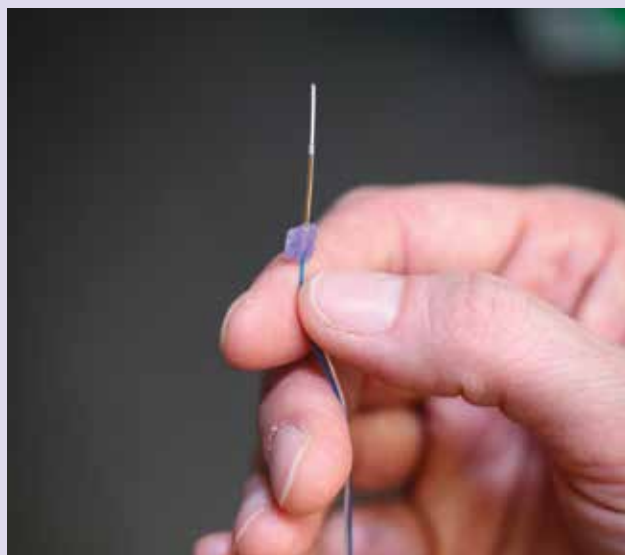


Photo by Russell Cothran

Research to Extend Lives

Big numbers illustrate the importance of Julie Stenken's work. An estimated 26 million Americans have diabetes, and another 79 million are experiencing symptoms of pre-diabetes, according to the American Diabetes Association. The association estimated the total annual cost of diabetes in the United States to be \$218 billion in 2007, the last year figures were available. That total included direct medical costs and indirect costs such as disability, work loss and premature death.

Even with the numbers of diabetics growing by an estimated 2 million a year, according to the association, only two companies are currently marketing implantable glucose sensors to American diabetics. A third discontinued its model in 2011. Type 1 diabetes is a serious medical condition. Extending the implanted glucose sensor's lifetime is crucial to the future well-being of this large population, Stenken said.

"Current glucose sensors still have to be calibrated against a finger stick on a regular basis," Stenken said. "So if you had a glucose sensor that was better integrated into the body, where you could reduce the calibrations that you need — and have it last a longer period of time — people would be more compliant with their insulin doses. It would be very helpful in managing their disease."

Also, episodes of nocturnal hypoglycemia are of particular concern for diabetics who rely on glucose sensors. When blood glucose drops to low levels during sleep, the person experiences symptoms such as headache, fatigue or night sweats. Untreated nocturnal hypoglycemia can cause the sufferer to slip into a diabetic coma. Scientists are working to create a glucose sensor that would signal an alert that would remind the person to consume carbohydrate.

cytokines, are part of a whole series of proteins that are involved in network responses within the immune system. We need to understand this communication process between all the cells so that we can direct the cells to the state where we want them to be."

This chemical signaling response to an artificial material within a tissue includes large cells known as macrophages. In an immune response, it is the job of the macrophage to destroy a foreign object, typically a virus or bacteria. The term is literally translated from Greek as "big eater." When the macrophages discover that they cannot destroy an object as large as a glucose sensor, they signal for fibroblast cells to lay down collagen, a group of proteins that form the main structural component of animal connective tissue. This "glue" eventually encapsulates an object, in this case a glucose sensor.

"There's an enormous interest in trying to redirect or bioengineer this whole process to improve outcomes," Stenken said. "These macrophages are very plastic. They have different states. We're trying to direct the macrophages to a certain type of cell, the M2. The M1 state is the classically activated macrophage where it is trying to destroy foreign material as quickly as possible. It's pro-inflammatory. The M2 state is considered to promote a wound-healing state."

To direct the macrophages, Stenken's research group uses a microdialysis probe that is placed under the skin of rats in order to mimic an implanted glucose sensor. The researchers, in a process unique to this group, then infuse different agents through the probe that are hypothesized to direct the macrophages into the M2, or healing, state.

"Once they are driven into the healing state, the question is, 'Do you see a longer lifetime for the implant?'" she said.

Stenken's work has drawn the attention of researchers across the country, including William M. Reichert, a distinguished professor of biomedical engineering at Duke University who has worked on biosensors.

"Julie has almost single handedly made a finicky microdialysis system work for the monitoring of wound healing," Reichert said. "I did some of this in the past but more or less gave up because of all of the experimental problems that she somehow overcomes. This can only be the mark of a careful and skilled experimentalist."

FEDERALLY FUNDED RESEARCH

In 2007, Stenken came to the U of A to accept an appointment as the inaugural holder of the Twenty-First Century Chair in Proteomics. The chair was endowed with a \$1.5 million gift raised by the university's Campaign for the Twenty-First Century. She brought with her ongoing microdialysis research that included two grants totaling more than \$1 million from the National Institutes of Health.

In addition to the current NIH grant, Stenken received a two-year, \$375,000 grant from the national institutes to use

the microdialysis probe to study cytokines in the brain. The Exploratory Developmental Research Grant (R21) will help to develop analytical chemistry methods to collect and detect cytokine proteins to allow for rapid translational medical treatments for humans. Cytokines as well as other neuropeptides are known to affect different human diseases related to the brain including, but not limited to, alcoholism, anxiety, appetite, depression, epilepsy, multiple sclerosis, pain, sleep, and various psychiatric disorders. These peptides and proteins are difficult to measure in the living brain.

"Cytokines are now considered the third-generation chemical communication system in the brain behind neurotransmitters and neuropeptides," Stenken said. "People have been very interested in cytokines in the brain because there are known receptors and they show up in many neurodegenerative diseases."

NIH R21 grants are meant to encourage high risk/high return research efforts. Stenken is enthusiastic about the possibilities.

"There are many biological areas that I know that these microdialysis probes will prove to be beneficial," she said. "I'm not afraid to learn new things in biology." ■



Photo by Russell Cothran

Stenken and Proteomics

Proteomics is the large-scale study of the structure and function of proteins. Julie Stenken is leading a research team that received a four-year, \$1.3 million grant from the National Institutes of Health to study the "foreign body" response to implants.

Stenken is collaborating on the grant with Jeannine Durdik, professor of biological sciences and assistant dean for research in the Fulbright College of Arts and

Sciences, and Liping Tang, professor of bioengineering at the University of Texas at Arlington.

In 2009, Stenken co-edited *In Vivo Glucose Sensing* with David D. Cunningham of Abbott Laboratories. The book, part of the Wiley Chemical Analysis series, is designed to provide state-of-the-art information on glucose monitoring to clinicians and medical educators.

Opening the Gates for Computer Programmers

By Chris Branam

Ma Sen holds a developmental circuit board in his hands, as if he is presenting it as a gift. Built on top of the green base are ports, switches, digital chips and connectors that comprise the hardware components of the board. Sen, a doctoral student in the Computer Systems Design Laboratory, points to a silicon chip called a field programmable gate array embedded on the board.

The architecture of that computer chip lies at the heart of the research being performed by Sen and other graduate students in the university's computer science and computer engineering department. They are working on a system that will help software designers to configure the gates in the field programmable gate array, known in the world of computing as an FPGA, to design and implement different electronic functions in a very short period of time.

As its name suggests, the chip features reprogrammable digital circuitry. It is unlike a standard microprocessor chip produced by companies such as Intel and Motorola, which has fixed gates that execute a set of functions that cannot be changed.

But a field programmable gate array has a dense array of configurable blocks of silicon that can run independently of each other and be configured and interconnected in a virtually unlimited number of organizations to best match the requirements of a specific application, said David Andrews, professor of computer science and computer engineering.

While commercially viable field programmable gate arrays have been around since the mid-1980s, only experienced hardware designers can figure out how to arrange and connect these gates to customize them for different tasks. There were only 70,000 computer hardware engineers in the United States in 2010, according to the U.S. Department of Labor. Meanwhile, there were an estimated 1.2 million professional software application developers and programmers.

"An FPGA allows you to reconfigure the gates on the chip to better support what the application wants to do," Andrews said. "The real challenge has been making those gates accessible to programmers. Part of what we are doing in this lab is allowing software engineers to actually guide the configuration of the gates."



Andrews has invented a system called "hthreads in the Cloud" to solve this problem. A software designer can describe a task to this system and hthreads will generate an appropriate field programmable gate array platform. Azad Fakhari demonstrated the ease and speed of hthreads by plugging some information into the hthreads website (<http://hthreads.csce.uark.edu/ARCHlang/>) and hitting "submit."

Within seconds, the downloadable components of a complete multiprocessor system on a programmable chip appear on the screen.

"You're just a click away from having a multiprocessor system," Fakhari said.

It would have taken someone who isn't a hardware designer "hours and hours and hours" to perform the task, Andrews said.

"If you didn't have this you would have to be an expert in digital design, an expert in computer architecture, computer organization and operating systems," he said. "You would have to

sit down and by hand configure millions of gates. This automates that whole process, by the click of a button."

The five graduate students in Andrews' lab — Sen, Fakhari, Abazar Sadeghian, Eugene Cartwright and Christina Smith — are joined by undergraduate Juan Rios, a Bodenhamer Fellow in the Honors College. The students are engaged in projects that seek to answer three questions about field programmable gate arrays: Can the underlying hardware be customized from a software program description of an application? Can the hardware self-modify as the system is running an application? What should next generation operating systems look like, and how should they be built?

Fakhari is creating a complete multiprocessor system to be put on one chip. This is called a "system on a chip" that goes into the field programmable gate array. Sen is trying to create a new vector-type processor that the Andrews team can use within its system. Sadeghian said he likes the challenge of tracking down bugs in hardware designs.

"We write some program applications to see if this hardware is doing what we expect it to do," Sadeghian said, "and then we measure their performance to compare it with the previous hardware. This is hardware architecture."

Smith, a master's student, said she became fascinated by programmable computer chips as an undergraduate at the U of A. She graduated in spring 2011 with a bachelor's of science in computer engineering.

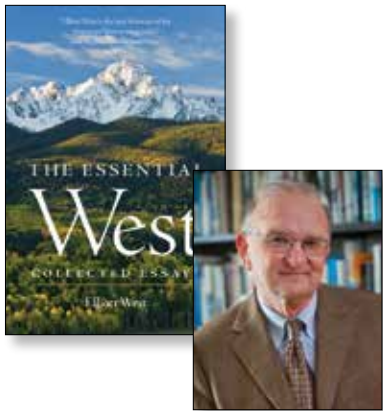
"I'm really enjoying the work," she said. "I've always thought FPGAs were really cool inventions and a really cool way for people to solve problems."

Andrews holds the Thomas Clinton Mullins Endowed Chair in the College of Engineering. His work with FPGAs has been funded by grants from the National Science Foundation and the United States Naval Research Laboratory. ■

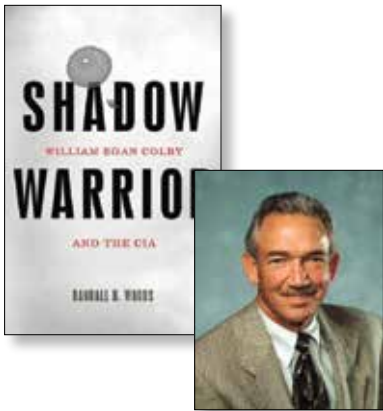


Photos by Russell Cothen

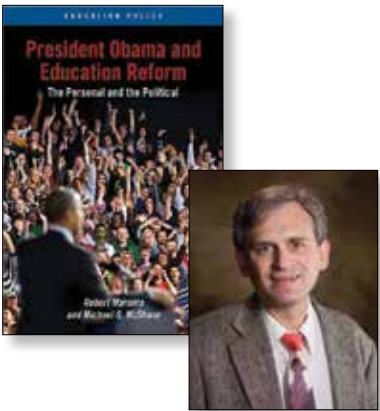
Upper left, Engineering students (left to right) Christina Smith, Azad Fakhari, Juan Rios, Ma Sen, Abazar Sadeghian and Eugene Cartwright discuss field programmable gate arrays in the Computer Systems Design Laboratory. **Left,** Smith holds a field programmable gate array and explains to Rios how she used it to implement a datagram protocol, which uses an ethernet port to send data over an ethernet cable.



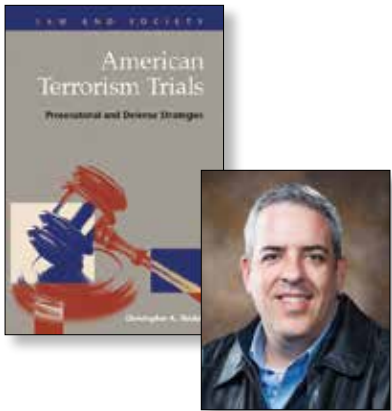
The Essential West: Collected Essays by Elliott West, was published by the University of Oklahoma Press. In this collection of essays, West covers an array of topics from conquest and frontier family life to the West of myth and imagination, all to reveal the past and present western America.



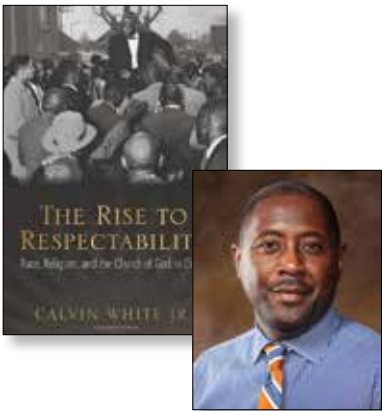
Shadow Warrior: William Egan Colby and the CIA by Randall B. Woods was published by Basic Books. Controversial post-war figure William Egan Colby played a critical role in momentous events in 20th century history. Colby was a World War II commando, Cold War spy, Saigon CIA station chief and eventual CIA director under presidents Nixon and Ford.



Robert Maranto co-authored, with Michael Q. McShane, **President Obama and Education Reform: The Personal and the Political**, which was published by Palgrave-MacMillan. The book offers insight into President Obama's educational policies, including efforts to improve long-term economic growth and foster class mobility, all of which have drawn skepticism from supporters of traditional public schools.



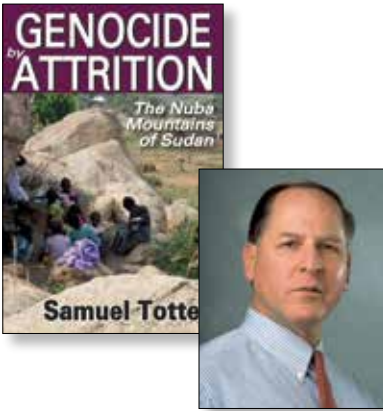
In **American Terrorism Trials: Prosecutorial and Defense Strategies**, published by LFB Scholarly Publishing, Christopher A. Shields examined the ways prosecutors and defense attorneys handle federal terrorism trials. He finds that they have developed politicized strategies unique to terrorism trials. Yet, he also finds that when prosecutors rely less on highly politicized prosecution strategies, conviction rates increased.



The Rise to Respectability: Race, Religion, and the Church of God in Christ by Calvin White Jr., and published by the University of Arkansas Press, traces the cultural and religious impacts of African Americans on the history of the South. White explores the intersection of race, religion, and class and how the history of the Church of God in Christ, intertwines with aspects of the African American experience.



Judi Neal co-authored, with Alan Harpham and published by Gower, **The Spirit of Project Management**, which explores the value of incorporating spirituality in projects to bring a larger sense of achievement and purpose. Incorporating spirituality can also act as a touchstone for ethical and sustainable decision-making.



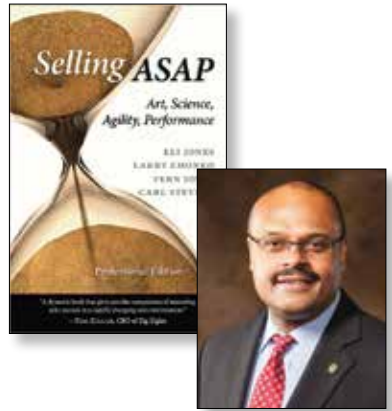
Genocide by Attrition: The Nuba Mountains of Sudan by Samuel Totten, published by Transaction Publishers, documents actions of the rarely researched government of Sudan during the attacks against the people of the Nuba Mountains in the late 1980s and early 1990s. It provides first-hand stories of the persecution and extermination of the Nuba people.



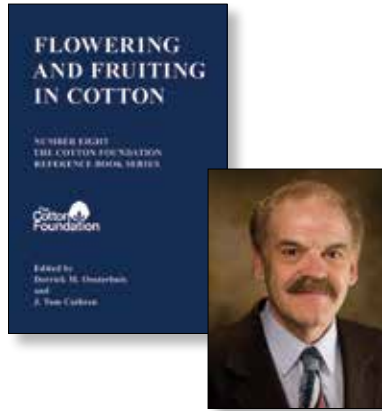
Margaret Bolsterli's **Things You Need to Hear: Collected Memories of Growing up in Arkansas, 1890-1980**, published by the University of Arkansas Press, gathers memories from Arkansans of a wide variety of backgrounds. Bolsterli includes the famous – Johnny Cash, Maya Angelou, Levon Helm and Jocelyn Elders – as well as everyday people. Interviewees reminisce about daily life in the early 20th century and how they got by in difficult times.



The Ongoing Burden of Southern History: Politics and Identity in the Twenty-first Century South, edited by Angie Maxwell, Todd Shields and Jeannie Whyne, and published by Louisiana State University Press, explores the contemporary South in light of C. Vann Woodward's landmark work of more than 50 years ago. Questions of equality, white southern identity, the political legacy of Reconstruction, the heritage of Populism, and the place of the South within the nation are all examined for a new generation.



Selling ASAP: Art, Science, Agility, Performance-Professional Edition, co-authored by Eli Jones, Larry Chonko, Fern Jones and Carl Stevens and published by Louisiana State University Press, is a comprehensive approach to professional selling. It focuses on the importance of making relationships with customers mutually beneficial through explaining unique processes and techniques of selling in real-world examples.



Flowering and Fruiting in Cotton, edited by Derrick Oosterhuis and J. Tom Cothren and published by The Cotton Foundation, provides comprehensive information about the physiology of the plant during the reproductive stage. In essays by more than 20 researchers, the book shows how understanding the growth of a cotton plant and its response to environmental stress can lead to optimum yields and fiber quality.



Extreme Environment Electronics, by John D. Cressler and H. Alan Mantooth and published by CRC Press, discusses the design and use of devices, circuits and systems that operate in extreme environments such as in space or on earth in gas and oil wells. The authors present best practices to design electronics to continue operating in extremely high or low temperatures or under intense radiation.

Question:

How does interior design affect health?

Jennifer Webb, associate professor of interior design in the Fay Jones School of Architecture, answers:

Have you ever thought about how much time you spend in interior environments? According to the Environmental Protection Agency, the average United States citizen spends 87 percent of his or her time indoors. Interior designers determine the sizes of indoor spaces and their arrangement, as well as the selection of all the things with which we fill spaces, such as surface materials, furnishings and accessories. These decisions directly impact human health and wellbeing, and here are several things to consider.

A qualified interior designer can help maintain good indoor air quality. For example, volatile organic compounds (VOCs) are found in all types of interior finishes and products, such as paint and upholstery cushions. Over time, these VOCs are emitted as gases and can cause nose and eye irritation as well as serious respiratory illness. In a work environment, isolating equipment such as printers and photocopiers can also improve indoor air quality by reducing the dust associated with paper.

Interior designers allocate space for circulation and arrange both exits and furnishings to make sure that individuals across the range of human functioning can access all parts of a space and conduct desired activities. Additionally, these elements ensure that people can safely exit a building during an emergency. The arrangement of space also provides access to natural light and views for the users. Visual access to the outdoors improves both task performance and attitude.



Interior designers can influence our emotional health and brain functioning. Certain colors can make us feel warm or cold or even chatty! Some colors have been linked to aggression. Different pattern scales for wall-covering and carpet have been shown to influence children's play behaviors, and the scale and enclosure of study spaces has been shown to influence the task performance of children with attention deficit hyperactivity disorder. There are many ways in which our interior environment contributes to our health and wellbeing, and interior designers make many of these critical decisions.

Question:

What is biofuel? How does it compare with gasoline?

Here's the answer, thanks to Jamie A. Hestekin, holder of the Jim L. Turpin Endowed Professorship in Chemical and Biochemical Engineering:

Now that is an interesting question. To me, in a simplified form, a biofuel is a fuel that is made from anything that was alive not that long ago. Of course, we need to be careful to add that closing "not that long ago." Oil came from organic matter (probably algae) millions of years ago, but it is not considered a biofuel, because it is dealing with old carbon, not new carbon.

So on to question two, is biofuel better than gasoline? That is an even more interesting question. It depends on your definition of "better." Right now, most biofuels are more expensive than gasoline. There are some estimates that oil from Saudi Arabia can be made for \$5-\$10 a barrel, corn biofuel (ethanol) is \$60 a barrel, switchgrass biofuel (ethanol) is \$100 a barrel, and algae biofuel (biodiesel or butanol) is more than \$100 a



barrel. So based on price, oil may seem better.

However, responsible biofuels like cellulosic ethanol and/or algae-derived biodiesel are more sustainable, are better for the environment, and can be produced in large quantities in the United States. Plus, the prices of biofuels continue to drop as the technology for making them improves. But they aren't going to lower gas prices tomorrow morning.

So are biofuels better than gasoline from petroleum? I think, as Americans, our answer has to be "yes," because we need to come up with a long-term, sustainable option that continues to create energy and jobs for future generations. Biofuels won't bring us the instant gratification of petroleum, but they are the long-term investment in our future.