AUBURN RESEARCH

FALL 2019

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GATHERING THEIR BEARINGS

AUBURN UNIVERSITY

As a Carnegie R1 research institution, Auburn is among an elite number of schools in the nation with a "very high level of research activity" classification.

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CELEBRATING STUDENT SUCCESS

Annual Auburn Research Student Symposium brings out research talent

By Charles Martin

Nearly 600 Auburn University students with a flair for research and creativity showcased their talents at the annual Auburn Research Student Symposium.

With projects ranging from chemical engineering to plant pathology to architecture and design, the symposium provided Auburn and Auburn Montgomery students an opportunity to share their discoveries university-wide. The daylong event took place in the Student Center.

Undergraduate and graduate students from almost every department participated through posters, oral presentations and creative scholarship displays. Approximately 400 student researchers presented and more than 180 gave 10-minute talks, all under the watchful eyes of judges who selected top honors in a variety of university-wide and college-specific categories.

An awards ceremony and reception were held with keynote speaker Dr. Michael Zabala, assistant professor of mechanical engineering, who earned his bachelor's at Auburn in 2007.

Dr. Steve Taylor, chair of the Research Symposia Committee and associate dean for research in the Samuel Ginn College of Engineering, said, "Our students' innovative research covers many areas, from projects in STEM disciplines [science, technology, engineering and mathematics] to the arts and humanities. They are working with our world-class faculty on life-changing projects that could shape new developments in many fields."

THEY LIKE US—THEY REALLY, REALLY LIKE US.

The 2018 issue of Auburn Research magazine—and the creative team that worked on it—were honored with 2019 AAF Montgomery American Advertising Awards (ADDYS) in three categories: Best of Print, Judge's Choice and a Gold ADDY. This is the magazine's second consecutive year to be recognized in the competition.

PROMISE THE MOON

By Jeremy Henderson

Mike Ogles, director of NASA programs in the Samuel Ginn College of Engineering, can't go a day without hearing it.

"You can't walk the halls of the Marshall Space Flight Center without seeing someone wearing an Auburn logo or hearing a 'War Eagle,'" Ogles said. "A lot of Auburn engineers go to work for NASA. Most of them are up in Huntsville at Marshall."

And on March 26 in Huntsville, just a few months shy of the Giant Leap's 50th anniversary, all of them heard the challenge. Vice President Mike Pence didn't mince words. Forget 2028, he said—America would return to the moon within five years, not nine. It wasn't a prediction. It was an order.

During his speech at the fifth meeting of the National Space Council, Pence urged engineers to double down on "developing the rockets of the future."

"For more than 60 years, Huntsville, Alabama, has built the finest rocket propulsion systems in the world," Pence said. "And we want to ensure it remains that way for the next 60 years."

Enter Auburn University's additive manufacturing program.

In March, the university landed a $5.2 million contract from NASA to help facilitate the space administration's Rapid Analysis and Manufacturing Propulsion Technology project, or RAMPT. The three-year investment is the latest in Auburn's public-private partnership with NASA that established the National Center for Additive Manufacturing Excellence (NCAME) in 2017.

RAMPT is focused on evolving light-weight, large-scale 3-D printing techniques for the development and manufacturing of regeneratively cooled thrust chamber assemblies for the liquid rocket engines necessary not only to return Americans to the moon, but to put the U.S. in the pole position for the race to Mars.

"We believe that when we land on the moon in 2024, our lander will be powered by an additively manufactured engine nozzle designed and developed right here in Alabama," Ogles told NASA brass and congressional staffers in a June meeting.

Thanks to the decisive investments, including the hiring of prominent experts such as NCAME director Dr. Nima Shamsaei and the $18 million renovation of the Gavin Engineering Research Laboratory which now houses NCAME, Auburn has quickly helped turn Alabama into an international hub for additive manufacturing.

The research funding from strategic partnerships with additional additive manufacturing heavy hitters like NIST, NSF, FAA, the U.S. Navy, and ASTM International hasn't hurt, either.

"NCAME currently has over 70 partners," said Shamsaei, Philpott-WestPoint Stevens Distinguished Associate Professor in mechanical engineering and principal investigator for RAMPT. "We're working on high impact advanced manufacturing projects to help the industry and the government in faster adoption of this emerging technology."

Given Pence's new timeline, that's good news for folks in Huntsville.

"In order to meet the vice president's expectations, we need to further develop key technologies such as additive manufacturing, and what NCAME will be doing on the RAMPT project will help us develop the next generation of liquid rocket engines," said Ogles, who also serves as project manager for RAMPT.

But Paul McConnaughey, deputy director of Marshall Space Flight Center, is quick to point out that Auburn's research will improve more than just space travel.

"This partnership with Auburn University and industry will help develop improvements for liquid rocket engines, as well as contribute to commercial opportunities," McConnaughey said. "The technologies developed by this team will be made available widely to the private sector, offering more companies the opportunity to use these advanced manufacturing techniques."

For now, though, the primary objective isn't the private sector — it's the solar system.

"The key to be able to get to the moon and then to Mars is how much payload the rocket can take," Ogles said. "You have to make the engine as light as possible, and with additive manufacturing techniques we can design rocket engines that have higher performance with a lower weight.

"When we look back in five years, we'll be able to say that Auburn played a role in taking us back to the moon and putting us on Mars."

If his recent conversation with NASA Administrator Jim Bridenstine is any indication, others will be saying it, too.

In June, Ogles was representing RAMPT at the NASA Technology Day on the Hill, a fuel nozzle manufactured through direct energy deposition in tow. Bridenstine introduced himself, picked up the nozzle and listened to Ogles' updates on Auburn's research. Then he put the nozzle down and looked at Ogles. "War Eagle," he said.

BRINGING HEALTHY BACK

By Maggie Lawrence

Champions for Health

If you are one of the 60,000 third graders and their parents who graduated from the Body Quest initiative in the past 10 years, you probably know that 4 grams of sugar equals 1 teaspoon. So, when you look at the nutrition facts label on a can of soda and see that it contains 40 grams of sugar, you know one small can holds 10 teaspoons of sugar.

Body Quest is the flagship school-based obesity prevention initiative of the Alabama Cooperative Extension System at Auburn University SNAP-Ed. The goal of the SNAP-Ed grant can be simply stated, but not easily achieved—to increase the likelihood that people, especially those with limited resources, will make healthy choices and ultimately prevent obesity.

"SNAP-Ed is a longstanding federally funded grant through the USDA Food and Nutrition Services," said Dr. Barb Struempler, program leader for Extension Nutrition Programs. "Although SNAP-Ed is a win-win for all Alabama citizens, it is especially impactful for those with limited resources. The statewide infrastructure of Alabama Extension allows SNAP-Ed to deliver multi-level obesity prevention initiatives in all of Alabama's 67 counties. Our classrooms and laboratories are the places where people live, work, play, eat and shop."

Research-based Education

For the Alabama Cooperative Extension System, education is our business. More than 30 SNAP-Ed county educators provide research-based nutrition and physical activity education to youth and adults. For example, Body Quest empowers 6,000 third-graders and their parents each year to make healthier choices.

During the 15-week intervention based on the experiential learning theory, 3rd graders learn through educator-led instruction and self-directed iPad app gaming. An annual statewide impact evaluation consistently finds that third-graders who participate in the program eat significantly more fruits and vegetables, drink significantly fewer sugary beverages and are significantly more physically active compared to before Body Quest and compared to control students who do not participate in Body Quest. Parents make positive changes in obesity prevention behaviors and the home environment. As one Body Quest parent said, "I enjoyed cooking new recipes with my son and learning how to get him to eat more vegetables."

Social Marketing

SNAP-Ed extends beyond schools and into communities. Have you ever been driving down a road in Alabama and noticed the three brightly colored billboards reminding you to "Eat Better," "Move More" or "Choose Water?" These billboards are the face of the SNAP-Ed social marketing initiative, Live Well Alabama.

Struempler, a professor in Auburn's College of Human Sciences, said the billboard campaign follows an evidence-based approach to ensure messages resonate. All messages and artwork are focus group tested. Billboard messages make more than 125 million impressions on Alabamians. Effects are measured with a cross-sectional phone survey. In 2018, respondents exposed to the campaign were more likely to take actions toward better health and reported significantly higher intakes of fruits and vegetables and water compared to those not exposed.

Live Well Alabama marketing efforts also provide health messages digitally to Alabamians in multiple ways every day, including social media, web-based educational content and text messaging.

Policy, Systems and Environmental Changes

SNAP-Ed nudges Alabamians to make healthier choices in many ways each day. In obesity prevention, a "nudge" is a subtle change in an environment or community that makes the healthy choice the easy choice.

In FY18, 33 SNAP-Ed educators fostered 250 improvements in 40 counties reaching 120,000 residents in local parks and trails, grocery and convenience stores, farmers markets, gardens, food banks and pantries, faith communities and schools.

SNAP-Ed educators are champions for health who collaborate with local partners. They use evidence-based strategies to conduct environmental assessments, increase access to healthy food and physical activities and evaluate the reach and impact of changes. For instance, when you visit the local convenience store, you may see healthier food choices available by the cash register such as a container of cut fruit chilling on ice. Perhaps your faith community has a new policy ensuring water is always available as an alternative to sugar-sweetened beverages at gatherings.

Dr. Paul Brown, Alabama Extension associate director, sums it up best. "Alabama Extension SNAP-Ed is uniquely positioned to advance the quality of life in Alabama. This statewide network of passionate nutrition educators is committed to improving communities for Alabamians, focusing on the hardest-to-reach."

Widespread and lasting change is right around the corner. Improving healthy eating and physical activity behaviors of individuals and families and building partnerships to improve the health of communities are among key SNAP-Ed efforts to prevent obesity and make it easier for Alabamians to Live Well.

Join the movement. Follow @LiveWellAlabama on Facebook, Twitter and Pinterest or text "LWA" to 555-888 for weekly texts.

$5.8
MILLION IN 2019 FUNDING

more than 2/3
of Alabamians are obese or overweight

13 COUNTIES
have adult obesity greater than
40%

Alabama is the
6th poorest
STATE IN THE U.S.

GOING TO THE DOGS

Auburn nursing researchers use therapy dogs to assist local dementia patients

By Joelle Trollinger and Amy Weaver

Researchers in the Auburn University School of Nursing found animal-assisted therapy promotes social engagement among adults with dementia or other cognitive impairments.

Assistant Professor Dr. Morgan Yordy and Associate Clinical Professor Dr. Stuart Pope studied the possible benefits with the school's therapy dogs—Miller, Choa and Daisy—at a community respite ministry at Auburn United Methodist Church. Refresh, Encourage, Activities, Care and Hope (REACH), is for persons with early to moderate memory issues.

As the number of older adults rises, so does the prominence of dementia. The Alzheimer's Association reports 5.8 million Americans are currently living with Alzheimer's disease. By 2050, the association projects the number to rise to nearly 14 million.

Health care professionals and caregivers must be prepared to assist this growing and vulnerable population with activities of daily living. Auburn researchers anticipated animal-assisted therapy would be an effective strategy in promoting communication and social engagement.

Yordy, Pope and Dr. Chih-hsuan Wang, an associate professor in Auburn's College of Education, authored a paper recently published in Nurse Educator, a scholarly, peer-reviewed journal for faculty and administrators in schools of nursing and nurse educators in other settings. The trio also published a paper in the Journal of Nursing Education and Practice, an international peer-reviewed and open access journal for nursing specialists.

Auburn's animal-assisted therapy program, CAREing Paws, or Canine Assisting Rehabilitation and Education, is believed to be the only animal-assisted therapy program of its kind in a nursing school setting.

By including the dogs on a clinical site experience, Yordy and Pope observed the engagement between participants with dementia and the animals, as well as student engagement and comfort level when working with such participants and animals together.

They called the project COPE, or Canine Outreach Promoting Engagement, and received funding from a Competitive Outreach Scholarship Grant through Auburn University's Outreach Office of Faculty Engagement.

"Students were significantly more comfortable and more effective in their communication with participants when the animals were included in the community clinical experience," Yordy said. "Patients were more engaged in the presence of animals."

"Individuals who have early dementia, when they participate regularly in a program that focuses on socialization, music therapy, pet therapy, community relationships, typically what we have noticed is that their cognitive decline slows a little bit," added Christine Browdy, REACH director.

Pope created CAREing Paws in 2010, knowing the empirical benefits therapy dogs have on patients. It has also given nursing students the opportunity to learn about the alternative therapy through classroom teaching and clinical experiences.

The stars of the program are Miller, a 7-year-old golden retriever; Choa, an 8-year-old Labrador retriever golden mix; and Daisy, a 2-year-old Goldendoodle.

"Our nursing students learn that the human-animal bond helps patients heal emotionally, socially, mentally and physically," said Pope. "Students leave Auburn with a degree in nursing and also the understanding of what animal-assisted therapy can do in diverse health care settings."

Yordy and Pope began collaborating on animal-assisted therapy research soon after Yordy joined the school's faculty in 2016. However, she has been a part of animal-assisted therapy teams since 2011.

"I have loved working with animals and people, and I knew this was where I wanted to grow my research," said Yordy. "There is little research out there regarding dogs in academics and I would like to further this exploration."

Currently, Yordy and Pope are the only dog handlers at the School of Nursing, but students who complete the animal-assisted therapy course can work with the dogs.

HOT ROD HISTORIAN

Childhood love for classic cars leads to academic pursuit and research passion

By Mitch Emmons

Dr. David Lucsko is known at Auburn University as the chair of the Department of History in the College of Liberal Arts. It is the position he recently rose to since joining its faculty in 2010.

Lucsko is also known for his love of classic cars, particularly the restoration of those would-be forgotten machines of the automotive industry's bygone era—and as the author of two insightful and historically thorough books that explore the growth of the hot rod car sub-culture as a significant segment of automotive Americana.

"As a child, I was always fascinated with cars," Lucsko said. "I liked machines of all types, buildings, too, but my passion was cars, particularly classic cars and relics."

Lucsko spent countless hours playing with toy cars as a young boy and was always sketching cars on the back of his school notebooks. He found himself so absorbed in his passion that by high school Lucsko had decided that he would attend nearby Georgia Tech and become an industrial engineer.

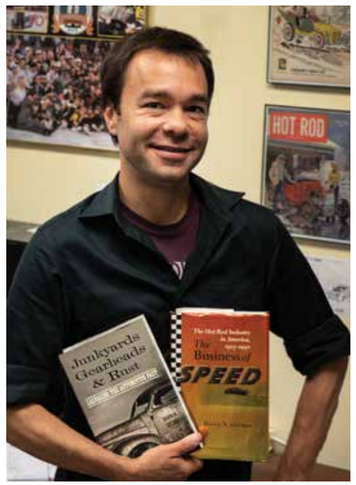
"I just knew that I wanted to be an engineer, so that I could design those cars and machines that I loved so much," he said.

But a decision during his high school senior year changed his thinking and his career path forever.

"I wanted to take a course that offered college credit that I could take with me to Georgia Tech," he said. "That course happened to be one in European History."

What happened next surprised him: "I loved that class," he said.

"I still wanted to be an engineer, but I really loved history," Lucsko said. "I went on to enroll at Georgia Tech, and I still planned to become an engineer and to design cars. But almost as soon as I got there, I learned about a program Tech offered called History, Technology and Society. I went to that office to talk and learn more, and after speaking with the faculty, a light went off in my head—this is what I want to do."



> **"As a child, I was always fascinated with cars."**
>
> *– David Lucsko*

He enrolled and the rest is… history. "I spent only one day as an engineering major," Lucsko quipped.

In that program, Lucsko was able to fuse his passions for automobiles, machines and industrial technology with his love of history.

Lucsko completed his degree at Georgia Tech and decided to pursue graduate school. He attended the Massachusetts Institute of Technology (MIT), where he studied under Dr. Merritt Roe Smith, a widely respected expert in 19th century manufacturing.

Before he enrolled, Lucsko took a year off, reacquainted himself with some of his car-tinkering pals from high school and began to rekindle his love of restoring old Volkswagens. It was during that summer he got the idea to explore the link between auto restoration and hot rodding for a paper proposal.

Lucsko presented it to Smith, half expecting it to be rejected.

"To my surprise, he approved," Lucsko said. "Dr. Smith excitedly interjected that he, too, had long been a fan of hot rod trucks, and he enthusiastically blessed my proposal."

Thus began Lucsko's path to his destiny.

"My paper morphed into my doctoral dissertation, and my dissertation grew into my first book, "The Business of Speed: The Hot Rod Industry in America, 1915-1990."

Lucsko added that as he conducted the research for that book, he began to hear another story which led to his second book, "Junkyards, Gearheads and Rust: Salvaging the Automotive Past."

"The more I researched, the more I learned that automobile restoration, hot rodding and the culture of those individuals who enjoy the hands-on hobby/profession of doing this work have a history dating all the way back to the Ford Model T, and they represent a significant segment of that industry in America and in the rest of the world," Lucsko said.

Lucsko is in the early stages of research on a third book project, which will focus specifically on the automotive restoration hobby.

LAUNCH FUNDS NEXT-LEVEL RESEARCH

By Mitch Emmons and Janet McCoy

LAUNCH is an endowed fund conceived by the Auburn University Research and Economic Development Advisory Board as a mechanism to bridge the gap between innovative research and the marketplace. Milestone-based awards are given to winning teams who complete a competitive process involving a two-stage evaluation of proposals by internal and external parties, followed by a live presentation before judges and the public. The fund was created in 2015 with the goal of creating an endowment of $10 million that will generate some $400,000 annually for research grants. Until this endowment is fully funded, the Office of the Vice President for Research & Economic Development supplies these awards.

Three Auburn research programs recently were recognized as recipients of LAUNCH funding.

'SMILE Plus' moving toward efficient production of novel treatment for drug-resistant cancers

Feng Li, an assistant professor in the Department of Drug Discovery and Development in Auburn University's Harrison School of Pharmacy, is approaching a method for efficiently producing a novel drug formulation found to be effective in treating drug-resistant cancers.

His research project, "SMILE Plus: A Nanoparticle Drug Formulation for Cancer Therapy," is among three projects recently recognized as winners in AU's LAUNCH program. His focus is to develop an efficient manufacturing method based on an existing FDA-approved drug for treating alcoholism that recently was discovered to also have cancer-fighting properties, into a nanoparticle complex that can treat cancers that are resistant to drug therapy. Li is particularly focused on effective drug therapy for fighting prostate cancer that becomes drug resistant over time as the disease progresses among stages.

"Prostate cancer is the most common type of cancer in men," Li said. "About one in 41 will die of prostate cancer, and almost all patients eventually develop drug-resistant prostate cancer. Moreover, there presently is no effective treatment for drug-resistant prostate cancer."

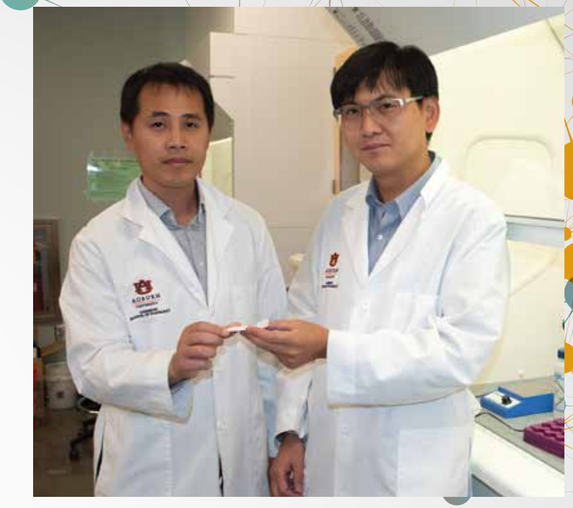
Li adds that a drug presently on the market and commonly used to treat alcoholism has been found to also be effective in treating cancer. The drug, Disulfiram, discovered by accident, has proven to be effective in killing cancer cells.

Li cites a study involving a 38-year-old cancer patient who had reached an advanced stage: "The cancer had spread into the bones," Li said. "This normally is a fatal turn of events. The patient became an alcoholic, and doctors stopped all cancer treatment, instead, giving the patient Disulfiram, to discourage drinking."

The patient survived 10 more years, perishing not of cancer, but in a fall, Li continues. An autopsy surprisingly revealed that the cancer was gone.

"The bone tumors had melted away, and only a few cancer cells were found to be in the bone marrow," Li said.

Further studies on cancer patients taking Disulfiram found that the death rate from cancer dropped 34 percent. Disulfiram also was found to be effective in treating those types of cancers that are prone to become drug resistant as the cancer progresses.



Pictured from the left: Dr. Pengyu Chen and Dr. Feng Li

The problem, however, is that Disulfiram has to be combined into a compound with copper to be most effective as a cancer treatment. No formulation was available for Disulfiram copper combination therapy.

Part of Li's research involves development of a method to manufacture the cancer therapy nanoparticle complex on a large, commercial scale. With the assistance of Pengyu Chen, assistant professor in materials engineering, Li is working not only to perfect the nanoparticle complex as an injectable prostate cancer treatment therapy for clinical use but also to develop an effective large-scale manufacturing technology.

Their development, using 3-D printing manufacturing technology, already has progressed to a patent pending technology. Li says that animal testing is projected to begin this year using the SMILE Plus nanoparticle formulation.

Researchers developing efficient, cost-effective microfluidic production platform

Stem-cell therapy is becoming a common way of treating a variety of medical injuries and conditions. Stem-cell therapy uses cells from the patient's own body to repair and speed up wound healing and tissue regeneration. Although it is proven to be effective, it is not without challenges.

One of the most significant challenges is having an efficient method for delivering these stem cells to the targeted area of treatment. Dr. Elizabeth Lipke, the Mary and John H. Sanders Associate Professor in the Department of Chemical Engineering, is among three winners of Auburn's LAUNCH program. The award recognizes her research and developments in creating engineered biomaterials as hydrogels. These hydrogels are formed using a novel, injectable microfluidic platform that has been found to effectively encapsulate stem cells in a hydrogel microsphere at a much faster rate and at higher cell densities than previously achieved.

Cell-laden microfluidic devices have potential for downstream commercial applications, Lipke explained. However, most current microfluidic systems require costly fabrication facilities and can only produce small microspheres with low cell densities and slow production rates using limited types of materials.

"Our work is developing a faster and more efficient and cost-effective platform," Lipke said. "Our LAUNCH proposal is focused on employing our microsphere production platform to advance high-throughput drug screening. Current drug screening is highly inefficient with most identified compounds failing to provide the desired clinical outcomes. Challenges include the use of 2D cell sheets, which do not reflect the complex cellular microenvironment and do not provide enough cells to carry out desired assays, and self-aggregated cell spheroids, which can be highly variable and are not able to be formed for many cell types, including many metastatic cancer cell lines and patient-derived cancer cells."

Lipke and Yuan Tian, a doctoral candidate in the Department of Chemical Engineering, have done extensive work with colleagues in other colleges at Auburn, particularly the College of Veterinary Medicine.

Lipke and veterinary collaborators have effectively used engineered hydrogels to treat equine distal injuries. Wound healing requires adequate blood flow to the affected area. With horses suffering from distal wounds—the leg region below the knee and hock—this is a challenge, because the distal area is mostly comprised of bone and tendon. There is not much muscle to carry blood to the wound to promote healing. Thus, such wounds are often difficult to heal.

Dr. Elizabeth Lipke

Through this collaboration, the researchers have employed Lipke's engineered hydrogels with great success, and through the LAUNCH initiative, Lipke's research will focus on building a commercial prototype cell encapsulation device; carrying out high-throughput drug screening preliminary studies; use of these microspheres as a bioink for bioprinting; and use of these microspheres to support therapeutic cell delivery.

"The engineered biomaterials are hydrogels that we are developing in our lab," Lipke said. "They protect and hold those stem cells together after injection to ensure that they reach their target and remain intact in order to form the type of regenerative cell desired."

Although this therapy structure is microscopic, the example used simplistically to illustrate its appearance is a gelatin fruit salad. "Think of the fruit as the stem cells and the gelatin as the hydrogel scaffolding that holds them intact," Lipke said.

Lipke's research developments have established a microfluidic platform that is customizable and sustainable, with improved control and flexibility over current methods. These characteristics should prove to be a cost-effective method for commercial application.

Veterinary Medicine faculty recognized for trich research to help cattle industry

A College of Veterinary Medicine faculty research group was one of three Auburn teams recognized by Auburn University for an innovative treatment that could significantly impact the cattle industry in Alabama and worldwide.

The CVM team has created an extended release, novel topical formulation of an approved drug to treat the infectious reproductive disease Trichomoniasis in cattle.

Trichomoniasis, commonly referred to as trich, is a venereal disease in cattle caused by the protozoa organism, Tritrichomonas foetus. This small organism is found only in the reproductive tract of infected bulls which can spread to cows resulting in loss of calves. Infected cattle can lead to major economic losses due to infertility, low pregnancy rates, an extended calving season and diminished calf crops.

College of Veterinary Medicine faculty Drs. Sue Hudson Duran, Julie Gard Schnuelle and Thomas Passler, as well as Soren Rodning, extension veterinarian and associate professor in the Department of Animal Sciences, were recognized. Additionally, Dr. Misty Edmonson, associate state veterinarian, and Dr. Jennifer Koziol, now at Purdue University, and Dr. Larisa Niehaus were involved in the project.

Duran, RPH, MS, PhD, DICVP, is a 44-year faculty member and professor emerita in the Department of Clinical Sciences and an adjunct professor in the Harrison School of Pharmacy. She recently retired but continues to work on contract. Dr. Kelly Joiner and Dr. Jennifer Spencer worked in the lab with Duran and the other team members for seven years including Merck Merial student Larisa Niehaus and graduate student Jennifer Koziol. Previous research included testing 12 different drugs for the most efficacious formulation. The funds will now aid the team to study the combined drugs and extended release formulas on bulls for the right dosages needed for appropriate treatment. Duran was invited as a keynote speaker to China in 2015 at the BIT's 5th Annual World Symposium on Drug Delivery Systems to present her work with extended release polymers as well as several other U.S. programs. This program brought together 350 scientists and researchers in academia and industry for innovative DDS technology. The university has sought a provisional patent on the team's work.

With the U.S. being the largest cattle producer in the world

Photo from the left: Dr. Sue Hudson Duran, Dr. Thomas Passler, Dr. Soren Rodning, Dr. Julie Gard Schnuelle and Dr. Misty Edmonson

(94.3 million annually), and cattle production is an $80 billion industry, the group's findings could have a significant impact to the cattle industry in the U.S. and worldwide as well.

There currently is no effective treatment and in some cases, the disease causes an entire herd, including the bull, to be put down. If one bull is infected with trich, as many as 80-90 percent of cows can be affected, which would destroy a cattle crop. The cost of prize bulls may $250,000, so the loss of this investment can have a devastating impact on a cattle farmer.

This funding will allow faculty to extend clinical trials of the treatment to more diseased animals to determine the efficacy of the research.

This new extended release topical formulation has shown that it will help the drug penetrate the tissues better and faster as well as extend the release of the drug, so it does not have to be applied daily.

POT AND PREGNANT WOMEN

Pharmacy researchers find mom's marijuana use may impair baby's memory

By Amy Weaver

With more and more states legalizing marijuana, use of the illicit drug for any purpose—medicinal or otherwise—is increasing, even in pregnant women.

A 2018 study out of Colorado—where recreational marijuana has been legal since 2014—showed infants exposed to the drug in the womb were 50 percent more likely to have a low birth weight. Another study found the majority of Colorado dispensaries—69 percent—recommended pot as treatment for morning sickness.

When Priyanka Pinky, a doctoral student in Auburn's Harrison School of Pharmacy under the direction of Drs. Vishnu Suppiramaniam and Miranda Reed, heard about a recent report claiming the number of women using marijuana during pregnancy had doubled in the past 15 years, she wondered what other effects it would have on the developing baby.

A medical doctor from Bangladesh, Pinky studied tetrahydrocannabinol, or THC—the active ingredient in marijuana—on rodent models to see what effect there was on the offspring's memory. Pinky is the lead graduate student on the project, and is assisted by Jenna Bloemer, Yifeng Du, Sharay Setti, Ryan Heslin and Warren Smith.

The research team administered THC to pregnant rodent mothers and found that THC could cross the blood placental barrier—meaning it could transfer from the mother's blood to the baby—and subsequently impact the growing fetus.

The team conducted several behavioral experiments and observed the young offspring to be forgetful.

"They could not perform the given task as efficiently as normal offspring of the same age," Pinky explained. "This made us to think 'what is the reason behind this?' We investigated further in the molecular level and we identified the culprit."

The Neural Cell Adhesion Molecule—a protein in the brain—works like an adhesive, maintaining the connection between neurons in the brain's hippocampus, where memories are formed. The adhesive connection facilitates the formation of memory and keeps memory intact.

"We found that this protein is significantly reduced in the brain of the THC-exposed animals," said Pinky. "Since there is reduced adhesion between neurons, memory is impaired."

Why pregnant women?

Suppiramaniam and Reed have extensive experience in prenatal research and expected THC to have deleterious effects on the brains of the offspring.

"This study is timely because marijuana use among pregnant women is increasing," Suppiramaniam said.

Reed said the popularity among pregnant women could be because "everybody's talking about legalizing." To date, 33 states and the District of Columbia have legalized the drug in some form, making it more accessible to the masses.

Whether it's to cope with morning sickness or not, "a lot of people assume it's okay to smoke during pregnancy," she said, especially if they hear a baby was born with no deficiencies.

Suppiramaniam said it's difficult to counteract the culture because the mothers "assume it can't be passed on" to the fetus.

While smoking marijuana is the most prevalent method of consumption, it can also be eaten in edible forms, such as gummy bears and chocolates. Reed said some people—such as pregnant women—likely think an edible form is less harmful than smoking a joint.

It could make sense to these expectant mothers since marijuana reportedly helps cancer patients cope with the side effects of the disease and its treatment.

But medical experts have claimed for decades that smoking cigarettes and drinking alcohol are detrimental to the health and well-being of the baby. How could marijuana be an exception? Experts say it's not.

The American Medical Association states that taking marijuana during pregnancy is dangerous, and the American College of Obstetricians and Gynecologists discourages pregnant women from using marijuana and other substances.

The Auburn researchers certainly agree that the potential threats to a growing fetus are far too high, yet they have more work to do.

Suppiramaniam said they hope to do more extensive research once a multi-year grant from the National Institutes of Health begins this fall.

National attention

Pinky presented the study findings in November 2018 at the Society for Neuroscience annual meeting—the largest conference for neuroscience in the world—and in April during the 2019 Experimental Biology meeting of the American Society for Pharmacology and Experimental Therapeutics annual meeting.

Additionally, articles about the research findings were published in Newsweek, Scientific American, Health News Digest, Neuroscience News, Science Daily, Daily Mail, Metro and others.

SUSTAINING CHANGE

By Joe McAdory

Produce spoils. Chemicals contaminate. Emissions pollute the air. Consumers now understand the potential damage of production and consumption. Today, companies are challenged to be socially and environmentally responsible—while still making a profit. This means managing to the "triple bottom line," a business philosophy that underscores the simultaneous pursuit of economic viability, environmental stewardship and social equity.

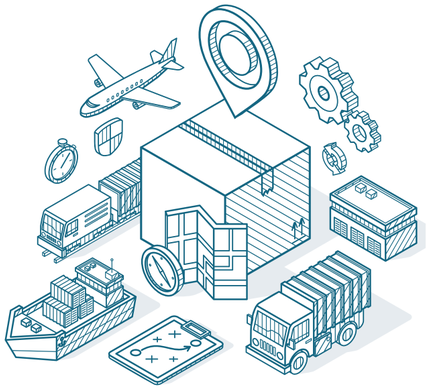
"How do companies leverage their supply chain to do that?" asked Dr. Beth Davis-Sramek, the Gayle Parks Forehand Professor in the Department of Supply Chain Management.

Davis-Sramek's co-authored paper, "Integrating Behavioral Decision Theory and Sustainable Supply Chain Management: Prioritizing Economic, Environmental, and Social Dimensions in Carrier Selection," examines the triple bottom line framework in a transportation context.

"Industry leading companies are challenged to be good citizens and to minimize their environmental footprint—to be more sustainable in their operations and more transparent about their activities," Davis-Sramek said. "The leaders are now pressuring other companies in their supply chain to do the same."

Transportation providers are a significant link in the supply chain. Davis-Sramek explained, "Trucking in particular creates a sizable carbon footprint. The industry also grapples with driver shortages, turnover and a tainted reputation for unsafe driving and accidents."

Companies outsourcing their transportation activities are called "shippers," and third-party transportation companies are the "carriers." In a perfect world, when the price of transportation is equal, shippers should choose more sustainable carriers, but do they? Decisions around sustainability are not well understood, because managing the triple bottom line means making priorities and accepting tradeoffs.



"Overreaching policies intended 'for the good of society' that harm the financial viability of companies will backfire."

– Beth Davis-Sramek

Understanding how decisions are actually made in carrier selection was the goal of the research. Findings point to environmental and social aspects as significant considerations, but the economic viability of the carrier is the biggest determinant of choice. In short, a carrier demonstrating environmental stewardship and social equity will lose the business if its financial health is questionable. Likewise, when a carrier demonstrates strong financials and environmental and social responsibility, it will be significantly more likely to get the shipper's business.

The lesson is this: Companies that invest in sustainability can differentiate themselves in the market—as long as those investments do not stymie their financial viability. "There is a clear message to policymakers as well," Davis-Sramek said. "Overreaching policies intended 'for the good of society' that harm the financial viability of companies will backfire. Market mechanisms are driving investments in sustainability. Companies investing in sustainability will prosper and those ignoring market forces will dwindle."

FACULTY ACHIEVEMENT **HIGHLIGHTS**

Dr. Hanqin Tian has been named a 2019 Andrew Carnegie Fellow and will receive $200,000 to support his research on how Asia, home to more than half of the world's population, can provide enough food for its citizens without detrimental effects on the environment. Tian is the Solon and Martha Dixon Endowed Professor and director of the International Center for Climate and Global Change Research in the School of Forestry and Wildlife Sciences.

Dr. Maria Soledad Peresin, assistant professor of forest biomaterials in the Auburn University School of Forestry and Wildlife Sciences, served as co-chair of the scientific committee for the International Conference on Nanotechnology for Renewable Materials in Chiba, Japan. The annual event draws professionals and students from around the world who are members of the nanotechnology division of the Technical Association of the Pulp and Paper Industry. Peresin specializes in developing novel applications of value added materials from renewable biomass.

Dr. Marcelo A. Kuroda is the recipient of a $536,000 NSF CAREER Award to investigate properties of heterostructures formed with ultrathin materials. Kuroda is an assistant professor in the Department of Physics. With the award, he will analyze complex heterostructures for their weak interactions and devise mechanisms to tailor their physical properties. His group will employ theoretical calculations and large-scale computations that capture both quantum mechanical phenomena and compositional details.

Dr. Lauren Beckingham, assistant professor of civil engineering, has been named a recipient of a National Science Foundation Faculty Early CAREER Development award for her work in environmental engineering. The $315,000 award is designated toward her work, "Quantifying evolution of accessible mineral surface areas and pore connectivity for improved simulation of mineral reaction rates," and it is funded through the NSF's Division of Earth Sciences, Geobiology and Low Temperature Geochemistry.

Two electrical and computer engineering researchers at Auburn University were awarded a patent for their invention of new logic cells for use in next-generation computers. **Dr. Michael C. Hamilton,** professor, and doctoral student **Uday Goteti** developed new logic circuits based on superconducting electronics, instead of the semiconducting silicon platforms used in traditional electronics. Their superconducting logic technology uses nearly lossless circuits that feature lower power dissipation and higher speeds of operation than traditional electronics, as well as other superconducting electronic technologies.

A scientific paper that the Auburn Department of Agricultural Economics and Rural Sociology Alumni Professor **Dr. Valentina Hartarska** co-authored has won the Association for Social Economics' 2019 Warren Samuels Prize. The society presents the award annually to a high-quality scholarly article that is important to the field of social economics and has broad appeal across disciplines. In the winning paper titled "Too Many Cooks Spoil the Broth: The Conflicting Impacts of Subsidies and Deposits on the Cost-Efficiency of Microfinance Institutions," Hartarska and collaborators discuss their study to evaluate the costs and benefits of microfinance subsidization. Their findings suggest that unsubsidized, credit-plus-deposit microfinance institutions constitute the most cost-efficient group, and unsubsidized, credit-only institutions the least.

Department of Theatre Chair **Dr. Chase Bringardner** has been elected as president-elect of the Association for Theatre in Higher Education (ATHE). Bringardner took office in August 2019 at the annual conference in Orlando, Florida, and after serving two years as president-elect will assume the position of president for a duration of two years. Bringardner specializes in the study of popular entertainments such as medicine shows and musical theatre; regional identity construction; and intersections of race, gender and class in popular performance forms.

Dr. Brian Connelly, professor and Luck Eminent Scholar in the Department of Management at the Raymond J. Harbert College of Business, has been appointed incoming editor at the Journal of Management. Connelly began his four-year term, balancing research, teaching and editing duties, as editor-elect in July 2019 and will take over as editor-in-chief on July 1, 2020. The Journal of Management is among the world's most prestigious journals, ranking among the Financial Times' top 50 business school journals.

PUT IT ON ICE

Award-winning research increases food shelf-life, cuts waste

By Paul Hollis

A novel approach to improving food shelf-life during the storage and transportation of raw poultry and seafood has earned Auburn poultry science assistant professor Dr. Amit Morey one of only nine New Innovator in Food and Agriculture Research Awards presented nationally in 2018.

The award, presented by the Foundation for Food and Agriculture Research, provides a total of $2.3 million over three years among the nine award-winning early career faculty members for their research to transform how foods are grown, processed and distributed.

"As a food scientist, I work to find ways to capture the food that is being wasted so we can improve the food security of people in the United States," Morey said. "The main focus of this research project is to devise innovative methods to reduce food waste in the supply chain.

"About 40 percent of the total food produced in the U.S. is wasted at different stages from the farm-to-fork continuum, amounting to 133 billion pounds. And all of this is occurring while people go hungry. Our research is focused on innovative ways to reduce food waste from the processing tep onward."

The foundation is investing in Morey's development of "functional ice," a product for storage and transportation that will increase food safety while reducing waste for the poultry and seafood industries.

Morey's functional ice is colder and melts more slowly than the ice typically used to pack and ship raw seafood and poultry. The ice could be a game-changer for these industries because it uses a slow, sustained release of an antimicrobial solution that works to actively eliminate bacteria.

His research team also will develop a "first-expire-first-out" concept to replace the customary "first-in-first-out" method in food supply chains to help grocery stores reduce food waste.

"This award gives me the funds to conduct the transformative research that is needed for our industry," Morey said. "At the same time, it gives me the opportunity to train undergraduate and graduate students in the area of developing innovative and advanced technologies to reduce food waste."

Also, it allows collaborations between food scientists, agricultural economists and the College of Business, he said.

"It'll strengthen our research moving forward," Morey said. "This research will provide pragmatic and innovative solutions that can improve food security by reducing food waste."

Morey described functional ice as a "very simple and innovative" way to increase both the safety and shelf life of raw foods.

"Functional ice is an innovation over conventional ice," he said. "Regular ice is made simply by freezing water while functional ice is made by adding together certain ingredients and freezing the solution."

It is called functional ice because it potentially will have the properties to serve multiple functions, including actively eliminating spoilage microorganisms and food-borne pathogens, maintaining or improving quality and providing lower cooling temperatures.

"Functional ice is a concept, and in this concept we are testing different solutions," Morey said. "Each solution might have a different effect on the product being tested, so end-users can select which of those effects is most important for them."

Researchers have filed a provisional patent through Auburn University and expect to file a full patent in the future.

"In terms of commercialization, we are in the initial phases of learning how to produce functional ice in commercial ice-making machines, so that could be used directly in processing plants or on fishing docks," Morey said. "Applications would mostly be for poultry and seafood because those are the largest consumers of ice in the industry. But it also could be used in other commodities where ice is used."

Researchers have been able to extend the shelf-life of chicken stored in functional ice by almost two days. They also have seen reductions in pathogens, especially Salmonella, when the chicken is stored in functional ice. Functional ice also has had a positive effect on the quality of meat compared to regular ice.

"We are working with commercial ice production equipment manufacturers, and once those trials are successful, we can launch it at a commercial level," Morey said. "Functional ice is easily adoptable because the ingredients used to make it are commonly known to the food industry and approved by the FDA. We are re-purposing how those chemicals are being used. It is a low-cost solution with potential higher benefits."

Morey's research collaborators include Dr. Joel Cuffey and Dr. Emir Malikov, both assistant professors in the Department of Agricultural Economics and Rural Sociology, and Dr. Shashank Rao, associate professor in the Raymond J. Harbert College of Business.

HUNTSVILLE PARTNERSHIPS PRODUCE PRIZED PROJECTS

by Morgan Martin

The Auburn University Huntsville Research Center (AUHRC) continues to provide north Alabama businesses, industries and government agencies with convenient access to Auburn's research capabilities. By facilitating collaborations between Auburn University researchers and Huntsville government and industry leaders on a number of federal contracts, the AUHRC aims to increase research funding to both Auburn University and the state of Alabama. Additionally, the AUHRC provides local and regional leadership in strategic areas of interest to Auburn by participating in organizations such as the Tennessee Valley Corridor, National Cyber Summit and Cyber Huntsville.

The following are examples of how the AUHRC is accomplishing these goals in 2019.

NASA has awarded a $5.2 million contract to Auburn's National Center for Additive Manufacturing Excellence (NCAME) to develop additive manufacturing processes and techniques for improving the performance of liquid rocket engines. The three-year contract is the latest expansion of a longstanding public-private partnership between Auburn and NASA's Marshall Space Flight Center.

Auburn University continues its partnership with Huntsville City Schools to further education and workforce development in the field of additive manufacturing from high school through graduate-level training. Auburn's collaboration with the district enables high school students and teachers to receive additive manufacturing training from Auburn's National Center for Additive Manufacturing Excellence through research on two machines owned by Jemison High School and Grissom High School.

The Undergraduate and Graduate Student Applied Research Program, an effort from the AUHRC and Samuel Ginn College of Engineering, is enabling Auburn students to gain real-world experience employed as research assistants for defense and aerospace industries and government agencies while still earning their degrees. More than 50 students are currently working for Boeing and Torch Technologies in Huntsville.

This year, the AUHRC initiated the hiring of an additional four full-time research staff members who are subject matter experts in their fields. Jason Cuneo, a Huntsville-based cybersecurity specialist, serves as chief technologist of the Auburn Cyber Research Center and provides subject matter expertise to AUHRC customers. Tim Allen is a senior systems engineer working on the SLS spacecraft at NASA Marshall Space Flight Center. Tara Clayton and Lee Vanrell are both software engineers at the U.S. Army Redstone Test Center.

In addition, the AUHRC is working closely with the Auburn Cyber Research Center and Dr. David Umphress and his students on research in Huntsville at the U.S. Army Space and Missile Defense Command, Redstone Test Center and PEO Missiles and Space.

The AUHRC helped establish the Tennessee Valley Corridor's Additive Manufacturing Collaboration platform, a secure suite of software products that enables government, industry and academia to communicate around advanced manufacturing. Dr. Greg Harris from Auburn's Department of Industrial and Systems Engineering will lead the platform's development.

The AUHRC is facilitating a partnership between the FBI and Auburn's McCrary Institute to collaborate on matters of critical infrastructure. The FBI has recently relocated 1,350 employees to Huntsville's Redstone Arsenal, and the organization is ultimately expected to create nearly 5,000 new jobs as it expands its presence in Huntsville.

The AUHRC is coordinating the installation of a Defense Research and Engineering Network (DREN) connection on Auburn's campus. The DREN is a high-speed national computer network that is the Department of Defense's recognized research and engineering system. The DREN will allow Auburn faculty and students to participate in Department of Defense-related research, exercises and demonstrations.

JUMPING JACK GENE

By George Littleton

Dr. Mike Roberts, an associate professor in the College of Education, directs the Molecular and Applied Sciences Laboratory in the School of Kinesiology. While much of Roberts' early career examined the physiological effects of dietary protein and nutritional supplements, he has become increasingly engaged in studying the relationship between muscle physiology and genetics. More specifically, his laboratory has been researching the LINE-1 (or Long Interspersed Nuclear Element-1) gene. Increases in LINE-1 activity have been linked to certain cancers; however, Roberts has focused on examining LINE-1 activity in skeletal muscle. Muscle cancers are exceedingly rare given that muscle cells are not constantly dividing like cells in other cancer-prone tissues. A few researchers have noted that LINE-1 activity in skeletal muscle increases with aging, and Roberts' laboratory recently replicated these findings in both rats and humans. Currently, Roberts is seeking to determine if exercise interventions can reduce skeletal muscle LINE-1 activity and, if so, determine what this means in regard to maintaining healthy muscle with aging.

"The human genome encodes more than 20,000 genes," Roberts explained, "and there are typically two copies of each gene: one from the mother, and one from the father. LINE-1 is what's called a repetitive element in that there are over 500,000 copies of it in the human genome. What's also fascinating is that this gene is a type of transposable element, or 'jumping gene,' termed a retrotransposon."

'Jumping genes' have been known to exist since the 1950s when Barbara McClintock published her research on the contribution of transposable elements to corn kernel coloration. Though her discovery was at the time largely ignored, she was later awarded the Nobel Prize in Medicine for this discovery. Traditional transposable elements, like the ones McClintock discovered, physically remove themselves from one genomic region and re-insert themselves into a different genomic region. LINE-1 elements, on the other hand, are retrotransposons. A LINE-1 element can essentially make a copy of itself and insert the copy into a completely separate genomic region while leaving its original element in place.

"What's interesting about LINE-1 elements is that many of them can be transcriptionally-active, or turned on," Roberts said. "Once activated it can encode two proteins which then dock to the mRNA and chaperone it back to the genome where it nicks a random site on DNA to reverse transcribe a new copy into the genome. In non-muscle cells, this can result in catastrophe in the form of irreversible mutations. Muscle cells are unique, however, given that they have multiple nuclei. So we're trying to sort through how age-related increases in LINE-1 may be contributing to muscle aging."

A 2013 research paper by John Sedivy's laboratory at Brown University demonstrated that skeletal muscle LINE-1 activity increased in older mice.

"This really grabbed our attention," Roberts said. "Our immediate questions became whether or not this occurs in humans as well, and is it possible that this contributes to age-related muscle degeneration?"

Since 2015, Roberts' doctoral students Matt Romero, Petey Mumford, Paul Roberson and Shelby Osburn have all performed elegant experiments to show that older rats and humans do indeed express more skeletal muscle LINE-1 mRNA.

Precisely how increased LINE-1 mRNA contributes to muscle degeneration, however, is complex, and Roberts' laboratory is currently trying to tackle that question. Roberts has formed collaborations with some of the country's most renowned geneticists, including Dr. Jef Boeke, who is a member of the National Academy of Sciences and Director of the Institute for Systems Genetics at New York University Langone Health. Roberts and Romero have also collaborated with Dr. John McCarthy of the University of Kentucky Medical School. Boeke provided McCarthy's laboratory with transgenic mice, which harbor a special type of LINE-1 in their genome. McCarthy then bred these mice with another set of mice which generated offspring that only express high levels of the LINE-1 gene when given a special chemical in drinking water. Roberts has been receiving tissue from these mice to examine features of LINE-1 activity as well as muscle aging.

"Assuming this mouse model works, it will allow us to determine whether elevating LINE-1 mRNA levels in muscle directly causes muscle degeneration. If this holds true, then we believe that we've identified a chief genetic cause of muscle aging."

While this may seem like a bleak reality of the aging process, Roberts believes his laboratory's most exciting finding is that exercise reduces markers of skeletal muscle LINE-1 activity.

"We've seen that, whether you're a younger or older human or rat, exercise—both weight training and endurance—decreases the expression of LINE-1 in skeletal muscle."

Roberts' laboratory plans on performing lifespan exercise training in rodents to determine if these patterns hold up, and then hopes to replicate the rodent findings to larger and more involved exercise interventions in humans. This research will take between five and 10 years to arrive at definitive answers. Roberts states that none of the past research endeavors or future aspirations could have been or will be possible without the talent and dedication of his doctoral students.

"Matt Romero, who recently defended his dissertation and began a post-doc internship at UCLA, has really been leading this research in my laboratory," Roberts said. "Matt came to Auburn from New Mexico State University, and he is uniquely situated for this type of research. He has a background in both physiology and genetics."

"Bringing these two fields together has obvious benefits when we are studying how these jumping genes affect skeletal muscle," Romero said. "In our work, we will obviously need to employ many different models. The rat studies are tremendously helpful because rats live, eat and exercise in a controlled environment. With humans, we know what their exercise habits are when they are with us, but we don't know what they do when they leave the laboratory."

With regard to his Auburn laboratory experience, Romero appreciates the opportunity to forge new paths in the world of research.

"No one else is doing anything exactly like this, and it's been great to tie my two fields together. Dr. Roberts has been a wonderful mentor, very enthusiastic and supportive. He has really allowed me to find my own niche, and I'm very proud of the work we have done in this laboratory."

As Romero moves on to begin his UCLA fellowship, he is handing off lead research duties to doctoral student Shelby Osburn, who has been in Roberts' laboratory since she was an undergraduate student.

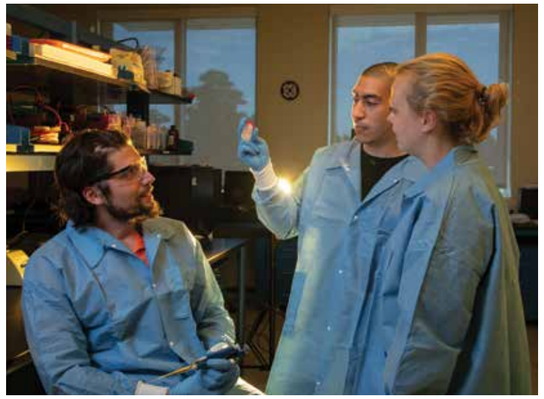
"My work here has opened up so many doors for me, and Dr. Roberts and Matt have both taught me so much," Osburn said. "Research will always be a major part of whatever I do in my future."

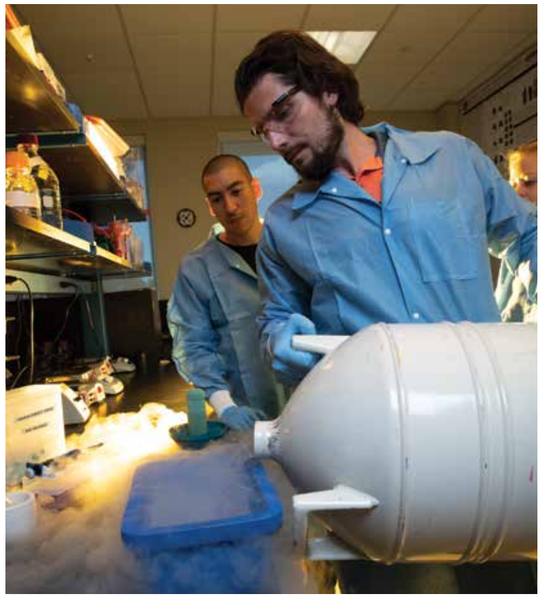
Similar to Romero's perspective, Osburn said her experiences in the laboratory have been transformative.

"We think LINE-1 damages skeletal muscle, but we do not yet know to what extent, or exactly how exercise mitigates that damage," she said. "Answering these questions will be our next big conquest."

Roberts' laboratory continues to be on the cutting edge of exercise genetics, and his group has been the first in the world to demonstrate that exercise reduces the activity of what he deems a harmful genetic parasite.

"If we continue to confirm this hypothesis with our upcoming experiments, then this will provide yet another example that reinforces the current-day adage that 'exercise is medicine,'" Roberts concluded. "While we are proud of our work thus far, the broader theme here is performing high-end research at Auburn University, which will ultimately improve the quality of life for humans."





Exploring and Protecting the lives of BLACK BEARS

by Teri Greene

Auburn researchers have settled deep in the woods to pursue a multi-year project focused on what may be Alabama's most elusive and enigmatic segment of fauna—the black bear. The state is home to one of the smallest and most fragmented black bear populations in North America.

In March, the project, led by Dr. Todd Steury, associate professor of wildlife ecology in the School of Forestry and Wildlife Sciences at Auburn University, received a $1.1 million grant from the Alabama Department of Conservation and Natural Resources, or ACDNR. The grant allows the team to extend its previous research into an extensive five-year examination of the bears' denning behavior and how it impacts reproduction and cub survival.

Steury said the grant will aid the ongoing research in three critical ways.

"We want to understand, first, what proportion of cubs make it to adulthood, and what the cause of death is for the ones that don't. Secondly, we want to find out where the females den for giving birth, and the quality of those dens. Finally, we want to see where the cubs that make it to adulthood disperse to and whether they are able to become part of the breeding population," Steury said.

"These questions are a priority, because anecdotal evidence from our own field research suggests that many of the cubs that are born are not surviving to adulthood," Steury said. "Thus, we need to determine if that's actually true and if so, why."

How many bears, and where?

The denning study builds on earlier research, also primarily funded by ADCNR, which focused on the locations and numbers of adult bears, as well as their movements, habitat use and genetic makeup.

In November 2018, Steury's team published its findings in the journal PLOS One. That portion of the study showed a growing bear population in northeast Alabama and a distinct genetic group in the Mobile area. The article, "Genetic health and population monitoring of two small black bear populations in Alabama, with a regional perspective of genetic diversity and exchange," was co-authored by Steury and graduate students Christopher Seals and John Draper.

An earlier phase of the study had pinpointed the locations of these two groups: an estimated 30 bears were centered in Little River Canyon and Fort Payne, and an estimated 85 bears—possibly as many as 165—resided in Mobile and Washington Counties, north of Mobile.

The research published in the fall showed the north Alabama bear population, which originally migrated from north Georgia, had more than doubled in the previous four years; team members observed that those mother bears often have three or four cubs in a litter, far higher than the typical litter of one or two. Researchers also noted that the bears north of Mobile, which have a high level of inbreeding, comprise their own distinct group, with no genetic connection to other bear populations. Steury said the south Alabama bears have the lowest genetic diversity of any comparison population in the Southeast.

For that phase, researchers collected more than 1,000 bear DNA samples from hair left on more than 300 snares placed in habitats and bear scat retrieved using Auburn's EcoDogs program. Groups throughout the state, including Munford High School students, the National Park Service and the Birmingham Zoo, helped collect data.

The team tracked bears using game cameras and equipped 20 bears in the two populations with radio collars. The collars allowed researchers to receive location information via the internet—every hour for a year—with locations superimposed over Google Earth map images so individual bears could be mapped.

That remarkable accumulation of data collected in the fall opened up the opportunity to get a closer view into the bears' lives as they progressed.

Dropping in on the den

Chuck Sykes, director of the Wildlife and Freshwater Fisheries Division at the ADCNR, said the denning portion of the study will yield significant information.

"Given the relatively small size of the population and its isolation from other bear populations, what happens to young bears when they disperse from the mother is of particular concern," Sykes said of the Alabama bears.

He said observation suggests that the black bears in the southern part of the state may lack appropriate denning habitats, and many young bears become lost before they recruit into the population, which may cause stagnant population growth.

Steury said examining the dwellings of bears in south Alabama, where the land precludes typical den-building, is key.

"Bears usually den in caves, under rock outcroppings, and in hollowed-out trees. The Mobile area doesn't really have caves or rock outcroppings, and the old, hollow cypress trees have long since been chopped down," he said. "Consequently, most of our Mobile bears seem to just build nests on the ground – hollowed out depressions, lined with vegetation. We're concerned that these nests don't offer good protection from predators and the elements for cubs, and hence may result in poor cub survival."

Steury's team has visited a number of Alabama bear dens, taking measurements of den characteristics in addition to fitting cubs with expandable radio-telemetry collars.

When the cubs are 2-years-old — the age in which they typically disperse from their mothers — the team will equip the young bears with GPS-enabled radio-telemetry collars to track their dispersal patterns and determine whether they recruit into the population.

The research on bear denning, reproduction and cub survival, dispersal and recruitment will continue through 2023.

This work is vital to ensure the protection of the state's bears, said Janaki Alavalapati, dean of the School of Forestry and Wildlife Sciences.

"Dr. Steury's research on the declining population of black bears in Alabama will yield information that is critical to preserving the species in the state," said Alavalapati. "This study will lead to efforts to protect the bears and ensure that they thrive."

Staying bear aware

In some parts of the United States, bears are a game species. But in Alabama, where the bear populations are dangerously low, there is no bear season. It is illegal to kill a bear in the state.

Steury said it's important to discourage bears from roaming into populated areas by taking measures such as not feeding them and not leaving trash or pet food outside. If you see a bear, he said, it's important to contact a local conservation officer of the ADCNR.

A sudden bear encounter requires quick thinking and some basic knowledge.

If you encounter a black bear, you should stay calm, make yourself big and loud, and back away slowly, Steury said. "A black bear will almost always run away, but if you are attacked, you should fight back."

"Dr. Steury's research on the declining population of black bears in Alabama will yield information that is critical to preserving the species in the state. This study will lead to efforts to protect the bears and ensure that they thrive."

- Dean Janaki Alavalapati

SAVING SOUTHERN PINES

Auburn forestry research helps lead to new product to reduce Southern pine seedling mortality

by Charles Martin

Auburn University research has helped lead to a new product to reduce Southern pine seedling mortality for the forestry industry.

"This is a major accomplishment that will allow forest tree nurseries to store their seedlings for longer time periods without detrimentally affecting the seedlings' survival," said Dr. Ryan Nadel, assistant research professor with Auburn's School of Forestry and Wildlife Sciences.

The product from AgroFresh, trademarked as LandSpring™, recently received EPA approval to include conifer seedlings after three years of testing by the Southern Forest Nursery Management Cooperative at Auburn.

The U.S. produces more than 1.2 billion forest tree seedlings for reforestation annually, with more than one billion produced in the Southeast. The majority of seedlings are conifers, produced as bareroot seedlings and grown in a similar manner to farming regular agricultural crops.

Seedlings are typically grown in native soil within open fields for about a year before they are removed from the soil during harvesting, or what is called lifting. They may be planted in areas that have been recently harvested or into fields, converting land back into forests.

Auburn research has shown the use of LandSpring increased the survival rate by 10 percent, which would potentially yield the growth of an additional 1.2 million pine seedlings after outplanting—the process of lifting, packing, storing and replanting—as compared to non-treated seedlings.

"Outplanting is stressful for seedlings, and storing forest tree seedlings is a foremost challenge for forest nursery managers due to the short time frame between lifting and planting," Nadel said.

Lifting usually occurs between late November and late February, the optimum time period to avoid increased mold and decay of the seedlings and decreased survival once replanted. The seedlings are packed in boxes, bags or bundles and placed in cold storage for two to three weeks before being shipped to the field where they are replanted in areas prepared for reforestation throughout the Southeast.

"Weather conditions are not always optimal for planting the seedlings once harvested from the nursery, requiring seedlings to be stored for longer periods than recommended," Nadel said.

The Auburn University Southern Forest Nursery Management Cooperative is a regional multisector member organization that serves to develop technologies for the economical production and utilization of forest tree seedlings in the southern U.S.

The U.S. produces more than

1.2 BILLION

FOREST TREE SEEDLINGS ANNUALLY

Dr. Ryan Nadel and Dr. Scott Enebak measure the growth of pine seedlings at the Southern Forest Nursery Management Cooperative.

TO INFINITY AND BEYOND

By Maria Gebhardt

Orbiting our planet, a miniaturized satellite collected data for research. Although this tiny satellite, known as a CubeSat, is just a four-inch cube (dubbed 1U, or unit), the story of the team behind this project has come full circle, empowering graduates to find careers with skills they directly learned conducting research at Auburn University.

Dr. Jean Marie Wersinger, emeritis professor in the Department of Physics in the College of Sciences and Mathematics (COSAM), created the initial Auburn University Student Space Program as a workforce development initiative that would train students in what he saw as a newly developing paradigm in space access and use. This led to the first CubeSat created by the program, named AubieSat-1.

On Oct. 27, 2011, AubieSat-1 launched into space from Vandenberg Air Force Base in California. This was the first student-built satellite in the state of Alabama to be accepted by NASA for an official launch. The results from AubieSat-1 provided data on various forms of solar cell protection materials. The information showed the two sides of the CubeSat covered with a plastic encapsulate substantially extended the lifetime of the solar cells.

"AubieSat-1 provided essential research data that 50 percent of the efficiency of the solar cells was completely lost in just two months without having this coating," said Dr. Wersinger.

Since the inception of the program, more than 1,000 students from across Auburn University have actively participated.

"Knowing what it takes to build a satellite helped me land an internship at SpaceX after my senior year and was instrumental in my getting fully funded to enter a Ph.D. program that aligned with my interests," explained Sanny Omar, an AubieSat-1 team member, '15 aerospace engineering and alumnus of the Honors College.

Launching a new partnership, satellite and careers

Auburn University has an exciting new CubeSat project underway, involving more than 30 students per semester, which will launch in 2021. Two, six-unit CubeSats are being designed and built to study the emission of high-energy gamma-rays produced by tropical storms on Earth. This new project is possible with funding through a National Science Foundation (NSF) grant of $893,873, and is a partnership among Auburn University, NSF, University of Alabama at Huntsville and NASA's Goddard Space Flight Center.

It also brought a new name to the program, the Auburn University Small Satellite Program, and a new faculty mentor, Dr. Michael Fogle, associate professor in the Department of Physics in COSAM. The goal of the program is to continue workforce development but also use the developed expertise in the program to utilize the now mature CubeSat platform for new science and technology initiatives.

"CubeSats have recently gone to Mars and will continue to be more efficient options to large-scale satellites in many cases," said Fogle. "Since it is too costly to launch all missions on a large-scale, CubeSat programs provide an opportunity for a significantly lower expense while retaining some of the same capability. This disruptive technology is changing the slope of advancement in science, and students at Auburn University are experiencing it first-hand."

To learn more, visit aub.ie/ssp.

FIGHTING FOR A CURE

Milestone marked as the first patient with GM1 gangliosidosis treated with gene therapy

By Janet McCoy

The first clinical trial of a gene therapy treatment created through a research alliance between Auburn University and the University of Massachusetts has been administered in a child at the National Institutes of Health (NIH) in Bethesda, Maryland.

The NIH clinical trial is a significant milestone for GM1 gangliosidosis, a deadly disease with no approved treatment. The clinical trial treatment was originated and created at Auburn University's College of Veterinary Medicine, where scientists for several decades have researched treatments to improve and extend the lives of cats affected by GM1 gangliosidosis.

The research alliance team of Dr. Doug Martin, professor in the Department of Anatomy, Physiology and Pharmacology in Auburn's College of Veterinary Medicine and the Scott-Ritchey Research Center, along with University of Massachusetts Medical School researchers Drs. Miguel Sena-Esteves and Heather Gray-Edwards, have worked collaboratively for nearly 19 years, combining animal and human medicine studies to cure rare diseases that affect both animals and humans.

In December 2018, the gene therapy product was licensed to Axovant Gene Therapies Ltd. (Nasdaq: AXGT), a clinical-stage company developing innovative gene therapies.

The first patient received the investigational gene therapy treatment of AXO-AAV-GM1 (also known as AAV9-GLB1), at the NIH by Dr. Cynthia Tifft, deputy clinical director at the National Human Genome Research Institute and a leading expert in ganglioside storage disorders.

To date, the 10-year-old patient has experienced no complications related to the intravenous administration of the vector and continues to be monitored by physicians. The NIH has released the protocol to treat additional children under the clinical trial.

"GM1 gangliosidosis is a devastating disease in young children, for which there are no currently approved treatment options. The development of a safe and effective gene therapy for these patients would be a welcome advancement in the field of pediatric lysosomal storage disorders affecting the brain," Tifft said.

"Treating the first GM1 patient with gene therapy is a huge milestone resulting from a long collaboration among Auburn, the NIH and University of Massachusetts Medical School," Martin said. "Seeing all of the effort come together to help patients who have no treatment options today gives me a lot of hope."

Martin was at the NIH to watch the child receive the treatment. "The treatment is a testament to one parent's refusal to give up, but speaks to the thousands of family members who have searched for a cure for this disease. The families have been the motivation of our research."

He said being at the NIH to watch the treatment was a pinnacle moment in his life, professionally and personally. "This treatment is extremely promising because it has worked well in GM1 mice and cats, and it is delivered by a single IV injection that takes less than an hour. We're hopeful that the treatment makes a real difference for patients and their families.

"As the trial progresses and more patients are treated, we'll have a good idea of whether the gene therapy helps children as much as it has helped the animals. This is certainly what we're hoping for."

For Opelika, Alabama, residents Sara and Michael Heatherly, whose son Porter was the first known case of GM1 in Alabama and died in 2016, the knowledge of a treatment is one of mixed emotions.

"We are excited to know there is hope for the future of children diagnosed with GM1," Michael Heatherly said. "We are thankful for everyone who has dedicated their time, resources and careers to move this treatment forward and to Axovant for bringing all of their work to life and making it a reality for GM1 patients."

The Heatherlys spoke at an Auburn GM1 conference in March with other families who have loved ones affected by the disease, remembering the "horrifying" diagnosis in 2012. "But we found out about the research at Auburn, and it gave us hope," Michael Heatherly said.

"As Auburn graduates, Sara and I were always a part of the Auburn Family, but through this research, we've developed an even greater family within the College of Veterinary Medicine community.

"We understood early on the research would not help Porter, but we wanted to help spread the word of the research and the progress that was being made." The Heatherlys gave Auburn researchers a reason to hope, and work harder for a cure. To honor the family, which held fundraisers for several years to support the research, the Scott-Ritchey Research Center incorporated Porter's likeness in a creative identity for the center.

Auburn graduate Cassie Bebout also has a personal connection to the research at Auburn, where she worked in Martin's lab. When she was 6 years old, her 9-year-old brother Jake died from GM1. The molecular biology major devoted her college career to helping find a possible cure for the disease. Bebout is now in the M.D./Ph.D. combined degree program at West Virginia University.

About GM1

GM1 gangliosidosis is a progressive and fatal pediatric lysosomal storage disorder caused by mutations in the GLB1 gene leading to impaired production of the beta-galactosidase enzyme. There are currently no approved treatments for GM1 gangliosidosis.

About AXO-AAV-GM1

AXO-AAV-GM1 delivers a functional copy of the GLB1 gene via an adeno-associated viral (AAV) vector, with the goal of restoring ß-galactosidase enzyme activity for the treatment of GM1 gangliosidosis. The gene therapy is delivered intravenously, which has the potential to broadly transduce the central nervous system and treat peripheral manifestations of the disease as well. Preclinical studies in murine and a naturally-occurring feline model of GM1 gangliosidosis have supported AXO-AAV-GM1's ability to improve ß-galactosidase enzyme activity, reduce GM1 ganglioside accumulation, improve neuromuscular function and extend survival.

"Treating the first GM1 patient with gene therapy is a huge milestone resulting from a long collaboration among Auburn, the NIH and University of Massachusetts Medical School. Seeing all of the effort come together to help patients who have no treatment options today gives me a lot of hope."

– Dr. Doug Martin

From the Classroom to the Catwalk

Auburn's annual Fashion Event celebrates exceptional design work of apparel students

By Charlotte Tuggle

Auburn's premier fashion showcase featured the best of apparel design, visual merchandising and interior design. The annual spring event was hosted by the College of Human Sciences' Department of Consumer and Design Sciences, the Apparel Merchandising and Design Association and co-sponsored by the Mint Julep Boutique.

The theme was Avant Garden—an ambitious idea that pushed the boundaries of design through the use of material and shape to challenge traditionally feminine ideas of florals by incorporating industrial elements. When Auburn apparel students created the Avant Garden, they encouraged guests to open their eyes to the future of fashion.

Consumer and Design Sciences Department Head Dr. Pamela Ulrich said she was pleased with the reaction to another successful, student-produced Fashion Event.

"We had a great team of directors, the show was well-organized and our crowd was happy with the students' work," Ulrich said. "It's important that for every show, we sit down and talk about how to improve every year and how to capitalize on our successes."

On the Beard-Eaves-Memorial Coliseum floor, e-portfolios and apparel merchandising vignettes displayed work by outstanding Auburn students. Apparel merchandising students Janneke Cobb, Mecca Hodge, Jessica Spain and Walton Stivender crafted a vignette for the Mint Julep Boutique, Fashion Event co-sponsor and local retailer in the Auburn area.

"This experience has shown me another side of fashion and apparel, something I never even considered doing," Hodge said. "And this was fun—their clothing selection is very on trend, but it's not so fashionable in the way that it'd be exclusive. It allowed us to be more unique with our vignette."

For the seventh year, DJ CoCo provided music for the event. Andrew Thorp, as he's called when he's not behind music decks, has mixed the music for runway shows in London, Paris, New York and Milan, among other high-profile events.

"It's important to do this because the students that are graduating from here are the ones that are going to go on to work for the big designers, so I'm going to see them around," Thorp said. "I think it's cool that they're doing the show because they really love fashion, and I like being a part of that."

On the runway, the show began with a variety of independent pieces, followed by those carefully crafted in the Avant Garden theme and collections from the capstone course. Capstone is a senior-level design course, where teams work together to develop a line for an existing brand's untapped market.

The Capstone collections included a Mommy and Me line, wedding wear, a wearable art concept, a collection inspired by philanthropic work and a line featuring lingerie. Anne Landau—a junior in the apparel design program whose academic achievement placed her in the senior-level course—worked on the Bella Donna for Ellie Saab lingerie collection.

"Backstage, we were just cheering for each model as she walked down the

runway. We were overwhelmed with excitement," Landau said. "As an aspiring designer, this gives me something to look forward to in the future. I know this is a student-run show, but it really gave me a glimpse into Fashion Week."

At the end of the show, a special guest was invited on stage. Thanks to Make-A-Wish Alabama, a little girl whose wish it is to be a fashion designer walked on the runway in a pink, princess-style ball gown, provided by Gabrielle's. Auburn's mascot Aubie the Tiger then surprised her by appearing with a bouquet of flowers to top off the experience.

The Fashion Event is a completely student-run production. From choosing a theme to coordinating the runway show, students in the Fashion Event Planning course are tasked with making the night one to remember. This year, apparel merchandising junior Gina Maddaloni and senior Olivia Frazier led the planning team as co-chairs.

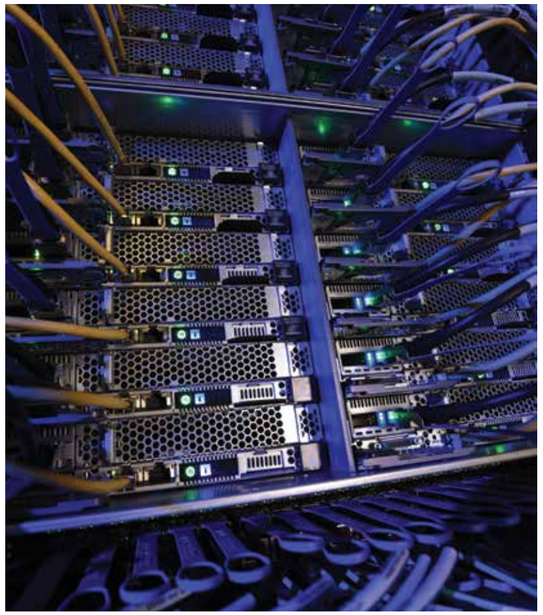
"This experience is invaluable. I think that I'm a more eligible and competitive candidate going into the retail field because of this program," Maddaloni said. "All the stress, the loss of sleep, the frustrations and anxieties, they don't mean anything right now. I feel so rewarded, so proud and grateful, that I had a great team that executed a fantastic show."

And for students who want to lead Auburn's annual night of fashion excellence, Frazier advises them to embrace big ideas, push for what they believe in and work hard to make the dream a reality.

THE NEW SUPERHEROES OF SUPERCOMPUTERS

Auburn's supercomputer user base and demands bring need for third system expansion

By Kittye Parker and Mitch Emmons



New discoveries often spawn new questions, which in turn increase the complexities and challenges for modern researchers. To tackle the size and intricacy of these new problems, Auburn is empowering faculty and students with state-of-the-art supercomputers from which they can observe new findings that are otherwise impossible to see.

In previous Auburn research efforts, scientific computing was treated as an ad-hoc effort, with each researcher or lab often maintaining and administering their own purpose-built machines as needed. This practice, however, carries with it the implicit overhead of making sure these complex systems are functioning properly and efficiently and are managed securely; ultimately, it takes time and effort away from the lab's primary focus. In an effort to reduce these complexities, and support the research community, Auburn's Office of Information Technology (OIT) has recently made breakthroughs in the university's centrally maintained high performance computational offerings and research computing support.

Auburn University unveiled its first centrally operated supercomputing system as a research enhancement tool and service in 2013. Now, in just six years' time, OIT is preparing to launch its third generation of this high-performance Goliath.

"We started with the CASIC machine—located in Auburn's Research Park, in the building with the same name," said Bradley Morgan, OIT infrastructure architect. "At that time, we had fewer than 50 researchers using the supercomputer."

Use grew rapidly, however, as researchers learned of CASIC's capabilities and the corresponding support provided by OIT's team of high performance computing (HPC) specialists. Within less than three years, the CASIC system had seen a major increase in demand, and it was complemented by a new $1 million supercomputer —HOPPER—named in honor of the late Rear Admiral Grace Hopper, who was a pioneer of computing technology. HOPPER is housed in Auburn's primary data center, which is located in the lower level of the OIT building on the south side of campus.

"HOPPER, along with our team of system administrators, now supports over 500 users working on a variety of projects across the majority of colleges and schools," Morgan added.

One such user, Dr. Evangelos Miliordos, speaks to the importance of using high performance computing to create better balance in his workload as an assistant professor. His innovative research with quantum chemistry has been underway since he joined Auburn in 2016, and its goal is to "disclose new chemical systems which can facilitate the conversion of inert hydrocarbons, such as methane, to functional platform chemicals, which can further be processed to make goods we use on a daily basis." Since joining the university, he had to find a balance among teaching, advising and researching. In addition to the computational power, Miliordos shared an appreciation for "researchers like me who have the time and energy to put their efforts in doing research and being productive. I am certainly grateful to HPC, and the human power behind the HPC initiative, for the most productive years of my career so far." He goes on to share his belief that "this facility is a great asset for our university, and I had no hesitation in investing and participating in the HPC initiative."

In response to such growing interest in high performance computing, Auburn has plans to build a third supercomputing system by 2020, Morgan said.

This new supercomputer cluster will make available to Auburn researchers the next generation of high performance computing nodes—a series of individual fast-operating computers tied together into a cohesive system that computes with lightning speed. Auburn's third generation system will have nodes with up to four times the processing power of HOPPER, which is already powerful with more than 16 terabytes of memory and 1.4 petabytes of disk space. To put this into context: consider the fact that a Blu-ray disc, which can hold three hours' worth of high definition movie and bonus material, is 50 gigabytes. It takes 1,000 gigabytes to equal a terabyte, and it takes 1,000 terabytes to equal a petabyte. That means 1.4 petabytes could store 28,000 Blu-ray discs!

To effectively process the large data sets that reside within this storage capacity, HOPPER and CASIC can crank out a combined 270 trillion FLOPs, or floating point operations, per second. A FLOP is basically a mathematical operation involving small or large real numbers. To match what happens in one second on these machines, a human would need to perform one calculation every second for over eight million years, or, to match the upcoming system, over 30 million years.

Faculty and graduate students in the School of Forestry and Wildlife Sciences share the importance of that added speed in their experience with HPC for their land climate interaction research. Sathish Akula, a graduate student working on this project, said that "our daily work involves analyzing multiple data sets of many years together. Doing this much processing on a personal computer would not be time efficient, whereas using HPC allows us to run the same script using multiple processors at the same time, which speeds up the processing." With time sensitive research such as drought predictions and both short-and long-term climate shifts, waiting a long time for results isn't an option. Akula goes on to say that their advancement in these sciences is due, in large part, to the processing power of HPC.

While Auburn's supercomputing efforts have only been around since 2013, it's worth noting that supercomputers have been in existence since the 1960s. Since that time, they have played an important role in the field of computational science, and they are still used for a wide range of computationally intensive tasks in various fields, including quantum mechanics, weather forecasting, climate research, oil and gas exploration, molecular modeling and complex physical simulations. In short, supercomputers exist to help solve extremely complex and difficult problems. They require the use of hundreds, or even thousands, of computer processors, vast amounts of memory, and parallel algorithms and software all working in concert to arrive at a solution.

"Our supercomputers currently have more than 700 software packages installed to support researcher needs," added Matt Smith, a system administrator in the OIT HPC team. "We provide software installation support for researchers, which can often be a major hurdle for them. Instead of spending hours chasing down compilation or installation problems, we take care of it for them, allowing them to focus more directly on their subject matter."

Principle investigators purchase their time and space on the supercomputer based on their computational needs. To provide efficient use of the machine, work is scheduled and managed through the system's workload manager, or scheduler. The scheduler keeps track of utilization in real time and allocates resources using a customized algorithm to determine the best allocation based on input provided by the researcher. OIT configures and maintains the scheduler, as well as the operating systems, software packages, cabling, hardware and anything else needed to run the system effectively. To help researchers in using the system, OIT also provides user training and technical support.

David Young, a researcher in the Department of Chemical Engineering, is grateful for the asset that is the HPC team. His project, which focuses on the development of screening strategies in the context of current technologies, has been underway since December 2016. To test a strategy, Young must perform a combination of simulations that could take hundreds of hours on a single computer. He knows HPC has significantly sped up his data collection process, but "without the help of the HPC admins, I think I would have had a much tougher time," Young said.

Currently, the colleges of engineering and sciences and mathematics account for the most users of the supercomputer at Auburn. Researchers in agriculture, forestry, veterinary medicine, pharmacy, liberal arts and education also use the system in the conduct of research. The supercomputing efforts at Auburn are still relatively young, but OIT is excited to facilitate growth as the technological needs of researchers continue to change and increase.

BREATHE IN, BREATHE OUT

Auburn researchers measure effects of family aggression on young adult health

By Charlotte Tuggle

What happens in childhood can have lasting effects later in life. Auburn University College of Human Sciences researchers found that family aggression during childhood can predict health problems in adolescence. Continuing along the same line of research through an R01 grant from the National Institutes of Health, Auburn researchers Drs. Mona El-Sheikh, Stephen Erath, Ben Hinnant and Joe Buckhalt are the first to examine how sleep and physiology may carry the effects of family aggression from childhood into early adulthood.

Individuals experience many changes during the transition to adulthood, including situations such as moving out, going to college, getting a job and committing to a serious relationship. During this time, psychological and behavioral problems that began in childhood or adolescence may intensify.

El-Sheikh and her team previously studied how sleep and physiological responses to family aggression can affect the health of children and adolescents. They are using the same model to study that subject in 23-to 25-year-olds, to determine whether our past still affects us after we move away from the aggressive environment.

Family aggression exists as a spectrum, including harsh parenting and marital aggression. Whether that aggression is short-term or chronic, it can influence antisocial and risky behavior, anxiety and depression, and impaired social and mental functioning. Research suggests that family aggression also predicts biological processes, such as autonomic nervous system (ANS) dysregulation (e.g., the "fight or flight" response) and sleep problems.

ANS responses and sleep can partially protect against the negative effects of family aggression in the short-term, but in the long term may show the negative impact of chronic family aggression, even across a major developmental transition such as the move into early adulthood.

"One of the major questions of this study concerns the durability of protective biological processes when family aggression persists," Auburn researcher Stephen Erath said. "Do they continue to provide protection or become part of the problem?"

The newly-funded study will measure health and adjustment outcomes across multiple facets of life, including bioregulatory (ANS and sleep), social (aggression in romantic relationships), cognitive (intellectual functioning), educational and vocational domains. These, in turn, may affect our overall health and behavior during early adulthood.

To identify ANS (dys)regulation, the researchers assess indicators of stress. One of the stress conditions examined is a mock job interview—a tense environment in which pressure is put on the participant—during which the team measures physiological responses to the situation. In other words, they are measuring things such as heart rate, sweating, etc.—ways your body physically reacts to stress and tries to regulate it. How one reacts may be an outcome of past family aggression's effects on the mind and body.

The Auburn study is the first to examine how sleep and ANS responses shape the health and adjustment outcomes of exposure to family aggression from childhood through early adulthood. This research is on the cutting edge of advancing developmental science to aid in the prevention of negative consequences of family aggression. El-Sheikh and her colleagues have found that while sleep and ANS responses are the ways in which we see the consequences of family aggression play out, these processes are also protective measures against negative health outcomes of family aggression in childhood and adolescence. A healthy amount of sleep and regulated physical response to stress can improve our social, mental and physical health, which may ultimately lead to a healthier transition through the many changes of life.

DIRECTOR, OFFICE OF UNDERGRADUATE RESEARCH

DR. LORRAINE WOLF

By Jonathan Cullum

What does the Office of Undergraduate Research do?

The Office of Undergraduate Research promotes and facilitates research involvement for undergraduates. As a university, Auburn recognizes that undergraduate research is a high-impact experience. That means it can have a very significant influence on a student's intellectual development and educational experience. Auburn also, through its undergraduate research program, offers the student a "small school" by engaging directly with a research mentor or a small research group. At the same time, the student gets access to world-class facilities and nationally recognized research faculty.

We have a publication venue for students who do research at Auburn and want to publish something they can add to their resume. We have an annual symposium event that we host, so students can exhibit their research and exchange ideas and see what other students are doing around campus. We offer, on our website, tools for professional development and resources—for instance, things like how to write an abstract for a professional conference and how to make an effective oral or poster presentation. We hold professional development workshops on those opportunities as well.

How does the Undergraduate Research Fellows Program work?

The fellowship program is specifically geared toward supporting faculty-mentored student research. It's a competitive program in which high-achieving students can apply with a faculty mentor. They construct a research proposal, and they apply jointly as a team—student and mentor. In addition to a stipend and project funds, the students are provided with a cohort experience; we have fellowship meetings where they have an opportunity to interact with other students and learn about how research is done in other disciplines.

Can you give some examples of particular projects that students have been involved in?

It always impresses me how broad the range of topics is for the undergraduate research fellows. They cover everything from your typical, bench-style research to the creative arts. We've had fellows researching topics such as theatre lighting, how the brain reacts to different kinds of music, nanoparticles for cancer treatment, use of botanicals or natural supplements in healthcare, artificial tissues and motor response of artificial body parts and even how athletic movement can be optimized for preventing injury and improving performance.

What is AUJUS?

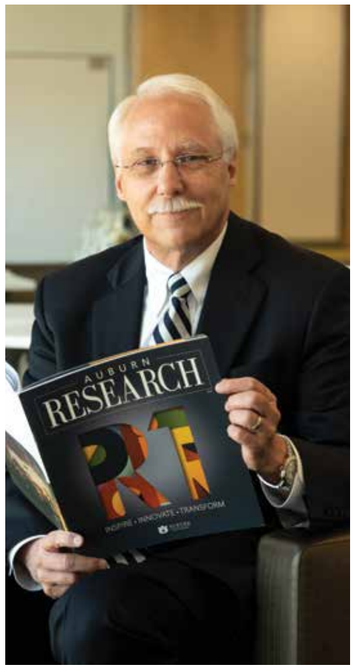
It's the Auburn University Journal of Undergraduate Scholarship, which is an online, refereed publication that accepts submissions only from undergraduate students. Students can submit year-round, and it provides them with a venue for publishing. This gives them an opportunity to be the lead communicating author. Their mentors and other people involved are co-authors, and it works for the timeframe of an undergraduate. This gives them an introduction into what it's like to publish in a professional venue.

What do you enjoy most about your job?

In the Undergraduate Research Program, I'm interacting with some of Auburn's top students. I've been very fortunate to have very collegial colleagues. I've had a good department, I've had a lot of support from the university and I've had good students to work with.

CLOSING THOUGHTS

FROM THE VICE PRESIDENT



James Weyhenmeyer, PhD
Vice President for Research & Economic Development

During my first months here at Auburn, I have had the privilege of meeting with faculty members across the university, getting a closer look at the vast array of research and creative scholarship for which our university is well known. What I have seen has impressed me greatly, and I am confident that, working together, we can continue to grow the important research efforts already underway while progressing in fields of study that will be so critical in the future. From artificial intelligence to space exploration to the ever-changing cybersecurity landscape, Auburn will push forward as a leader.

I hope that as you have perused this issue of Auburn Research, you have noticed the breadth and depth of scholarship that earned Auburn its Carnegie R1 designation. But, of course, the research enterprise at Auburn—or anywhere else, for that matter—is not just about numbers. The work that our researchers do is the work of solving real-world problems, improving the quality of life for citizens in Alabama and beyond, and growing the economy through innovation and discovery. Our research faculty are working to save lives with new disease therapies, protect our environment and continue the legacy of impactful research programs by training the next generation of scholars.

I look forward to helping Auburn significantly expand its research output in the coming months and years, and I know that our state, region and nation will be the beneficiaries of this growth. It is an exciting challenge but one that we are more than ready to tackle. I invite you to stay connected to the unfolding story of Auburn research, in these pages and online, as we continue to find new ways to solve pressing problems and make life better for all.

At Auburn,we have grown our research efforts in both STEM and non-STEM areas, furthering our commitment to benefit Alabama, the Southeast and the nation through research results that improve quality of life and enhance our students' learning experiences.

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