GATHERING THEIR BEARINGS
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.
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.
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 lightweight, 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 Garvin 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.

“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,” Ogles said.

“This partnership with Auburn University and industry will help develop improvements for liquid rocket engines, as well as contribute to commercial opportunities,” McCannegh 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 into the private sector — it’s the solar system.

“NCAME currently has over 70 partners,” said Shamsaei, Philipson-Woollcott 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.”

Green Peace’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 McGonoughy, deputy director of Marshall Space Flight Center, is quick to point out that Auburn’s research will improve more than just space travel.

“If his recent conversion 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.

“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.
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 Alabamians, 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, third graders and their parents each year to make healthier choices.

Social Marketing

SNAP-Ed extends beyond schools and into communities. Have you ever being 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. “SNAP-Ed extends beyond schools and into communities. Have you ever being 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. 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 tips.
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, Choo and Daisy—at a community youth ministry at Auburn United Methodist Church, Refresh, Encourage, Activate, Care and Hope (REACH), 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 prepared to assist this growing and vulnerable population with activities of daily living. Auburn

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 Volkwagens. 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.


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, suffering no cancer, but in a fall, Li continues. An autopsy surprisingly revealed that the cancer had 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.

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 our desired assays, and self-aggregated cell spheroids, which can be highly variable and are not able to form 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. “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 our high-throughput drug screening preliminary studies; use of these microspheres as a biokinetic; 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 these 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 a 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, Trichomonas vaginalis. 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 Dr. Sue Hudson Duran, Julie Gard Schnuelle and Thomas Pasteur, as well as Soren Rockling, extension veterinarian and associate professor in the Department of Animal Sciences, were recognized. Additionally, Dr. Mary Edmonson, associate state veterinarian, and Dr. Jennifer Keuritz, now at Purdue University, and Dr. Lanna Nichaux were involved in the project.

Duran, RPH, MS, PhD, EVCop, 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 research. Dr. Kelly Johnson and Dr. Jennifer Spencer worked in the lab with Duran and the other team members for seven years including Merck Merital student Lanna Nichaux and graduate student Jennifer Keuritz. 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 formulation on bulls for the right design 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 formulas on bulls for the right design 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 formulas on bulls for the right design 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 formulas on bulls for the right design needed for appropriate treatment.

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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.

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 those expecting 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.
Produce spoils. Chemicals contaminate. Emissions pollute the air. Consumers now understand the potential damage of production and consumption. Today’s businesses are challenged to be socially and environmentally responsible—to still make 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.

“The industry leading companies are challenged to be good citizens and to minimize their environmental footprint—to be more sustainable. Those ignoring market forces will dwindle.”

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 prioritizing sustainability will be more profitable and competitive in the long run. Companies outsourcing their transportation activities are called “shippers,” and third-party companies outsourcing their transportation are called “3PLs.” The industry is grappling with driver shortages, turnover and a tainted reputation for unsafe driving and accidents.

“‘Trucking in particular creates a sizable carbon footprint. The industry also grapples with driver turnover and a tainted reputation for unsafe driving and accidents.”

Dr. Maria Soledad Ferevez, 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 Chile, 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. Professor van Overheul said the conference is a forum for novel applications of value-added materials from renewable biomass.

Dr. Marcelo A. Kunoda 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.

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Dr. Hanqing Tian has been named a 2019 Andrew Carnegie fellow and will receive $100,000 to support his research on how Asia, home to roughly half of the world’s population, can provide enough food for its citizens without detrimental effects on the environment. Tian is the Salon 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.

In SUSTAINING CHANGE

By Joe McArdy

The lesson is this: Companies that invest in sustainability can differentiate themselves in the market—so 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 decline.”
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 1.35 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 step 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 will 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 phase 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 these 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. 
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’s 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 PED 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 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.
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 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 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 makes a new copy and reinserts itself into the genome. In non-muscle cells, this can result in carcinomas in the form of invasive 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 it is 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 geneticians, 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 Romo 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 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 degeneration. “We’ve seen that, whether you’re a younger or older human or rat, exercise—whether 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 of his 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.”

“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 immensely helpful because rats live long enough to study exercise in a controlled environment. With humans, we know what their exercise habits are when they are young, 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.”

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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 ACNR. 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.

“There 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 ACNR, 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 these 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.

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For that phase, researchers collected more than 1,000 bear DNA samples from hair left on more than 300 snares placed in habitat and bear scent retrieved using Auburn’s EcoDogs program. Groups throughout the state, including Munsford 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
Auburn University research has helped lead to a new product to reduce Southern pine seedling mortality

by Charles Martin

The U.S. produces more than 1.2 billion forest tree seedlings annually (Figure 1). However, lifting and replanting—specifically, storing and replanting—as compared to non-treated seedlings, results in 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,” said Nadel.

“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 potential yield the growth of an additional 1.2 million pine seedlings after outplanting—the process of lifting, packing, storing and replanting—an average for 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 since 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,” said Nadel.

“Auburn University, NSF, University of Alabama in Huntsville and NASA’s Goddard Space Flight Center.

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 any coating,” said 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,” said Sanny Omar, an AubieSat-1 team member, 15 aerospace engineering and alumni 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 $895,874, 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 the College of Sciences and Mathematics (COSAM), created the initial Auburn University Student Space Program. AubieSat-1 was developed in response to a small satellite 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.

AubieSat-1 has recently gone to Mars and will continue to be more efficient options to larger-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 ausie/op.

Obstruing our planet, a miniature 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, emerita 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 she saw as a newly developing paradigm in space access and use. This led to the first Cubesat created by the program, named AubieSat-1.

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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 new nanosat 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.”

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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 ABO-AAV-GM1 (also known as AAV9-GLB1), at the NIH by Dr. Cynthia Tiff, 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,” Tiff 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. Seeing all of the effort come together to help patients who have no treatment options today gives me a lot of hope,” 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 treatment to one patient’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 can, and 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 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 program 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 initials 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.

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— Dr. Doug Martin
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 created 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’ll 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 Fanier 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 lost 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, Fanier 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 often away from the lab’s primary focus—a series of efforts 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 high-performance Galahad.

“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.

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 million floating point operations, or 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 take the importance of that added speed in their experience with HPC for their land climate interaction research. Sathish Akela, 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 prediction and forest change and long-term climate changes, waiting a long time for results isn’t an option. Akela 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 house more than 700 software packages installed to support researcher needs,” added Marri Smith, a systems 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 admin, 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 their 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.

[38] AUBURN RESEARCH
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 adulthood. 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 Himel and Joe Bucholz 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 continue to provide protection or become part of the problem.

El-Sheikh and her colleagues have found that aggression is short-term or chronic, it can affect our overall health and behavior during 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 predictive measures against negative health outcomes of family aggression in childhood and adolescence. A healthy amount of sleep and regulated physical responses to stress can improve our social, mental and physical health, which may ultimately lead to a healthier transition through the many changes of life.

Dr. Mona El-Sheikh and her team recently completed a mock job interview study. The researchers assessed indicators of stress in 23- to 25-year-olds and determined whether our past still affects us after the transition to adulthood, including situations such as the move into early adulthood. They are using the same model to study that subject in 23- to 25-year-olds, to continue to provide protection or become part of the problem.

To identify ANS (dys)regulation, the researchers assess indicators of stress. One of the stress conditions examined is a mock job interview—stress 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.

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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.