MEASURE

THE RESEARCH PUBLICATION OF ARKANSAS STATE UNIVERSITY

ARKANSAS STATE UNIVERSITY
FALL 2015

We the people...

PROTECTING OUR NATION NATION NATION & ITS RESOURCES

DISCOVERIES TO CHANGE OUR WORLD

MEASURE

THE RESEARCH PUBLICATION OF ARKANSAS STATE UNIVERSITY

WHAT IS MEASURE?

How do we measure our commitment to research?
How do we judge successful scholarship?
How do we place value on creative expression?
How do we appraise the impact of service?

- Student engagement?
- Productivity?
- Awards and expenditures?
- Comparison with our peers?
- National and international recognition?
- Influence in the field?
- Solutions to real world issues?
- Economic impact?
- Community enrichment?

The answer is: all of these, and more.

At Arkansas State, we value each discipline and their measures of success.
MEASURE is a showcase of A-State success in a variety of disciplines.

Arkansas State University Mission Statement
Arkansas State University educates leaders, enhances intellectual growth and enriches lives.

We the people...

PROTECTING OUR NATION & ITS RESOURCES

DISCOVERIES TO CHANGE OUR WORLD

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arkansas state university : the measure of success

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LETTERS:

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MEASURE
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Friends of Arkansas State:

Higher education institutions take great pride in the scholarly work of their faculty members, and the fifth edition of MEASURE : THE RESEARCH PUBLICATION OF ARKANSAS STATE UNIVERSITY showcases a portion of the pure and applied research underway in Jonesboro. This publication is a part of our ongoing commitment to inquiry into problems and the quest for solutions. This serves as a core principle of Arkansas State's mission to enhance the lives of citizens. While many universities make similar statements, what I believe sets Arkansas State's work apart is our faculty's strong commitment to involve students, particularly high-achieving undergraduate students, in their laboratories and projects.

In this year's issue, we focus on activities that enable us to safeguard America's resources and to strengthen the economy. As a public research university, A-State has a special responsibility to demonstrate a return on investment for every dollar of research funding. Each article in this MEASURE describes research and related initiatives that are producing high-impact, significant outcomes.

In ***National Security***, we spotlight the programs of two faculty members who are working on solutions to protect the homeland from threats within and beyond our borders. ***Human Resources*** recognizes three outstanding student researchers at A-State who are discovering ways to reduce manufacturing costs, solve problems for our legal justice system and engineer healthier plant food products. Global food security and agricultural sustainability are the focus of ***Red, Rice & Blue***, which features the work of two exceptional tenured faculty members who are helping to secure our state's economy and future through improvements in rice production and processing.

We hope you enjoy this edition of MEASURE and welcome your comments and suggestions.

Warm regards,

Tim Hudson, Ph.D.
Chancellor

Rebekah L. Craig

We the people...Working Together

Interdisciplinarity and collaboration are hallmark characteristics of modern science. One of the strongest indicators of a robust, sustainable university research program is the development of research collaboration networks. Such networks create a shift in thinking away from insular academic "silos" toward shared language, values and out-of-the-box thinking across disciplines and institutions.

TRANSFORMING THE DELTA

In the past decade, A-State has been devoted to advancing its standing as a research institution. When the Research and Technology Transfer (RTT) office was created in 2004, the university was receiving approximately $5 million in external grant funds, directed mostly to early childhood development programs. The establishment of a five-member consortium of state research institutions and receipt of Congressional appropriations for defense research enabled A-State's research programs to begin moving forward. Despite this and other advances, a readily identifiable weakness in research infrastructure for A-State and institutions across our region is the lack of strong collaboration networks.

"The experience we have had at A-State is not unique. We have a good solid start, but sustainable growth is challenging, particularly in today's fiscal environment," said Rebekah Craig, director of research development. "Grant sponsors are increasingly emphasizing collaboration and broader impacts that extend far beyond one's own institution." In response to this challenge, the A-State RTT office introduced a solution: the formation of a Delta Research Consortium (DRC), with more than 50 four-year universities in the Mississippi River Delta and Alabama Black Belt regions invited to participate.

"While we have many regional differences, by and large the Delta is a cohort – our cultural, social, political and economic realities are shared throughout the region. Since we have been united for decades by shared challenges, we must now unite to create and implement lasting solutions," said Craig (pictured with Dr. Andrew Sustich, left, and DRA Federal Co-Chairman Chris Masingill).

The Delta Research Consortium was launched in April 2015 with strong support from the Delta Regional Authority (DRA), regional economic development leaders and other public/private stakeholders. Participants from 23 universities and 12 other stakeholder groups across eight states, including local economic development professionals and state legislators, gathered at A-State to envision the future of the consortium. In Fall 2015, Chancellor Tim Hudson, DRA Federal Co-Chairman Chris Masingill and University of Memphis President David Rudd will host a President's Roundtable meeting of university executive leaders from the region. The meeting will be the first time these university leaders have assembled as a regional network. "The consortium's efforts will focus on priorities for collaborative research that will capitalize on our resources and inform local and state leadership for evidence-based decision-making that addresses the challenges we face in the Mississippi River Delta and Alabama Black Belt regions," said Masingill.

CO-LEADING WITH STUDENTS

When students are engaged as co-leaders, studies at the primary and secondary education levels have found sustainable gains in student participation, improved competencies in skills such as critical thinking and problem-solving, and a strengthened sense of organizational commitment. However, the majority of student government organizations focus their energies primarily on social activities and are rarely engaged in formal problem solving that relates to broader academic issues or institutional culture. This year the RTT office launched an initiative that aims to demonstrate that the same sustained, positive outcomes may be expected as students are engaged in co-leadership during their college experience.

Student members of the new A-State Student Research Council (SRC), formally advised by the RTT office, meet regularly with research administrators to keep abreast of upcoming research opportunities and contribute a student perspective to the university research environment. "This novel student-led model allows A-State to provide the equivalent services of a staffed undergraduate research office, but to do so in a way that improves student learning and commitment to A-State, and uses minimal administrative resources," said Emily Devereux, associate director of research development. Devereux hopes the A-State model will equip other undergraduate institutions for growth during a time when universities are pressed to "do more with less." She has presented the model at regional conferences, published it in a professional journal and plans to work with other universities to develop regional and national networks of student-led research councils.

INVESTING FOR IMPACT IN 2015

¼ = fraction of nationally available funding for capacity building in non-land grant universities awarded to A-State from USDA

1.2 = million dollars from the National Science Foundation in research awards to six faculty

1.7 = million dollars in A-State's first National Institutes of Health research award

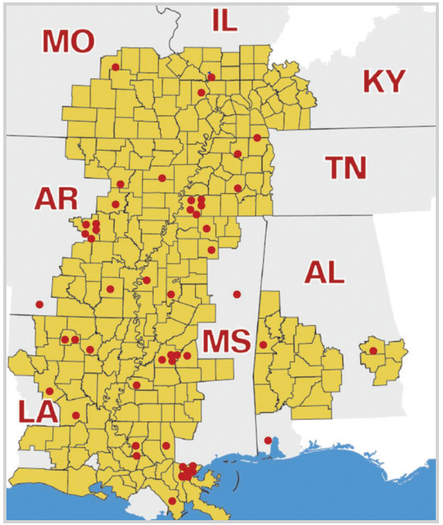
2.1 = million dollars in research awards from the U.S. Department of Agriculture

19 = million dollars in research expenditures

131 = students selected to give Create@STATE oral or poster presentations of their mentored research experiences

770 = thousand dollars in A-State's first National Institute of Justice research award

881 = thousand dollars invested by the Arkansas Science and Technology Authority in support of 11 faculty and five student-led research projects



More than 50 universities were invited to join the Delta Research Consortium.

The U.S. Department of Agriculture – Agricultural Research Service – Delta Water Management Research Unit (USDA-ARS-DWMRU) is bringing two new scientists to the ARS station located on the A-State campus. "Our collaboration with A-State allows us to have access to great students, great facilities and great collaborators," said USDA research hydrologist Michele Reba.

Learn more about the DRC. Scan this QR code to watch a video.

NATIONAL SECURITY

HOMEGROWN TERROR

Today, America has an estimated 20 MILLION brown, mestizo ILLEGAL ALIENS who have INVADED OUR NATION - this evil, corrupt Judeo-Capitalist system - where basically 3% of the population, control 85% of the nation's wealth, are demanding and will eventually grant "amnesty" to these foreigners. Why?

Because they want a cheap, slave-like work force - where decent wages and benefits will be a thing of the past. All in the name of selfishness greed. Every year, our White children's expected life-style - is declining - compared to the previous generations. Once these illegals ARE granted "citizenship", by LAW - they are allowed to bring into our country - ALL their "extended families". This means not only their usual very LARGE amount of children - but, mom, pop, grandma, grandpa and who have you.

By 2025 - given only CURRENT population trends, coupled with this "amnesty" - WHITE AMERICA will be a total MINORITY in a nation that WAS ONCE THEIR BIRTHRIGHT! Does this

BORDER DETECTION

U.S. ATTACKED

'Dirty Bombs': A Cheap Way To Sow Panic

'IT CAN HAPPEN ANYTIME, ANYPLACE'

Dirty bomber's plot to hit stations and hotels

War on America

TERROR HITS HOME

Protecting our nation requires vigilance on every front. Using sophisticated analysis and technology, A-State researchers are helping law enforcement agencies to differentiate peaceful protest groups from those that foster violent extremism and distinguish background radiation from potential nuclear threats.

Tom Ratliff

HOMEGROWN TERROR

The Internet has changed virtually everything requiring human communication, from how we do business to how we meet our spouses. It has also changed how extremist and hate groups connect to followers and promote violent actions. Consequently, these groups have flourished to more than 750 active hate groups in the U.S. and the number is still growing. From 2008 to 2012 alone, anti-government patriot groups increased by over 800 percent.

"Scientifically, we must tell the story as it is and lay emotions and politics aside. The truth and reality of the matter will lead people in the right direction. I don't have to editorialize. I can let the content speak for itself."

Tom Ratliff, assistant professor of criminology, is helping the federal government to identify and counteract radicalization. His research creates "virtual" profiles of extremist groups by cataloguing and analyzing how they use the Internet. A critical outcome of his work is equipping communities and law enforcement agencies to understand recruitment processes and propaganda underlying Internet activity by extremist groups. "We want to know the scope of domestic extremists' use of the internet and how they recruit, particularly among youth," said Ratliff. "We want to know the language, the tactics and the worldviews of these groups, which have grown exponentially in the past six to eight years."

This year, the National Institute of Justice (NIJ) awarded Ratliff and his collaborators nearly $800,000 to study extremist Internet activity during the next three years. The research team includes graduate and undergraduate students, A-State faculty Matthew Costello and Rebecca Barrett-Fox, and internationally renowned experts David Snow (University of California at Irvine), James Hawdon (Virginia Tech) and Jennifer Earl (University of Arizona). "The network building was critical to moving this project forward," said Ratliff. He also credits A-State seed grant funds that allowed him to design the current study while continuing his research on protest policing, which is a separate but overlapping endeavor. "Without that internal support there is no way I could have had the time to continue my other research activities and accomplish the work necessary to design the NIJ grant."

The primary recruitment age for extremist groups is 15 to 35 years old.

Ratliff's team analyzes "homegrown terror" groups and trends in hate-group incidents to provide preventive measures and training for law enforcement agencies. State offices of Homeland Security and the FBI have already reached out to him. Ratliff explained, "Protests occur in cycles with peaks of violence. Being prepared for those peaks benefits everyone. When I look at the pulse of protests over 50 years, there is a peak in 1968-69. If you map that onto the current cycle of protests, we could be moving toward another peak now." Looking at the growth in extremist movements complements his research on protest policing, which documents protest events from 1960 to 2012. Thus, Ratliff's work spans the spectrum of dissent, from prayer vigils and peaceful demonstrations to riots and terrorist attacks.

"If we don't understand extremist groups there is no way to prevent youth from buying into these worldviews," said Ratliff. "It is also a matter of understanding the landscape of our nation." Where his research on protest events uses archival data from newspapers, Ratliff said the Internet provides a source of data that allows us to be aware of social and cultural changes happening in our nation in real-time. "Given the growth of extremist groups since the election of President Barack Obama, particularly those affiliated with white supremacy, the Internet and social media are crucial in understanding current political and social changes."

arkansas state university : the measure of success

"We must work to understand violence and intolerance rather than shutting out or ignoring it."

Ratliff's team will provide a picture of how extremist groups see themselves and the impact of their online movements. They will illustrate the pulse of groups acting violently over time through protests, riots, individual attacks and domestic terrorist events, and can then discern which groups are the most dangerous.

Simultaneously, they will be conducting a survey to learn from participants how their exposure to extremist websites affected them. This stage of the research is particularly relevant to youth. Ratliff explained, "In the 1960s, policymakers and police viewed protestors as a wild, rowdy mob and their individuality was lost in the collective action. We also view extremist groups this way and blow them off. But we can miss something critical, because they actually do have a purpose and a clear strategy with action steps."

Ratliff hopes his research will not only produce practical and scholarly knowledge, but will also help shape the lives of A-State students. "I want to teach our students that although this is not the 'Jim Crow' era, the battle for equality and tolerance is not over. Non-violence is still a viable solution for our problems. If our young people will take up the mantle, we can as a nation overcome the worldviews, actions and impact of extremist hate groups through non-violence."

In his Ph.D. research, Ratliff saw close connections between Vietnam and Iraq anti-war protests, which led to his current focus. "I'm very passionate about my country, and the disenchantment with government that happened around those times concerns me," he said.

TIMELINE OF TERROR IN OUR OWN BACKYARD

These attacks were not driven by foreign influence, such as ties to international terror networks, but by instances of violent extremism perpetrated by U.S. citizens in response to the beliefs or political agenda of their hate group.

1995 — bombing of the Federal Building in Oklahoma City, which killed 168

1996 — Centennial Olympic Park bombing in Atlanta, Ga., which claimed one life and injured 111 spectators

2001 — anthrax attacks, which killed five and infected 17 others

2008 — church shooting in Knoxville, Tenn., that killed two people and wounded seven others

2012 — Wisconsin Sikh temple shooting that killed seven and wounded four people

2013 — California attacks that targeted law enforcement, leaving five dead and three wounded

2014 — Kansas City-area Jewish Community Center and retirement center shootings that claimed three lives

2015 — Charleston, S.C., church shooting that wounded one and killed nine parishoners

Learn more about Ratliff's research. Scan this QR code to watch a video.

Koushik Biswas

Biswas designs rapid response detectors that can scan large crowds quickly and produce real-time data output in an environment cluttered with high background "noise." This will be useful to keep sporting events, concerts, protests and other large events safe.

BORDER DETECTION

A semi-truck attempts to cross a border but passive radiation detectors sound an alarm, alerting Customs and Border Protection (CBP) agents that the trailer is emitting gamma rays, the most dangerous type of radiation. At the same time, agents at a port flag a radioactive cargo container on a ship arriving from a foreign country. Traffic is paused at the border crossing and workers stop unloading containers from the ship until CBP agents clear the containers for entry. Every minute means loss of money for the U.S. economy. Every minute is also closer to potential detonation of a "dirty" bomb.

Although CBP agents are not scientific experts, they are supported around the clock by a team of analysts at a secure location who evaluate radiation signatures in real-time to determine whether suspects and cargo are detained or allowed entry. Those analysts are supported by scientists across the nation working to make the process faster and more accurate, protecting the U.S. people and our economy. Koushik Biswas, assistant professor of physics, is one such scientist.

With more than $540,000 in funding from the U.S. Department of Homeland Security, Department of Energy and the National Science Foundation, Biswas collaborates with other researchers to create better nuclear radiation detectors. His collaborators include researchers at Wake Forest and Fisk universities, and Radiation Monitoring Devices, Inc., working together toward a global nuclear detection architecture. This will create a multi-layered defensive network to assist law enforcement agencies in detecting and responding to radiological and nuclear threats.

> "This all cannot be achieved simply. There must be different paths with a broad, complex solution."

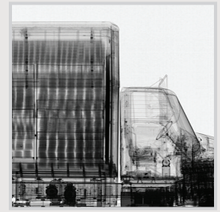
"Distinguishing naturally occurring radiation from that used for bombs is complex," Biswas explained. The most common bomb components, uranium-235 and plutonium-239, emit only small levels of radiation, thus requiring very sensitive detectors. Bulk shipments of common consumer products may emit more passive radiation than the small amount of radioactive material required for building a very destructive bomb. Additionally, components of a nuclear bomb may be shipped in shielded containers, making detection even more difficult. Because of the sensitivity required, false alarms at our borders are common and very disruptive. Biswas and his collaborators are designing radiation detectors with two main components: material that absorbs radiation and emits a signal, and an electronic component that analyzes the signal and helps analysts distinguish radiological threats from background radiation. Biswas says his team faces two challenges. "First we must create a more effective material to reduce false alarms and an electronic component that analyzes signals more quickly to prevent shipping delays. The second challenge is to produce the materials as cheaply as possible without sacrificing precision of the detector."

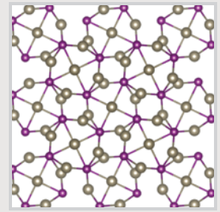
Biswas has a benchmark challenge to create a $100 detector with a specified level of precision. "This can only be accomplished by pairing theory and experiments together," he explained. "I examine at the atomic and electronic levels how potential detection materials react with radiation and what signals they produce. I use physics theory to answer these questions and then talk to my experimental partners who actually probe the materials and signals." During his education and training, Biswas said he was always attracted to theory, but became an experimentalist instead. He worked for IBM, National Renewable Energy and then the Oak Ridge National Laboratory before finding his "true calling" in theoretical and computational physics. Biswas credits his current success in part to his diverse training experiences. "Sampling other branches of physics and having an experimental background helped," Biswas explained. "I now collaborate closely with experimentalists and can communicate well with them. Because of this, I can reach common goals with collaborators who think and work very differently."

Biswas plans to continue his innovative work in materials physics. "Every technology – smart phones, iPads and touch screens – these are all materials that were very expensive in the early 2000s. But hundreds of researchers like myself worked together to contribute to breakthrough touch screen technology that created a more affordable material. It is so exciting because I can see the impact of my work and I want to continue to be a part of that."

Biswas predicts harvesting energy from renewable sources and storing it in easily accessible ways will be a large part of the scientific community's work in this century. That technology is important for example, in smart cars. "Energy storage and production is another area where I will invest effort in the future, but the theme remains the same," he said. "It is always the materials." Biswas has big dreams, such as designing semiconductor materials that would allow us to produce $1 computers. Considering his skills in collaboration and his contributions thus far, the dream may not be far-fetched.

Protecting our borders efficiently is vital. A one-day shutdown of just one of our nation's largest ports could cost the U.S. economy nearly $1 billion in trade.

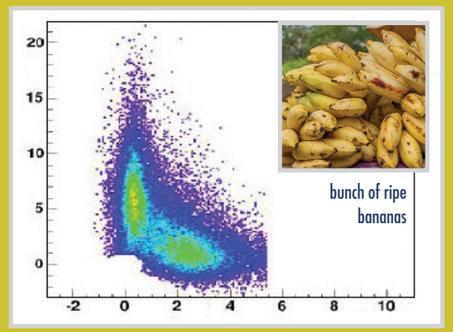




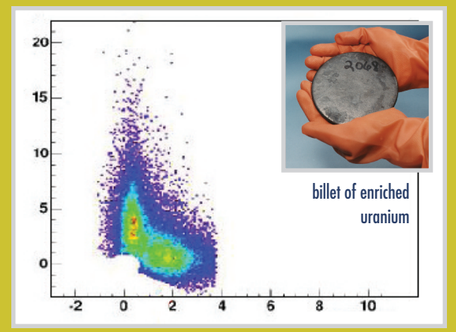
Nearly 26 million shipping containers pass through U.S. ports and borders each year. In 2014, only three percent were scanned for radiologic or nuclear materials.

BANANAS OR BOMBS?

Bananas give off radiation from the naturally occurring, but unstable potassium-40. The average shipment of bananas contains about 10 million pounds of fruit. The radiation emitted from a banana shipment could be 10 times greater than from one pound of enriched uranium. Only a few smuggled pounds of uranium could produce a powerful nuclear device. Other consumer products such as ceramic tiles, glossy magazines, metal jewelry, cat litter and Brazil nuts also emit radiation. With average use, these products give off only trace amounts, but when shipped in large quantities, they can easily cause false alarms for radiation detectors.



bunch of ripe bananas



billet of enriched uranium

Learn more about Biswas' research. Scan this QR code to watch a video.

HUMAN RESOURCES

Mentored research experiences allow A-State students to integrate their academic knowledge with their personal passion. Three outstanding students have joined with faculty mentors to focus their energy and apply their research skills, generating solutions for real-world problems.

Kenny Rains
Student Researcher

KENNY RAINS

As a five-year-old, Kenny Rains knew he wanted to be an inventor. Throughout his early education, he spent time "tinkering," learning how to take ideas from his imagination to reality. When Rains was in high school he learned about researchers at Wake Forest University who were using a 3D printer to "print" kidneys and heart valves that may someday be used as transplants. That inspired him to pursue a future in biomedical engineering and he began saving money to purchase his own 3D printers.

As an electrical engineering student at A-State, Rains' adviser and interim dean of the college Paul Mixon said, "Kenny was the first student I ever knew who had his own 3D printers at home. It's kind of a new technology. I knew what a 3D printer was, but I can say that he taught me just as much about 3D printing as I taught him about some of his engineering courses."

Rains met a fellow engineering student, Alex Cossey, who was paralyzed from the shoulders down. Cossey could move his arms and wrists but not his fingers. Rains adapted designs for an artificial hand to meet Cossey's unique needs and used his 3D printers to produce a movable prosthetic. When Cossey moves his wrist up, the prosthetic fingers close, allowing him to grasp objects he couldn't previously hold.

Other innovations Rains created with his 3D printer have led to a pending patent for a cell phone solar charger accessory and $35,000 in awards for his team, Agricultural Innovations, at the recent Donald W. Reynolds Governor's Cup collegiate business plan competition. Rains' innovative spirit has impacted his college. "Kenny educated me on the potential value of 3D printers, particularly for the educational environment and for preparing students for careers in manufacturing," said Mixon. "The College of Engineering now has one and we are setting up a process for students to be able to use the machine in their personal time to pursue their own ideas as Kenny did. A lot of high school students are very excited to come here and use our 3D printing lab."

"He has a brilliant mind, always thinking outside the box. He's an emotional leader, a leader by example, both on and off the field."

– Blake Anderson,
Head Football Coach

Learn more about Kenny. Scan this QR code to watch a video.

BACK TO THE DRAWING BOARD

Rains is employed by Bad Boy Mowers where he painted his office walls with whiteboard paint so he has plenty of space to innovate solutions for engineering problems. He said, "To anybody who is afraid that you will get on your job and have no clue what to do, I'm going to tell you you're not. You've been equipped with the tools to figure it out. Wherever you go to work you're going to have to dive into some problems head first, get messy and figure it out."

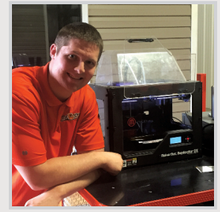
"I would love to make an Iron Man™ suit for people who are paraplegic, quadriplegic... to make different prosthetics to help people who really need it."

Rains did what few other students do and finished his Bachelor of Science in engineering degree in just four years. He did that while also playing tight end for the A-State football team, and has continued his education at A-State by pursuing a master's degree in engineering management. Rains sought employment with Bad Boy Mowers, a lawn mower manufacturing company headquartered in Batesville, Arkansas. The company recognized Rains' talent and created a position for him in January 2015. "I use 3D printing to clean up a lot of manufacturing processes," said Rains. "I print models for machine components, which we then test for interference before sending it to be manufactured."

He recently printed a gasoline tank cover that required 750,000 lines of computer code and 29 hours to print. Making the model in-house cost about $50 but may have cost up to $7,000 if they outsourced the 3D printing. With the first model, the engineering team discovered interferences that required modification, so Rains made the changes and printed another model. Before integrating 3D printers into the manufacturing process, a mold would be cut at a cost of more than $30,000 and a few months' time. If there were interferences with the component, a new mold would be required. The $12,000 industrial grade 3D printer has paid for itself in the production of just one component.

Every day Rains applies the critical thinking and problem-solving skills that he learned at A-State through his experiences with both engineering and football. Learning from different professors and playing football for five different head coaches in five years, Rains said he learned there are multiple ways to solve one problem.

"At my workplace, no one tells me how to solve problems, they just throw it at me and say 'solve it.' If I see something that can be improved upon, I will work toward a solution." In the future, Rains plans to start his own business and continue solving real-world problems through engineering research and development. "I am constantly creating new things and want to take each one as far as it can go. I want to see how far I can ride each idea."



"I've always wanted to be an engineer and an inventor. I just happened to discover that I'm also good at football."

"It's hard to imagine that anyone could excel in both football and studying engineering to the point that they complete the degree in four years. It's quite remarkable."

– Paul Mixon,
Interim Dean of Engineering

Chris Elms
Student Researcher

Elms' research utilizes rice, one of the state's most abundant crops, and sugar beets. Producing plants that enhance consumer health may have positive economic benefits for producers.

CHRIS ELMS

Innovating solutions for health is what motivates Chris Elms, a junior undergraduate honors student who is pursuing a double major in biology and chemistry. Many drugs are created using plant products used to treat existing diseases. What if we created foods that act as a preventive medicine, reducing the incidence of chronic diseases? Chronic upset in the colon ecosystem leads to inflammation that is implicated in autoimmune disorders, inflammatory bowel disease, colorectal cancer, obesity and diabetes. Elms' research addresses dietary intervention at the level of food product proteins, a novel approach that may enhance the colon's ability to protect against pathogens and inflammatory diseases.

"As the field of medicine makes a push toward using more natural treatments, plant protein production will be a strong research focus in the future," said Jianfeng "Jay" Xu, Elms' faculty mentor in the College of Agriculture and Technology. Their research aims to enrich whole rice products and sugar beets with specialized, bioactive proteins. Rice bran, the hard outer layer of the rice grain, is a milling byproduct rich in vitamins and minerals and an excellent source of dietary fiber and protein. In beets, the cell wall structure may be modified to release bioactive proteins during plant processing. Elms' research may allow us to grow rice and beets that contain healthier proteins, which can then be used directly in food products or for livestock feed, producing healthier meats and poultry that may help reduce chronic inflammation when incorporated into the consumer's diet.

Elms' excellence in research has been recognized and supported by National Science Foundation funding through two Arkansas Advancing & Supporting Science, Engineering & Technology (ASSET) Initiative internships and an Arkansas Plant-Powered Production internship, and by a Student Undergraduate Research Fellowship award from the Arkansas Department of Higher Education. As he prepares to enter medical school, Elms said, "The hands-on activity in Dr. Xu's lab and weekly lab team meetings have been invaluable in boosting my learning experience by applying my classroom learning. It has broadened my horizons by making me think outside of the box, look at the bigger picture and analyze complex issues."

"My research experience has helped me develop a more analytical thinking style and the ability to solve very complex problems."

Learn more about Chris. Scan this QR code to watch a video.

STUDENTS AS MENTORS

As a founding member and undergraduate chair of the A-State Student Research Council, Elms said his time with the council has shown him that a group of motivated individuals can bring about change. His advice to other students is to look for an opportunity, and as it comes to you, grab onto it and do not let it go.

arkansas state university : the measure of success

SKY JOHNSON

If a child cuddles a dog for comfort while giving testimony in a jury trial, will the "cuteness" of the dog influence the jury? Is there evidence to confirm, as defense attorneys assert, that the "cuteness" of support objects may bias the jury and result in an unfair trial for the defendant? These are the questions examined by Sky Johnson's research in the A-State Forensic and Applied Cognition in Society Research Laboratory.

Johnson, a senior undergraduate psychology major, uses mock trials to evaluate the effects on juror perceptions of the consistency of a child witness' testimony. "Being in a courtroom, surrounded by strangers can be very frightening for a child," Johnson explained. "The fear and stress can cause the child to become more vulnerable to suggestion by attorneys and can decrease the accuracy of the child's testimony." Johnson measures juror reactions when the child is petting a support dog or another object. So far, in comparison to the other objects, the dog has had no biasing effects.

Her faculty mentor, Christopher Peters, said Johnson approached him with her research idea and a request to join his research group. Johnson had a passion to serve children through her career. Though Peters' research interest was primarily with forensics and didn't involve children, they agreed to combine their interests to create a new direction of research that has been largely unexplored. "There isn't a lot of research in child forensic psychology," said Peters. "Most of the existing research is very basic about child memory. There isn't much knowledge about the impact of trauma, stress and overall anxiety on a child witness' ability to provide accurate testimony."

Johnson's research was funded by a Student Undergraduate Research Fellowship from the Arkansas Department of Higher Education. "I quickly learned that to have a successful career in psychology, you must have research experiences as an undergraduate. It is critical to advance my career," she said. Johnson's goal is to work with children one-on-one as a clinical psychologist while staying active in research, which will allow her to provide her clients with the best treatment possible.

Johnson evaluates the use of a courthouse dog, cute teddy bear and other support objects in jury trials.

Sky Johnson
Student Researcher

"Sky is one of my three lab leaders, in charge of running projects and organizing the other research assistants. She has led several of my own research projects," said Chris Peters, Johnson's faculty mentor.

While leading several research projects, Johnson has also devoted time to mentoring and training other undergraduate student researchers who will succeed her in the A-State Forensic and Applied Cognition in Society Research Laboratory after her graduation in August of 2015.

Learn more about Sky. Scan this QR code to watch a video.

RED, RICE & BLUE

FROM SOIL...

Arkansas produces more than 50 percent of the nation's total rice supply, providing over $6 billion dollars annually for the state's economy. Argelia Lorence is engineering rice plants with higher tolerance for environmental stressors in the field to help producers weather the uncertainties of the future.

...TO SILO

Post-harvest processing of rice is a vulnerable point in the U.S. grain commodity supply chain, which is 12 percent of global rice exports. Tanja McKay is securing the future of this valuable Arkansas crop by discovering environmentally safe and cost-effective strategies for pest management in rice mills.

Argelia Lorence

A HEALTHIER GRAIN OF RICE

When Argelia Lorence, professor of metabolic engineering, was recruited to Arkansas State University in 2005 she said, “All I had was an empty room and lots of dreams.” Her dreams revolved around answering one pressing question: How are we going to feed a growing world population without a growing amount of arable land?

In their search for a solution, Lorence and her research team have discovered a new pathway to Vitamin C formation in plants. Their research has substantially advanced the frontiers of plant science by helping researchers and producers understand how to enhance the growth, stress tolerance and nutritional value of food crops. “Just as Vitamin C improves the health of humans, it is also critical to the health of plants,” explained Lorence. Vitamin C protects cellular components of plants from environmental stressors like salt, drought, cold and excess light, and is a part of the plant response to ozone exposure and pathogen attack. It also has a role in modulating plant embryo development, flowering time and aging.

Despite its importance, only recently have scientists begun to identify the pathways for Vitamin C formation in plants, which differ from that of animals. Lorence’s team is leading that effort. They are the first in the world to demonstrate that increasing Vitamin C concentration in rice plants has a markedly positive effect on plant growth. They also found rice plants with higher Vitamin C content have potential for use in phytoremediation, a process by which plants are used to restore an environment in which the soil or water is polluted with toxins.

These discoveries have moved us several steps closer to being able to grow food crops on land that has not previously been suitable for farming, and to help plants tolerate increasingly harsh climates. This will enable scientists not only to engineer plants that have a higher stress tolerance and nutritional value, but also to better utilize natural variation. Lorence is currently testing natural variants of rice so plants with the highest Vitamin C content can be used as breeding materials to increase the health, quality and yield of rice crops.

Lorence’s is the first academic lab in the nation to utilize Scanalyzer HTS technology, which creates a digital phenotype, allowing the research team to observe the real-time use of Vitamin C in several hundred plants as they grow. In a process called “high-throughput phenotyping,” the Scanalyzer takes bioimages that capture the three-dimensional plant architecture, growth rate, leaf characteristics and water and chlorophyll content, as well as pigment concentration and other plant stress responses.

As the global population increases, demand for rice is expected to increase by as much as 35 percent by 2035. U.S. rice production currently represents 12 percent of the global export market.

Rice plants are sensitive to environmental changes. Crop yields may be reduced by 10% or more for every 1 degree Celsius increase in nighttime air temperature.

This powerful technology can analyze nearly 10,000 plant samples at one time and allows the research team to take multiple measurements of the same plants throughout their life cycle. Funding from the National Science Foundation enabled A-State to purchase the system. “A-State is the first public university in the U.S. to own a Scanalyzer HTS. Before us, only large plant biotech companies had access to this technology,” Lorence said.

Since joining A-State in 2005, Lorence has secured more than $11 million in grants from the National Science Foundation (NSF), the National Institutes of Health and the U.S. Department of Agriculture that have helped advance her research program. The NSF recently funded a $6 million collaborative effort of researchers in Arkansas and Missouri called the Plant Imaging Consortium (PIC), which Lorence co-leads. PIC is developing new tools and approaches to study plant stress and will also fund seed grants to allow other scientists to utilize the A-State Scanalyzer HTS and other consortium imaging technologies in their research programs. The new knowledge and infrastructure this program generates will help ensure Arkansas remains a leading agricultural state and will prepare A-State students to address global food security challenges when they enter the workforce.

Mean global surface temperature is expected to increase by 2 to 4 degrees Celsius over the 21st century, critically impacting rice production.

Lorence, a 2015 Arkansas Research Alliance Fellow, received a $75,000 fellowship aimed at retaining Arkansas’ scientific talent and maximizing research commercialization and economic impact.

THE FUTURE IS OURS TO SEE

Astronaut Sally Ride said, “You can’t be what you can’t see,” meaning students need role models who allow them to see all the possibilities for their own futures. Lorence takes seriously her responsibility as a mentor for students and young professionals. From the beginning of her nine-year tenure at A-State, she has trained 10 master’s and doctoral students, 34 undergraduate students and three high school students. Of her 44 university students, 30 were female and 26 were from minorities that are underrepresented in science. Of her 22 publications and more than 200 presentations at scientific meetings, 90 percent include undergraduate co-authors. All of her graduate students have been retained in the scientific workforce, either in industry or academia.

Learn more about Lorence’s research. Scan this QR code to watch a video.

Tanja McKay

Preventing insect infestation of milled rice is crucial to avoiding considerable economic losses from reduced grain quality, treatment costs and lowered consumer food quality.

PLANNING FOR PREVENTION

The 1991 U.S. Clean Air Act and the Montreal Protocol, an international treaty, were enacted to halt thinning of the earth's ozone layer. They required methyl bromide, a common but environmentally destructive pesticide, be phased out of use by 2005. Fumigation with the pesticide has been an important addition to sanitation protocols to aid in preventing pest infestations of rice during post-harvest processing and storage. Since no feasible alternative yet exists for methyl bromide, some industries were allowed a temporary "critical use exemption" to prevent disruption to commercial markets. However, for rice and other grain commodities, methyl bromide was completely eliminated in 2014. A-State researcher Tanja McKay is working to develop effective and economically feasible alternative strategies for integrated pest management (IPM) for rice mills and producers.

McKay, professor of entomology and director of the graduate environmental sciences program, began her current research by monitoring the presence of the lesser grain borer in rice mills. Her team placed and monitored 99 pest traps around the perimeter of a rice mill for three years to learn patterns of activity, flight status and seasonality of insects associated with stored rice. The project yielded valuable knowledge and she and her collaborators from Louisiana State University, Oklahoma State University, Texas A&M University and the USDA Agricultural Research Service presented workshops for rice mills and producers across the nation to help protect this critical commodity. Their work was the first ever to focus on alternative methods of preventing pest infestations in post-harvest rice, despite the fact the U.S. is the fourth-largest rice exporting country, accounting for 12 percent of global rice exports.

"The economics of the global rice industry are very vulnerable to the impact of pest infestations."

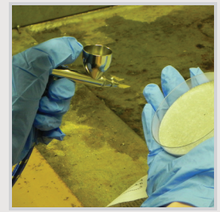
McKay and her team next shifted their focus to the red flour beetle, the primary driver for continued use of methyl bromide fumigation. They expanded pest monitoring to include both the inside and outside perimeter of rice mills and examined beetle development at various stages of processing. "As the rice grain goes through the milling process, each machine does a different function at a different temperature and produces a different byproduct," explained McKay. "Our research will determine the potential for the red flour beetle to impact these byproducts at each stage of processing. This has never been done before."

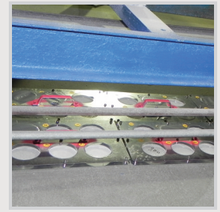
"Our most important outcome is to let the rice industry know about this work and that we are here to help them develop individualized pest management plans."

The research team includes undergraduate and graduate students funded by the U.S. Department of Agriculture. Working in walk-in incubators, they tested beetle growth under conditions that correlate with the milling process. They also examined the use of cyfluthrin, an insecticide used for spot treatments. Beetle mortality was tested on petri dishes containing cyfluthrin and a layer of cement that depicts the floor of a rice mill. The dishes were then placed in the rice mills to determine how long the insecticide remains effective. Rice mill workers were asked to "clean" the cement petri dishes using the same process they use to clean the mill floor. "It really comes down to cleanliness and sanitation," said McKay. "In our current studies we are asking, how does sanitation play a role in the movement of insects in a milling situation and how we can use sanitation plans to prevent pest infestations." Once vulnerable areas for management of the red flour beetle have been identified, infestations can be prevented or managed using a combination of sanitation and targeted insecticide treatments.

Economic analysis of alternative IPM strategies is a key component of the team's research. Rice mills check incoming rice for quality and mill a small sample to determine the price for each load of grain. If there is an insect in the sample, the mill will reject the entire load. There also may be loss of product during milling. "More than 10 percent of grains are destroyed in post-harvest processing," said McKay. "The economics of the global rice industry are very vulnerable to the impact of pest infestations." There are a variety of alternative insect management strategies including heat treatment, fumigation with other insecticides and sanitation that can be implemented. McKay's team is evaluating the differences in economic risks associated with these alternative strategies.

McKay said the most important aspect of her work is to let the rice industry know who they are and that they are here to help them tailor an IPM plan. "We are conducting workshops in Arkansas, California, Louisiana and Texas for mills and producers. We examine each production system and are assessing whether the research is making any changes in the industry. We are available to help develop individualized integrated pest management, sanitation and response plans for each mill."





Rice mill workers collaborate with A-State researchers to determine optimal sanitation techniques for pest control at each phase of the milling process.

Researchers examine rice byproducts from various stages of rice milling: (from left) rice bran, rice flour, broken rice, milled rice dust and rough rice.

IT'S A DIRTY JOB, BUT...

McKay's laboratory is not solely focused on pests that affect post-harvest rice. She and her students were featured on the popular Discovery Channel show, "Dirty Jobs with Mike Rowe" for their research on dung beetles that inhabit Arkansas cow pastures. She also studies insects of medical and veterinary importance.

An enthusiastic mentor, McKay believes learning is most effective when both students and teachers are excited by the science. In the last eight years, she trained more than 200 K – 12 grade teachers to teach forensic entomology by applying research skills to a "real-life" context. She mentors students daily in her laboratory, with 20 undergraduate and 10 graduate students participating in her research in the past decade.

Learn more about McKay's research. Scan this QR code to watch a video.

CREATE @ STATE

A Symposium of Research, Scholarship & Creativity

A-State students from all disciplines participate in the symposium.

Create @ STATE : A Symposium of Research, Scholarship & Creativity *is an annual event dedicated to the celebration of research, scholarship and creativity by students at Arkansas State University. This year a Student Advisory Committee was added, made up of the Student Research Council Executive Committee. These student leaders worked closely with the Faculty Advisory Committee to transform the symposium into a student-led research event.*

The fifth annual **Create @ STATE** on April 7, 2015, marked a transformation of the symposium with significant changes initiated by the student advisory committee. The event added a juried selection process to make acceptance into the program competitive. Printed proceedings gave way to a completely digital format for the proceedings book and archives from past events.

Presentation categories and award structure were reorganized to create a more equitable judging process across all disciplines. A luncheon and plenary session featuring a keynote speaker was added for the first time.

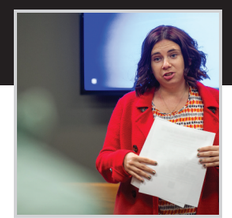
Student leaders emphasized their need for professional development, which led to the choice of Wayne Breitbarth, author of "The Power Formula for LinkedIn Success," as keynote speaker. The plenary session focused on increasing student awareness and knowledge of how students can use online professional networking to advance in their careers, even during their college experience. A photo booth, featuring student photographer, Kayla Macomber, under the direction of Dr. Gabriel Tait of the College of Media and Communication, was a very popular feature throughout the day. The photo booth, sponsored by Phi Kappa Phi, provided professional photos for students to use in professional social media profiles, on sites like LinkedIn and in their online résumés.

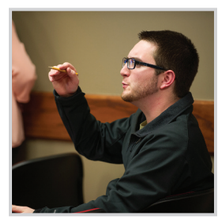
A-State Student Research Council

The A-State Student Research Council (A-State SRC) is a new student-led, registered campus organization with the purpose of encouraging participation of students in research activities across all academic disciplines. The key functions of the council include boosting student leadership and participation in:

- University research symposium and related events
- Professional development initiatives
- Faculty/student mentoring workshops
- A peer-reviewed student research publication
- Activities to broaden participation in research within the university and at regional primary and secondary schools
- Evaluation and assessment of A-State SRC program and initiatives; and
- Design of dynamic communication models and data tracking systems to engage current students and maintain communication after graduation.

The council is formally advised by the A-State Research and Technology Transfer office and governed by a committee of elected undergraduate and graduate student co-chairs and officers, with subcommittees for professional development, special events, communications and fund raising. The council works closely with faculty and staff to develop, strengthen, expand and institutionalize student research on campus. For more information regarding the A-State SRC, please visit *AState.edu/ortt/StudentResearch*.





Students participate enthusiastically in council and sub-committee meetings.

2015 Create @ STATE Awards and Proceedings

The annual research symposium is an opportunity for both undergraduate and graduate students in all disciplines to showcase their accomplishments through poster, oral and creative/artistic presentations. In this year's newly transformed competitive event, there were 133 presentations from which 17 presentations earned first or second place awards.

< 2015 Create@STATE winners received certificates and gift cards

Professional Social Media Networking Initiative

This year A-State launched an initiative to educate and encourage students to establish themselves on professional social networks, such as LinkedIn. Beginning with the first semester of their college experience, this professional digital presence will position A-State students for success in today's workforce and enhance their opportunities to find employment. Enthusiastic support from across the university includes Career Services, Academic Deans Council, First-Year Experience, Leadership Center, Marketing & Communications, Research & Tech Transfer, Alumni Relations and University Advancement.

< Create@STATE keynote speaker and LinkedIn trainer, Wayne Breitbarth

Scan this QR code to access symposium proceedings and a list of winners.

Scan this QR code to access the SRC website and social media.

Andy Sustich

Friends:

What is the MEASURE of the value of a university? Many tell us this value is in how well our students are prepared to begin a meaningful job upon graduation and entering the workforce. As the parent of two college students, I can certainly appreciate this viewpoint and expect that my children will be prepared for tomorrow's job when they graduate. The real value is in how prepared we (students, faculty, staff, community, state, nation and world) are for the lifetime ahead of us and how we ensure this preparation continues for generations to come. The transfer of what's already known can prepare us for tomorrow. But at the heart of a university is the ability to learn today's subject matter, analyze tomorrow's data and context, and create the new knowledge that will define our future.

Within the Research and Technology Transfer office at A-State, we are privileged to see this process of research and creative activity across all areas of the university. Our faculty and students are developing solutions for today's problems, and creating the knowledge base to solve future problems we do not even know today. We are justifiably proud of their efforts and we share their accomplishments at every opportunity.

Our annual MEASURE research publication provides an opportunity for us to bring you some snapshots of the achievements of just a few of our faculty and students. Their stories are repeating many fold across campus and we will continue to bring new ones forward with each year's publication. On behalf of Research & Technology Transfer, along with A-State's artists, researchers and scholars, we extend our deepest appreciation to you. Thank you for taking the time to read this issue and we look forward to sharing the next edition with you.

Best regards,

Andrew T. Sustich

Andrew T. Sustich, Ph.D.
Vice Provost for Research and Graduate Studies

MEASURE

THE RESEARCH PUBLICATION OF ARKANSAS STATE UNIVERSITY

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