ENGagE 2019

FORT VALLEY STATE UNIVERSITY
1895
EMPOWER *the* POSSIBLE.

FVSUag
COLLEGE OF AGRICULTURE, FAMILY SCIENCES AND TECHNOLOGY

Plant science-biotechnology majors Bacari Harris, Jordan Reid and Breonna Caldwell (pictured from left) are former recipients of the National Science Foundation (NSF) scholarship.

FORT VALLEY STATE UNIVERSITY
EMPOWER *the* POSSIBLE.
1895

Dr. Paul Jones
President
Dr. T. Ramon Stuart
Provost and VP for Academic Affairs
Dr. Ralph Noble
Dean, College of Agriculture, Family Sciences and Technology
Dr. Govind Kannan
Associate Dean for Research, College of Agriculture, Family Sciences and Technology
Dr. Mark Latimore Jr.
Extension Administrator

CONTENTS

Letters from the President, Provost and Dean **2**

A new way to shake up harmful bacteria **4**

Lending a hand with research on pest infestation in peanuts **6**

Improving health through stevia research **8**

Tackling an invasive pest affecting farmers **11**

Changing the game with gene editing **14**

Students apply bioinformatics to agriculture **18**

Advanced technology boosts graduate students to see research 'clearly' **20**

Ag Knowledgements **23**

Emerging Scientists **24**

News & Notes **28**

AGRICULTURAL COMMUNICATIONS DEPARTMENT

Agricultural Communications
Fort Valley State University
P.O. Box 4061
Fort Valley, Georgia 31030-4313
478-825-6345
ag.fvsu.edu

Marquinta Bey Gonzalez
Director
ChaNaè Bradley
Senior Communications Specialist
Russell Boone Jr.
Public Information Editor/Writer
Latasha Ford
Research Communications Specialist
Jeff Brothers
Graphic Designer

On the Cover:
Fort Valley State University animal and veterinary science professionals and students collaborated with the U.S. Department of Agriculture (USDA) scientists to conduct gene-editing research on goats. Pictured are Dr. George McCommon (right), FVSU's department head and professor of veterinary science and public health, and USDA scientist Telugu Bhanu performing surgery on a goat to transfer embryos. Assisting in the rear is Mikayla Alexander, a junior veterinary technology major.
Photo by Danny Gilleland

FROM THE **PRESIDENT**

As part of our outreach engagement as Georgia's 1890 Land-Grant institution Fort Valley State University presents Engage, the 2019 Agricultural Research Report.

Continuing our rich heritage in scholarship, service and scientific research, this publication highlights the work of FVSU agricultural research scientists who are finding solutions to global challenges, such as treating crop diseases, providing sustainable food systems and enriching students' learning opportunities.

In this edition, we spotlight the ways FVSU researchers are helping local farmers grow stevia, a naturally sweet plant which could have a huge impact on human health. We also showcase the work of our researchers to investigate pest control techniques and perform gene-editing research.

Also included are profiles of students and scientists who have received national and international awards for their research efforts and scientific pursuits. The hands-on research experiences at FVSU, for students in particular, are an invaluable component of our academic and co-curricular learning regimen which we believe is novel in its approach and integration into the academic environment.

We hope that the scholarly activities taking place at this university elicit worthwhile information which you can use and share.

Respectfully,

Paul Jones, PhD
President
Fort Valley State University

PROVOST'S MESSAGE

Dear Readers:

Academic success and scientific research are the essential components that create the innovative experiences and opportunities that students, faculty and the community receive from Fort Valley State University (FVSU).

For this reason, it is with great pleasure and excitement that I present our agricultural research faculty and scholar students in the 2019 edition of Engage. Our faculty work hard to provide our students with the research skills and experiences that prepare them to pursue work in government, industry, education or as entrepreneurs.

Through this report, we hope to expose you to the multifaceted discipline of agriculture, enlighten you with knowledge and engage you in learning opportunities offered through FVSU. Likewise, we encourage you to share our work with prospective students and stakeholders.

Best wishes,

T. Ramon Stuart, PhD
Provost and Vice President
for Academic Affairs
Fort Valley State University

FROM THE DEAN

Greetings,

As the new dean of Fort Valley State University's College of Agriculture, Family Sciences and Technology (CAFST), I am pleased to introduce the 2019 Research Report, "Engage."

It is an honor to represent an 1890 Land-Grant Institution devoted to enhancing the agricultural industry, the quality of life of low-wealth communities and academic excellence. I look forward to working with faculty, staff and students in the CAFST to expand our research endeavors, student enrollment and success, and community involvement.

We are going to grow together and tackle all challenges as a family. Through innovative research such as those highlighted in this report and active engagement in the classroom, laboratory and field, expect our programs to flourish and our graduates to thrive academically and professionally.

Our FVSU scientists and CAFST students are leaders in performing cutting-edge research with the latest and greatest technology. I am excited to be a part of the Wildcat family and to join forces with talented professionals who seek to make a difference worldwide.

Furthermore, I appreciate the diligence and commitment of our CAFST colleagues, students and alumni. We are all thankful for the support of our community stakeholders and research partners.

Please enjoy reading this year's report. I encourage you to engage in the possibilities of science at FVSU.

Sincerely,

Ralph Noble, PhD
Dean of the College of
Agriculture, Family
Sciences and Technology
Fort Valley State University

A new way to shake up harmful bacteria

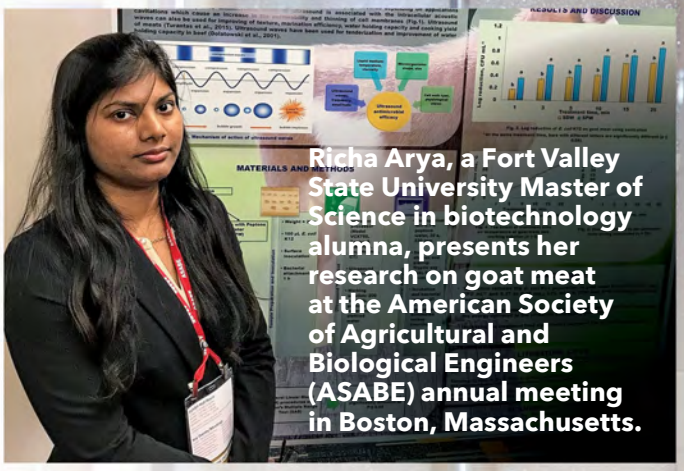
By Latasha Ford

Food industries have widely used conventional chlorine wash to kill bacteria on meat surfaces. However, the adverse effect of this method on the quality of the meat has shifted researchers' focus toward alternative processing methods.

For that reason, an experimental group led by Dr. Ajit Mahapatra, a Fort Valley State University associate professor of food engineering, discovered that sonication can kill the E. coli (Escherichia coli) K12 strain in goat meat.

Mahapatra described that the human ear can recognize frequencies between 20 and 20,000 hertz (cycles per second), but humans cannot scream louder than 3,000 hertz. "All sounds above 20,000 hertz are known as ultrasounds," he explained. "Sonication is an alternative technology that uses ultrasound waves of frequency 20,000 hertz or greater to kill bacteria in food." He said a high frequency sound wave's energy (vibration) is capable of shaking apart bacterial cells like an opera singer shattering wine glasses.

To test this alternative technique, the FVSU expert and his team used a sonicator to kill E. coli in goat meat. Their two-year experimental process involved treating goat meat samples containing E. coli with sonication (20,000 hertz) for one, three, five, 10, 15 and 20 minutes. They used peptone water or distilled water as a contact medium between the ultrasound source and E. coli. This process does not affect the texture of the meat.



Richa Arya, a Fort Valley State University Master of Science in biotechnology alumna, presents her research on goat meat at the American Society of Agricultural and Biological Engineers (ASABE) annual meeting in Boston, Massachusetts.

"Our results indicated that sonication was effective in killing 88 percent of E. coli in goat meat within 20 minutes," Mahapatra said. At one minute, sonication only exterminated 33 percent of the bacteria. This experiment marks the first time use of sonication to kill E. coli in goat meat.

"Our experiments demonstrate that sonication is a potentially safe and effective way to kill bacteria in food products. However, the efficiency of sonication is dependent on treatment conditions, bacterial characteristics and environmental factors," Mahapatra noted.

To advance his research, the associate professor plans to explore using sonication to kill bacteria in chicken and beef. He is also investigating other alternative processing technologies such as combining sonication with pulsed ultraviolet light. His research shows that he achieved a 99 percent E. coli reduction within 20 minutes of sonication followed by 30 seconds of pulsed ultraviolet light.

Dr. Ajit Mahapatra, a Fort Valley State University associate professor of food engineering, uses a sonicator to destroy bacteria in goat meat.

"This research helps provide consumers with safe, quality meat," Mahapatra said. In addition, he said FVSU graduate students are acquiring skills using the latest technology. "If they decide to go into the food industry, they will have that experience," he said.

Gaining that hands-on experience, Richa Arya, a FVSU Master of Science in biotechnology alumna, contributed to the ultrasound research in goat meat for her master's thesis project. She and Mahapatra presented their results at the recent American Society of Agricultural and Biological Engineers (ASABE) annual meeting in Boston, Massachusetts. ASABE is an international organization with more than 8,000 members worldwide, representing educators, researchers and professionals. Arya is currently pursuing her doctorate in the Department of Food Science and Human Nutrition at the University of Maine in Orono.

The U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) funded this research (Evans-Allen, 1001168).

For more information about food safety, contact Mahapatra at (478) 825-6809 or mahapatraa@fvsu.edu.

LENDING A HAND

with research on pest infestation in peanuts

By Latasha Ford

Peanut research at Fort Valley State University continues to aid Georgia farmers who face challenges controlling a pest that is damaging peanut crops.

The peanut, the official state crop, is under threat by an insect called the burrower bug, Pangaeus bilineatus. With this pest causing significant yield loss, Georgia farmers expressed interest in a solution.

As a result, Dr. George Mbata, chair of FVSU's Department of Biology, initially received an $11,000 grant from the Georgia Peanut Commission to begin his four-year research.

This led to the biology professor expanding his pest management research using a combination of biological and chemical insecticides. He later received a $200,000 Agriculture and Food Research Initiative (AFRI) grant (2016-69008-25089) from the U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA). For this project, he collaborated with Dr. David Shapiro-Ilan, an entomologist at the Agricultural Research Service's (ARS) Southeastern Fruit and Tree Nut Research Laboratory in Byron, Georgia, and Dr. Mark Abney, a University of Georgia Extension entomologist.

"The burrower bug attacks the peanuts while they are still underground," Mbata explained. "Current control methods for this pest, which are based on the use of chemical insecticides, have not been very successful."

During their research, the entomologists investigated the efficacy of an entomopathogenic nematode, Heterorhabditis bacteriophora Poinar (Oswego strain), and a fungus, Beauveria bassiana (Balsamo) Vuillemin (GHA strain). They applied the nematode and fungus alone and in combination with chlorpyrifos, which is a common insecticide used to control soil-borne insect pests on a variety of food and feed crops.

The research experts discovered that H. bacteriophora was more effective in significantly reducing populations of the burrower bug when used in combination with chlorpyrifos.

"When applied as single treatments, the two entomopathogens were not pathogenic. They did not cause mortality in P. bilineatus adults that was different from the non-treated control," Mbata said. "However, 3 and 7 d post treatment, the combination of the H. bacteriophora and chlorpyrifos caused higher mortality than the nematode, fungus or insecticide alone, or the combination of chlorpyrifos and B. bassiana."

Dr. George Mbata, chair of Fort Valley State University's Department of Biology, is giving Georgia peanut farmers a hand in reducing a harmful pest, the burrower bug. Assisting him as a research associate is Sydnee Shaw, a Georgia Southern University Bachelor of Science in geology alumna.

Mbata added that this is the first report of synergy between a nematode that was not pathogenic when applied alone and with a chemical insecticide. "Based on the observation of synergy, the combination of H. bacteriophora and chlorpyrifos should be investigated further for potential adoption in the management of P. bilineatus on peanut farms," Mbata said.

The FVSU researcher said the goal is to keep pest populations at a level that does not cause injury or crop loss, to provide farmers with tools they can use to mitigate infestation and to have a sizable yield. He plans to investigate methods for raising the seasonal burrower bug so that he can work year-round on this project.

For more information about pest management in peanuts, contact Mbata at (478) 825-6550 or mbatag@fvsu.edu.

IMPROVING HEALTH THROUGH STEVIA RESEARCH

By Latasha Ford

Two Fort Valley State University researchers are investigating ways to help local farmers grow a naturally sweet plant that could have a huge impact on human health.

"Stevia possesses anti-inflammatory properties and is an all-around health additive that we are going to use as a sweetener," said FVSU research professional Dr. Steven Samuels. He is working with Dr. Bipul Biswas, assistant professor of plant science, who received a grant to study stevia for four years on FVSU's campus.

"It is non-caloric, so it does not cause weight gain. It regulates insulin and glucose levels, which Americans have high incidents of that. We use a lot of sugar," Samuels explained. "By having this as a product that we produce and promote, it will change the way people diet."

For this reason, the FVSU graduate, who earned a bachelor's degree in plant science-biotechnology, and Biswas plan to develop cultivars of stevia that can effectively grow in Georgia's climate and soil. Furthermore, they are working on developing secondary glycosides (sweet tasting products) that do not have a bitter aftertaste.

Samuels explained that currently on the shelves in grocery stores, stevia products contain rebaudioside A, which is a secondary metabolite that is nearly 200 to 300 times sweeter than sugar.

"It starts out sweet, but then at the end, it is a bit tangy. That is rebaudioside A. The plant naturally produces a high amount of it," Samuels said.

"We are collaborating with researchers from Michigan State University (MSU). They have the capability to quantify and identify each individual rebaudioside," Samuels said. MSU will also do a genetic analysis to support their testing.

"When they identify other samples that fit the perimeters, we will breed those, plant the seeds and do the analysis again," he added. "It's a process of doing that until we identify lines phenotypically. The genetic information validates what we see and taste."

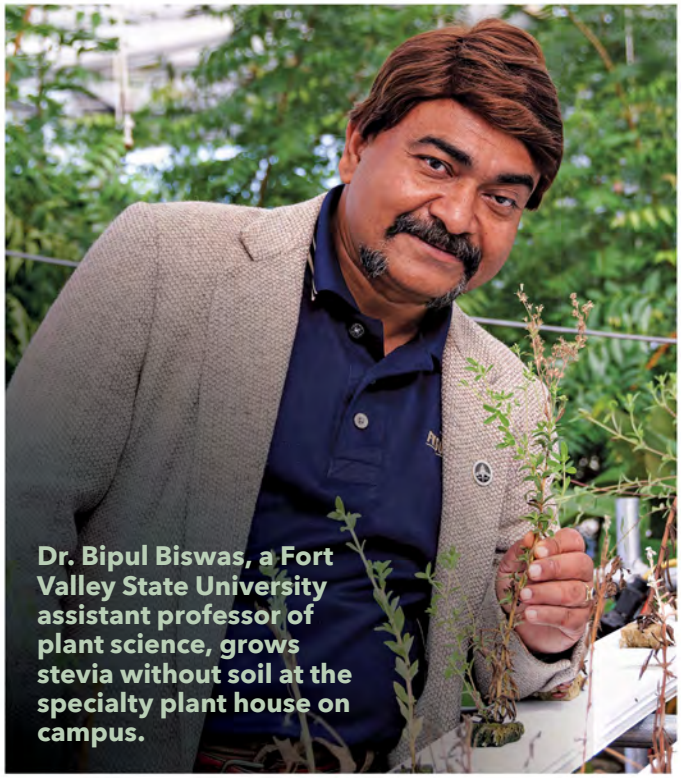
The Thomson, Georgia, native said this project will benefit consumers and producers. The purpose is to develop a product that small farmers can grow and sell in the United States.

To kick off the research process, Samuels said they have already started intercropping studies in the peach

The leaves also produce rebaudiosides D and M in very low quantities. "They are just as sweet but have none of the bitter aftertaste," he said. The goal is to increase the production of D and M. "We believe we can do it because rebaudioside A is a precursor for D and M," Samuels said.

To pull this scientific endeavor off, this will require Samuels and Biswas to breed those specific plants. First, they will plant several different lines in the field on campus and observe them as they grow.

"It is non-caloric, so it does not cause weight gain. It regulates insulin and glucose levels... By having this as a product that we produce and promote, it will change the way people diet."



Dr. Bipul Biswas, a Fort Valley State University assistant professor of plant science, grows stevia without soil at the specialty plant house on campus.

Dr. Steven Samuels, a Fort Valley State University research professional, is studying how local farmers can grow stevia (a naturally sweet plant) in their own backyards. Assisting with this research is D'Amber Jones, a FVSU biotechnology graduate student.

field on campus by growing stevia and strawberries underneath the peach trees.

"You are using the same amount of land and the same amount of time to increase your revenue," Samuels said. "Once you plant stevia, it regrows the next season after harvesting." He said this could especially benefit small farmers who may have multiple peach trees.

"Your peach leaves fall, decay and add nutrients to the soil for the stevia to grow. This increases overall farm profitability," he advised.

In addition to growing stevia in the field, the Tuskegee University alumnus, who earned a doctorate in integrative biosciences through a joint program with the University of California, Davis, said they are looking at using hydroponics to promote sustainable agriculture.

"Less soil, less land, less water," he noted. "Growing outside, you're subject to the seasons, so you have a limited amount of time to generate profit. Growing hydroponically, you can grow all year round."

Furthermore, Samuels said it is fulfilling to return to his alma mater as an employee and work on a project that allows him to work in both the laboratory and field.

"I enjoy being back here where I received my degree. It means a lot to me to be able to help others and impart the knowledge that I have gained," he said, proudly.

FVSU biotechnology graduate student D'Amber Jones and five undergraduates are assisting Samuels and Biswas on the project. Their responsibilities range from cleaning and maintenance of the greenhouse, laboratories and fields to participating in germination experiments.

Biswas received $345,406 from a $3,208,657 grant awarded to MSU for his project, "Developing a sustainable stevia industry in the United States." The U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) is funding the project through its Specialty Crop Research Initiative (SCRI) program.

For more information, contact Samuels at (478) 825-3134 or steven.samuels@fvsu.edu, or Biswas at (478) 825-6827 or biswasb@fvsu.edu.

Tackling an **invasive pest** affecting farmers

▸ *By Latasha Ford*

Southern farmers could soon receive assistance in controlling a new invasive pest affecting their sorghum yield.

Sorghum is an important crop in the southern cropping systems. Farmers use this versatile crop as forage and silage for livestock. In addition, it serves as feed for the broiler (chicken) industry and is valuable for bioethanol production.

Dr. Somashekhar Punnuri, a Fort Valley State University research assistant professor, investigates a highly damaging pest (sugarcane aphid) that is affecting sorghum growers in the Southeast.

Since 2013, the country's southern states have witnessed a new invasive pest (sugarcane aphid [*Melanaphis sacchari*]) that is severely reducing sorghum yield, forage quality and feed consumption.

For this reason, Fort Valley State University research assistant professor Dr. Somashekhar Punnuri is utilizing a half million dollar grant to investigate this highly damaging pest, which is affecting sorghum growers in the Southeast.

Awarded a $499,997 Capacity Building Grant (GEOX-2018-04866) by the U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA), Punnuri aims to develop new sorghum varieties that resist the sugarcane aphid and to strengthen the research capacity in plant breeding activities at FVSU.

He is collaborating with Drs. Joshua Peschel with Iowa State University and Jason Wallace with the University of Georgia (UGA). Other partners include Drs. Xinzhi Ni, Karen Harris-Shultz and Joseph Knoll with the USDA's Agricultural Research Service (ARS) in Tifton, Georgia.

"We want to know every detail about this pest that is damaging sorghum and how we can control it," Punnuri said.

To carry out this three-year mission, the research assistant professor and his colleagues are developing a field-based robot to help increase the precision in phenotyping for sugarcane aphid damage and to facilitate accelerated plant breeding.

"Phenotyping involves quantifying and characterizing a plant's physiological growth and biochemical properties that attribute resistance to the plant," Punnuri explained. "We are deploying speed breeding for developing resistant varieties in sorghum that can give a good yield."

Currently using visual scoring for sugarcane aphid damages, Punnuri said this technique is labor and time intensive.

> *"We want to know every detail about this pest that is damaging sorghum and how we can control it."*

"These constraints in field phenotyping further necessitate the use of machines for high-throughput (HTP) phenotyping," he said. "The development of suitable HTP platforms such as robotic-based systems can be very powerful."

HTP phenotyping allows for Punnuri and his team to investigate the underlying genetic cause of a plant's resistance to the sugarcane aphid.

The FVSU scientist said they plan to use a diverse set of lines (sorghum association panel [SAP]) that utilize the allelic diversity in sorghum for the development of insect resistant varieties using genome-wide association studies (GWAS).

The SAP is a collection of photoperiod-insensitive breeding lines that are racially, geographically and phenotypically diverse. Punnuri and his team first plan to establish an insect rearing facility on FVSU's campus. He will acquire a growth chamber, a walk-in cooler for seed storage and a seed thresher to process and maintain the germplasm collection.

The objective is to obtain the SAP and increase the number of seeds for each accession in the greenhouse and field. The robotic phenotyping platform, designed by Iowa State University, will have multiple types of sensors for use in the field and greenhouse to quantify aphid populations and damages and to identify aphid-resistant lines. It will also measure plant traits such as plant height, stalk diameter and leaf area index.

The project group plans to conduct field trials on sorghum plots grown yearly in Tifton and on FVSU's campus.

In addition to this research helping farmers, Punnuri said it could enhance the workforce at FVSU and provide additional training for existing personnel. It will further allow students in the Master of Science programs and those taking related courses to receive hands-on experience and assist in the development of a suitable phenotyping platform.

Additional opportunities will include trainings and workshops for students and research professionals on how to use genotyping and phenotyping and how it could benefit farmers. Punnuri said they also intend to give field demonstrations to educate farmers on sugarcane aphid and ways to control it.

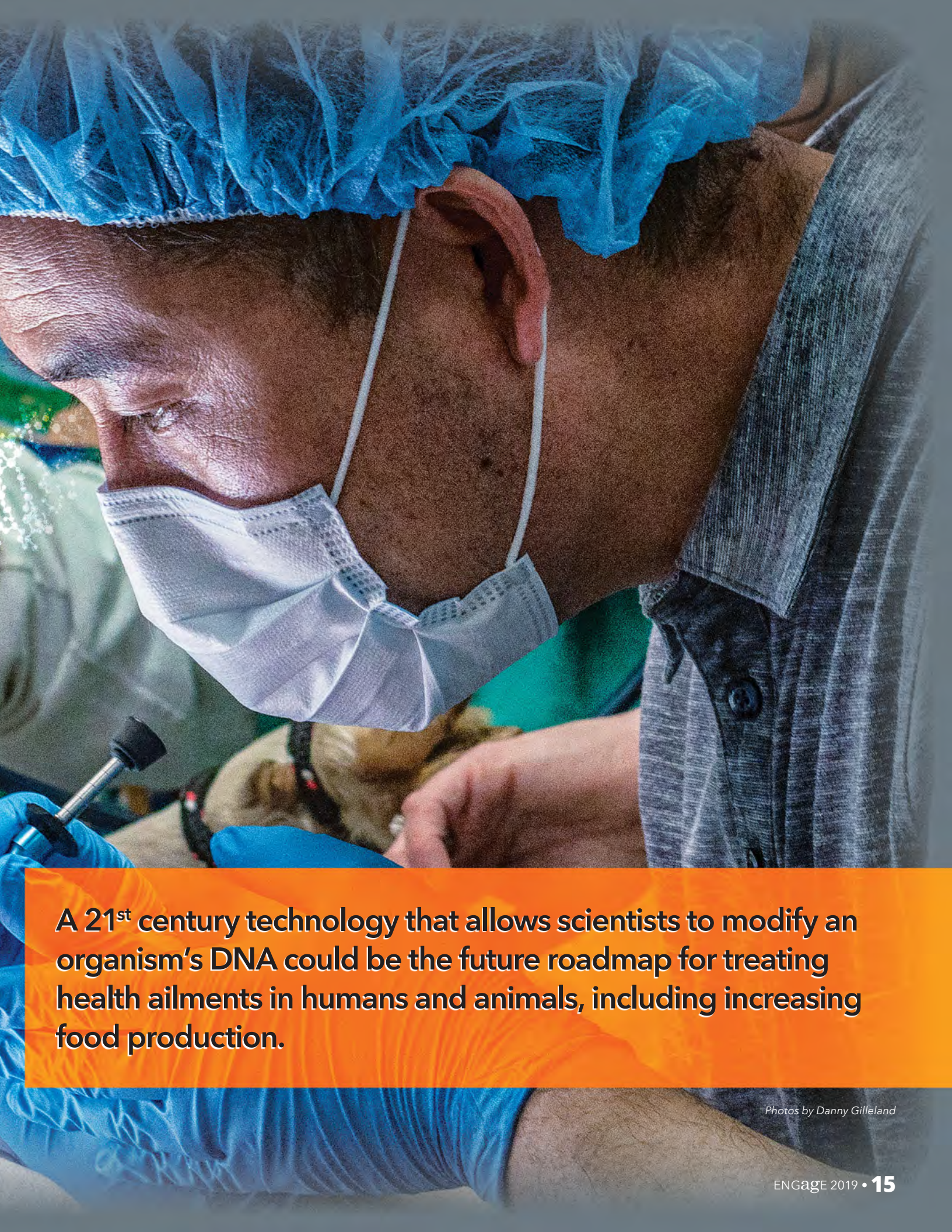
"This project will enhance collaboration and cutting-edge research activities using HTP and genotyping technology," Punnuri said. He added that this scientific study could further support other national programs such as the USDA-ARS area-wide pest management project headed by Ni. Punnuri serves as the co-principal investigator, and FVSU is one of the seven experimental sites for this project.

Ultimately, Punnuri said this NIFA project could yield scientific data that are fundamental and crucial to the agronomic improvement of sorghum as an important grain and bioenergy crop for feed and ethanol.

Dr. Somashekhar Punnuri aims to develop new sorghum varieties that resist the sugarcane aphid and to strengthen the research capacity in plant breeding activities at Fort Valley State University.

For more information about programs related to sugarcane aphid in sorghum, contact Punnuri at (478) 825-6519 or punnuris@fvsu.edu.

CHANGING THE GAME with gene editing



A 21st century technology that allows scientists to modify an organism's DNA could be the future roadmap for treating health ailments in humans and animals, including increasing food production.

Photos by Danny Gilleland

By Latasha Ford

A 21st century technology that allows scientists to modify an organism's DNA could be the future roadmap for treating health ailments in humans and animals, including increasing food production.

Taking this revolutionary step, Fort Valley State University animal and veterinary science researchers teamed up with U.S. Department of Agriculture (USDA) scientists to conduct gene-editing research on goats.

To introduce this efficient technology on FVSU campus, Dr. Mahipal Singh, a FVSU professor of animal biotechnology, applied for a $99,870 USDA Faculty Research Fellowship grant (58-8042-7-019), in collaboration with the Veterinary Science Department.

"Our goal at FVSU is to establish genome-editing technology for use in goats and sheep to train students and undertake challenging research projects in animal science," he said.

The animal biotechnology expert says traditional agricultural practices have reached their limit.

"We need to have more innovative ways to feed the growing population and benefit human and veterinary health," Singh said.

With gene editing, scientists can precisely alter the sequence of a desired gene without introducing a foreign gene in the native genome.

"This technology is like editing letters in a textbook," Singh described. "It is revolutionizing almost all disciplines of biology, especially livestock agriculture, to increase milk and meat production, prevent diseases like mastitis (infected udder) and create large animal models for human diseases."

During a three-month trip in 2017, he visited the USDA Animal Biosciences and Biotechnology Laboratory in Beltsville, Maryland, where he trained in Drs. David Donovan and Telugu Bhanu's laboratories.

"The entire genome-editing procedure is a complex enterprise and involves a good teamwork of personnel with various skills in molecular biology, genetic engineering, bioinformatics, embryology, livestock surgical procedures and animal husbandry," Singh said.

Following his training, the professor returned to campus to collaborate with the Veterinary Science Department on an embryo transfer procedure in December 2018. This research involved 16 80-130-pound Spanish and Saanen goats.

For four days, a team of approximately 10 students, three USDA scientists and personnel from animal science and veterinary science transferred genome-edited embryos in synchronized goats. This requires obtaining several mature eggs from each animal. The procedure also included utilizing a combination of hormones to get a herd of goats in heat simultaneously.

The first step was surgical aspiration (recovering the eggs from oviducts by flushing) of the super ovulated eggs from six donor goats and collecting semen from the male goats (bucks).

"These freshly recovered eggs and sperms were then processed for in-vitro fertilization, where sperms and eggs are cultured together, and growing embryos in a culture dish," Singh explained. "These early, one cell

Dr. Mahipal Singh, a Fort Valley State University professor of animal biotechnology, sets up an inverted microscope and micromanipulators for DNA microinjection in goat embryos.

> *The entire genome-editing procedure is a complex enterprise and involves a good teamwork of personnel with various skills in molecular biology, genetic engineering, bioinformatics, embryology, livestock surgical procedures and animal husbandry.*

stage embryos (zygotes) were then microinjected with genome-editing reagents called CRISPR/Cas9 (clustered regularly interspaced short palindromic repeats)."

Subsequently, the 10 goats receiving embryos were tested for pregnancy.

"Our initial tests on the blood hormone levels gave some positive indication in at least two of the goats," Singh said. "However, these results are still preliminary."

Conducting initial pre-trials, Singh said the team improved their methods for the December operation by using a new incubator (experiment requires 5 percent carbon dioxide and 5 percent oxygen for the cultures to survive) and fresh semen from the bucks.

With participants only taking pizza breaks during the four-day procedure, Singh said the process is meticulous and involves diligent preparation a year in advance.

"Our veterinary science collaborators played a significant role," he said.

Dr. George McCommon, FVSU's department head and professor of veterinary science and public health, commended the partnership and said everyone involved brought something different to the table.

"Veterinary science provided the well-fed healthy goats, cared for the animals and took care of all medical and husbandry issues for the past two years," he said. The department also provided anesthesia and worked hand in hand during the surgeries with the USDA scientists.

In addition to this partnership, two FVSU graduate students assisted in the planning process as part of their master's thesis.

"Training today's students in specialized technologies like genome editing is essential," Singh said.

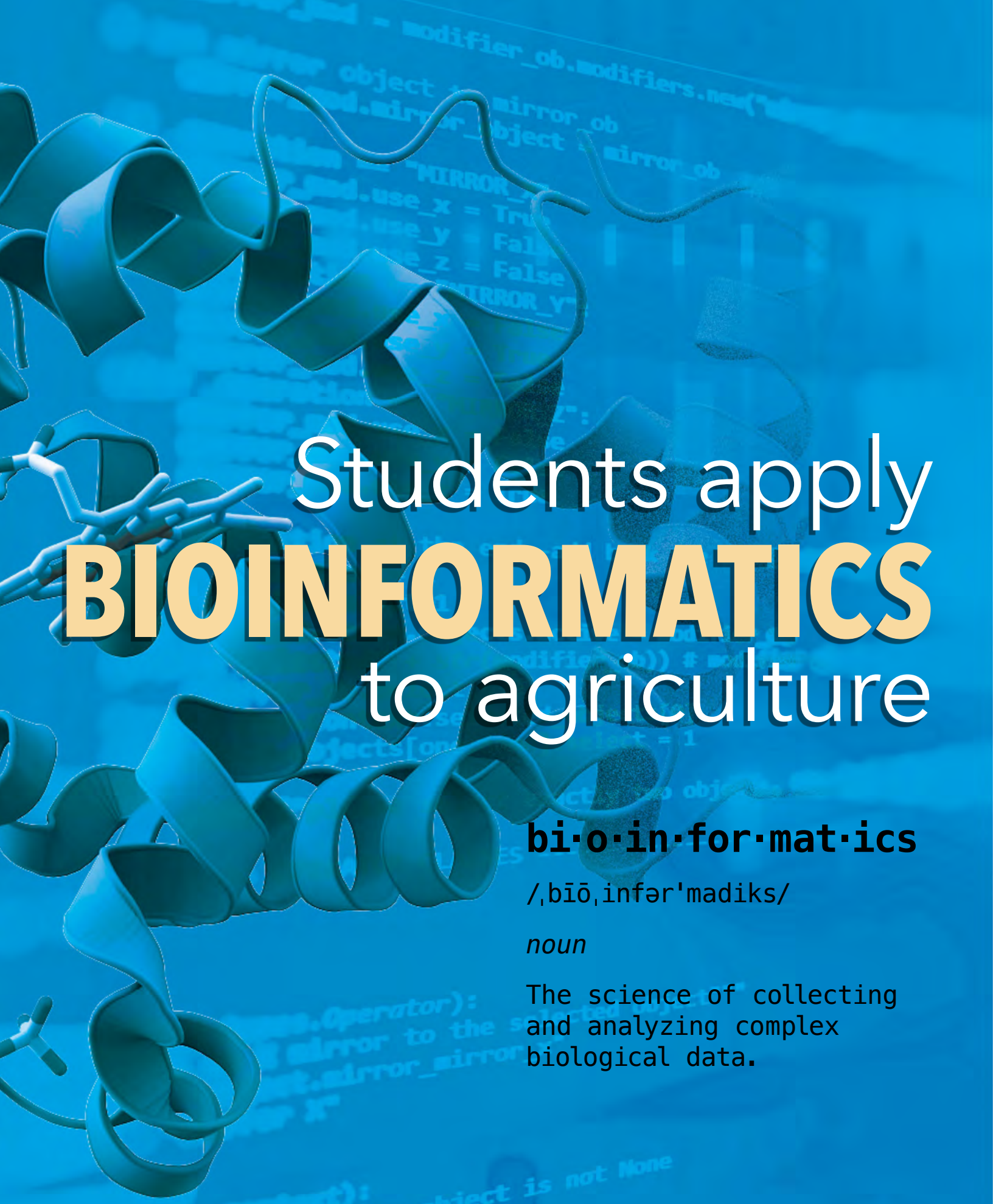
Tyler Williams, 24, of Waynesboro, Georgia, is pursuing a master's degree in biotechnology. Interested in becoming a physician assistant in regenerative medicine, he said preparing for the surgeries was the hard part, but the overall experience allowed him to broaden his horizon.

"It gives me a diverse mindset on what I am aiming for and on how methodical and detailed research can be and how it can transfer to other areas," he said.

Arunachala Kutagulla, 27, who is pursuing a master's degree in animal science, said this kind of trending research on goats is new for him but provides the experience he needs.

The India native aspires to be a scientist specializing in conservation of animal genetic resources. "Dr. Singh's lab provides a lot of resources for research," he said. "It is the kind of exposure you want."

For more information about this project, "CRISPR/Cas mediated gene targeting to reduce milk allergens and mastitis in goats," contact Singh at (478) 822-7042 or singhm@fvsu.edu.



Students apply BIOINFORMATICS to agriculture

bi·o·in·for·mat·ics

/ˌbīōˌinfərˈmadiks/

noun

The science of collecting and analyzing complex biological data.

By Latasha Ford

Bioinformatics, an evolving interdisciplinary science, is giving Fort Valley State University agricultural students the tools they need to potentially treat diseases and create a sustainable food system.

Using software that organizes and analyzes large amounts of biological data like DNA and proteins, undergraduate and graduate students are receiving hands-on training in a newly completed laboratory.

Dr. Ramana Gosukonda, a FVSU agricultural sciences professor, is the first at the Historically Black University to teach bioinformatics through the Principles of Biotechnology course.

"There is no other way for students to continue professionally without knowing bioinformatics because it is highly integrated within agricultural research," he said.

Learning to code using bioinformatics, biotechnology graduate students Zandria Chambers and Matthew Durst-Scarlett, apply those skills to their agricultural research projects.

Chambers uses bioinformatics to depict her research on hydrophobic aerogels. The 26-year-old from Albany, Georgia, is attempting to create a reusable green product by using cellulose, which comes from a residual waste. "Bioinformatics connects all of the dots statistically," she said. "We use these programs to depict the problem and solution in a 3D way."

Durst-Scarlett applies bioinformatics to his research on pest management in grain storage. The 27-year-old from Warner Robins, Georgia, is investigating wasps to control the problem. "In biology, we tend to deal with very large sets of data. With bioinformatics, we can organize and manipulate that data so we can see it in different ways, store it and then share it with other scientists to collaborate on things," he said.

Similar to a police detective using a database to check for criminal background information, Gosukonda explained that biological databases serve as a repository of information for scientists and students. "As a result, any biological problem they want to solve, they have to use these databases and other bioinformatics tools. Without the use of these tools, biological research cannot progress beyond a certain point," he noted.

The agricultural sciences professor said the main component in bioinformatics is the research process. He creates and presents simulated modules to students in the laboratory located in the Georgia Small Ruminant Research and Extension Center on campus. These modules include students exploring how to build an evolutionary tree and finding a drug to treat a disease. "They can convert DNA into a protein and make it into a 3D structure," Gosukonda said.

Biotechnology graduate students Zandria Chambers and Matthew Durst-Scarlett, who aspire to be research scientists, apply their coding skills to their research projects.

In addition to providing students with hands-on training, he looks forward to expanding the bioinformatics curriculum with additional modules and training more faculty to teach the courses.

"Bioinformatics is so dynamic. What I learn today may not be the same in two years," he said. "My goal is to make bioinformatics a major or minor at FVSU. Currently, none of the HBCUs offer it as a major or concentration for undergraduate students."

Gosukonda encourages students to consider a career in bioinformatics. "Anyone who knows a little about programming and has an understanding of biological problems can easily get a decent job," he advised.

The U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) awarded Gosukonda a $149,999 1890 Capacity Building Grant to create bioinformatics courses and a laboratory for hands-on training.

Since receiving the grant four years ago, Gosukonda has trained more than 60 students. The recently finished bioinformatics laboratory now contains 19 computers, audiovisual equipment, panels, speakers, WiFi and electric computer desks.

For more information about bioinformatics, contact Gosukonda at (478) 825-6836 or gosukonr@fvsu.edu.

Advanced technology boosts graduate students to see research 'clearly'

By Latasha Ford

Biological and physical sciences heavily depend on imaging to see beyond the naked eye. An advanced imaging facility at Fort Valley State University is giving graduate students and faculty members the vision to look deeper at issues affecting agriculture and food production.

To further this effort, Dr. Nirmal Joshee, a FVSU plant science professor, assisted Dr. Govind Kannan, FVSU's associate dean for research, in establishing the Center for Ultrastructure Research (CURE). The new facility, located in the Stallworth Agricultural Research Building, will enhance research capacity, student training and industry partnerships. As the center director, Joshee will also pursue revenue-generating opportunities for the Research Station by allowing other institutions in the state to access the center for a predetermined fee.

"This center will be the only one of its type in middle and south Georgia with both scanning electron microscopy (SEM) and transmission electron microscopy (TEM) capabilities," Joshee said. "It will be a great selling point in attracting STEM (science, technology, engineering and mathematics) students."

Electron microscopes allow scientists to obtain images of biological and non-biological specimens at a much higher resolution and magnification (up to 300,000 times) than light microscopes. FVSU's CURE is now home to these high quality instruments.

Joshee employed this technology while pursuing his doctorate research from 1981-1986 in India and during his post-doctoral research on cancer cells from 1998-2001 at the University of Nebraska Medical Center in Omaha. After taking a research professional position in 2001 at FVSU, his fascination with electron microscopes led him to bring this advancement to the College of Agriculture, Family Sciences and Technology in 2010.

"Imaging is an important part of science," he said. "When our students prepare for medical careers in dentistry, ophthalmology or as a researcher, they need imaging concepts. Therefore, we should catch our students early, especially in agriculture."

Joshee, a medicinal plant researcher, said the SEM and TEM microscopes give a different dimension to research. SEM displays the surface structure of a specimen, whereas TEM shows the internal structure. This requires cutting sections of a specimen and obtaining details at more than one million magnification. Unlike light microscopes that have certain limitations, electron microscopes do not use any lenses for image generation. They use electron beams.

One feature in the new Center for Ultrastructure Research (CURE) is a transmission electron microscope (JEOL 1400S).

Dr. Nirmal Joshee (standing), a Fort Valley State University plant science professor, and Brajesh Vaidya (sitting), a FVSU research assistant, examine an Aronia leaf using a Hitachi scanning electron microscope.

Another feature in the facility is a tabletop scanning electron microscope.

During processing to prevent any damages, a study material receives a thin layer of gold in a sputter coater.

The material must also go through a drying process in a manual and automated critical point dryer.

Electron beams hit a study material at a high speed for image generation. To prevent any possible damage, a sample has to go through elaborate processing. These steps include fixation, dehydration, critical point drying and then coating with a thin layer of gold using a sputter coater. As a result, researchers obtain sharp, detailed images of a specimen, which could lead to better research.

The plant science professor said FVSU is already experiencing the reach of this technology. So far, the SEM lab has logged more than 2,000 hours in sample preparation and picture generation for faculty members' research projects, graduate students' thesis research and collaborators across the nation.

Brajesh Vaidya, a FVSU research assistant, benefited from using the advanced imaging for his thesis project on Scutellaria, a medicinal plant. He now helps manage the center labs.

The 2012 FVSU Master of Science in biotechnology graduate said he is thankful that the university has this facility on campus for students. "We let them do their own processing," he said. "We are making them more marketable when they graduate. It always helps to have that extra feather in their hat."

Scientific instruments worth approximately $1 million are currently in place. Joshee plans to add a small class or demonstration room with audiovisuals and a refurbished walk-in cooler.

For more information about the FVSU CURE, contact Joshee at (478) 822-7039 or josheen@fvsu.edu.

agKNOWLEDGEMENTS

Fort Valley State University's agricultural research scientists receive national and international recognition from federal agencies, state commodity groups and international societies through mention on social media channels Facebook and Twitter. Check out some of the agKnowledgements received by our funding agencies and supportive networks in the agricultural sciences.

Biotechnology graduate student uses soilless growing for food sustainability

By Latasha Ford

Twenty-five thousand people are dying of starvation every day, according to the Food and Agriculture Organization of the United Nations. Feeding a population expected to grow from 7.7 billion to 9.7 billion in the next 30 years means taking innovative measures.

Seeing a need, Fort Valley State University biotechnology graduate student D'Amber Jones decided to explore a sustainable solution. She is taking a non-traditional approach — growing plants without soil.

"Population growth puts a demand on food production, and food production puts a demand on our already finite natural resources," she said. "Seeing how hydroponic systems could be used to help alleviate or conserve our water and food crisis inspired me."

This motivation led her to research cultivated plants under hydroponic conditions compared to traditional agriculture.

Currently in the first phase of her research, the 29-year-old is growing bean and cucumber plants using a deep water culture hydroponic system (suspending a plant's roots in a solution of nutrient-rich, oxygenated water) and a tower garden (a vertical aeroponic growing system).

The first process is germinating the seeds in a controlled environment (in vitro) and then transplantation. "The plants in the field will be grown in soil, and the plants in hydroponics will be put in rockwool (mineral wool used as a medium to hold the plant)," Jones explained.

Subsequently, she will compare the yields and food quality from the two hydroponic systems to raised beds in the field and to seeds planted in the ground. She plans to grow four to six food crops in fall 2019 for the second phase of her research. She will use additional hydroponic systems versus the field and raised beds.

"Hydroponics uses less land and less water and grows more crops," Jones said. "You can collect more harvest than traditional agriculture. We have one harvest season, but with hydroponics, you could have three, if not more."

She said the advantages of hydroponic farming include high food production, water and land conservation, space efficiency and easy operation. "It could help expand self-sufficiency in communities for farmers and students alike," she noted.

In addition to bean and cucumber plants, Jones is growing mint using hydroponic systems and is interested in growing stevia plants. Both stevia and mint have health benefits. Stevia is non-caloric, possesses anti-inflammatory properties and regulates insulin and glucose levels. Jones said her mother sparked her interest in growing stevia because she has diabetes and had to change her eating habits.

Mint helps alleviate digestive issues and can help repel insects. "I am using the foliage of specialty crops to create organic pesticides," Jones said. "That way, everything can stay organic in the hydroponic systems."

Jones, who earned a bachelor's degree in plant science-biotechnology from FVSU in 2018, said her overall goal is to help people by sharing knowledge through her research.

"Growing plants and food is nothing new to me. I grew up in the country on acres of land watching my grandparents grow tomatoes, corn, peppers and watermelon. Growing up in that environment, I saw how I could use science and my love for plant science to help make the world a better place," Jones said.

After graduation, the young scientist aspires to be an entrepreneur who assists people interested in hydroponic farming. She also wants to own a greenhouse and create her very own hydroponic system.

Jones, a first-year graduate student, is the recipient of a graduate assistantship, which helps her finance her studies. "Fort Valley is a good school. My advisers are great, and I couldn't do it by myself," she said.

For more information about FVSU's Master of Science in Biotechnology Program, visit https://bit.ly/2RMWcWL.

Alumna's passion for research leads to doctoral studies

By Latasha Ford

A Fort Valley State University alumna is continuing her research endeavors in plant science at a fellow 1890 Land-Grant Institution, the University of Maryland Eastern Shore (UMES).

Lani Irvin, who earned her Master of Science in biotechnology at FVSU, is pursuing her doctorate in the agricultural sciences program at UMES in fall 2020. Her research will focus on grapes and gene editing to improve disease resistant varieties.

"I am excited to work on producing successful grapevine crops. Grapes are grown and consumed worldwide as fresh fruit, jams, jellies, juice and wine. They are beneficial for human and animal health because of the antioxidant and anti-inflammatory properties they possess," Irvin said.

The biotechnology graduate first became fascinated with plants while pursuing her bachelor's degree in biology at Middle Georgia State University. "I did not know until my senior year of undergrad that I was a plant person," Irvin said.

After graduating in 2015, she met Dr. Nirmal Joshee, a FVSU plant science professor, who exposed her to more plant research while pursuing her master's degree at FVSU.

"I have always been interested in alternative medicine and plant pathology," Irvin said. "I feel like everything on Earth is here for a purpose and I believe the cure for many diseases can be found in plants."

Upon graduating in 2017, she returned to her alma mater, Middle Georgia State University, to teach

biology. However, she continues her research on Scutellaria at FVSU.

"Scutellaria is a medicinal plant. There are more than 360 species of Scutellaria found throughout the world," Irvin said. She read an article on the analysis of 13 herbal products that claimed to have Scutellaria in them. "What they came to find out is that only five of those products had what they claimed to have in them," she said.

Using biotechnology tools, Irvin wants to create a DNA barcode system similar to Universal Product Codes, which track trade items in stores.

This led the biology instructor to research the molecular characterization of Scutellaria species for her graduate thesis project. She said approximately 70 percent of the global human population uses medicinal plants as a source of primary health care and in plant-based products, including shampoo, daily vitamins, medicine, toothpaste, face cream, spices and tea.

"If people expect to have Scutellaria in their herbal supplement, it should be there and should not be adulterated with anything that can cause harm to them or an inferior product," she said.

Her goal is to find a short sequence in plants that scientists can identify rapidly through the Barcode of Life Database (BOLD) and the GenBank sequence database. However, Irvin said this is a challenging process.

"With animal species, you can use one gene to differentiate species. With plants, you have to do a combination of genes. We chose two chloroplast genes and a nuclear gene and compared them to some of their nuclear DNA to see if we can find a sequence that is short enough to produce a barcode," Irvin said.

Throughout her three-year research, she worked on 22 Scutellaria species (collected by Joshee) that are located in the on-campus greenhouse. After collecting the leaves and extracting the DNA, she verified the purity of the sample and then amplified the DNA sequences. "When you amplify the specific regions, you can see the gene of interest," she explained.

Closer to establishing a sequence, the FVSU alumna said the process involves feeding the data into a computer program that will provide the statistical analysis. She collaborates with a bioinformatics professor in Spain to interpret the data. This exercise will help her develop a DNA barcode for Scutellaria so that she can score its presence or absence using molecular tools.

In addition, the plant scientist is interested in Ocmulgee skullcap (Scutellaria ocmulgee) and the large-flowered skullcap (Scutellaria montana). The Ocmulgee skullcap (found in Georgia and South Carolina) and the large-flowered skullcap (found in Tennessee and Georgia) are vanishing in wild populations. Their conservation is an immediate concern.

Irvin said being a graduate student at FVSU gave her the opportunity and exposure that she needed to prepare for a doctorate program. She commended her involvement in graduate research, learning about instrumentations and interacting with fellow graduate students and researchers at international conferences.

For her barcoding research, Irvin received financial support as a graduate research assistant through the Strengthening Minority-Serving Institutions project, "Advancing Graduate Education in the STEM Disciplines for the Underserved African American and Low-Income American Population." The U.S. Department of Education funded this project.

NEWS & NOTES

College of Agriculture students take home research awards

Four Fort Valley State University students recently won second and third place awards for their presentations at the Association of 1890 Research Directors (ARD) 19th Biennial Research Symposium in Jacksonville, Florida.

Hard work and dedication in the classroom and laboratory allowed four Fort Valley State University students to win awards and cash prizes.

Graduate students Breyanna Morning and Lubana Shahin, along with undergraduate students LaShombria Ellerbee and Adelia McKinley, placed second and third at the Association of 1890 Research Directors (ARD) 19th Biennial Research Symposium.

The ARD symposium provides opportunities for scientists and students at 1890 Land-Grant Institutions to present research papers and posters that share innovative and practical research findings in the food and agricultural sciences.

FVSU students and faculty were among more than 1,000 participants to attend from March 30-April 3 at the Hyatt Regency Riverfront in Jacksonville, Florida. This year's theme focused on "Making Critical Contributions to Rural Prosperity and Solving Challenges in Food and Agriculture."

Devoting her research efforts to this cause, Morning's poster presentation on the "Screening of Lespedeza Germplasm for Forage Quality Indicators" led to a second place win. The Master of Science in animal science major also received a $200 cash reward.

Shahin, who is pursuing a Master of Science in biotechnology, earned third place and a $100 cash reward for her oral presentation on the "Evaluation of Five Drying Methods and Their Effects on the Physical Properties of Paulownia elongata and P. fortunei Flowers and Leaves."

Additional awards went to agricultural economics seniors LaShombria Ellerbee and Adelia McKinley. Ellerbee took home second place and a $200 cash reward for her oral presentation on "Consumer Preferences for Goat Meat Attributes."

McKinley won third place and a $100 cash reward for her oral presentation on "Factors Influencing the Demand for Goat Meat in the Southern United States."

"To see our students shine and win awards is the greatest feeling for us as educators," said Dr. Govind Kannan, FVSU associate dean for research. "I am proud of all of our students who presented their papers at the symposium and faculty mentors who groomed them."

For more information about ARD, visit https://bit.ly/2I1zuF2.

Fulbright scholar provides insight into Bangladesh's agricultural industry

Fulbright scholar Dr. M. Saidur Rahman visited Fort Valley State University's campus to give a lecture on Bangladesh's agricultural practices.

Fulbright scholar Dr. M. Saidur Rahman recently visited Fort Valley State University's campus to give a lecture on Bangladesh's agricultural practices and to learn about FVSU's research and outreach services.

FVSU and the University of Georgia hosted Rahman at both campuses through the Fulbright Scholar Program's Outreach Lecturing Fund (OLF). OLF enables visiting scholars to share their research interests, speak about their home country and exchange ideas with U.S. students, faculty and community organizations.

In his lecture, "Development of Agricultural Education, Research and Extension in the Agricultural Universities in Bangladesh: How Far We've Come and How Far We've Yet to Go," faculty and students with FVSU's College of Agriculture, Family Sciences and Technology learned about Bangladesh's progression in agricultural education and the need to expand their research facilities and collaborative efforts.

The professor and former head of agricultural economics at Bangladesh Agricultural University said land-grant universities like FVSU and UGA have their own Extension system to serve communities. He said the Bangladesh government oversees outreach programs, and as the growth rate increases, their priority is to make sustainable food production.

Rahman looks forward to potentially collaborating with FVSU on future research projects and plans to take back some Extension practices that could help build a better connection with farmers in his country.

In addition, Dr. Bipul Biswas, FVSU assistant professor of plant science, said Rahman's visit allowed students to see that the opportunities in agriculture are worldwide.

For more information about Fulbright lectures at FVSU, contact Biswas at (478) 825-6827 or biswasb@fvsu.edu.

Animal science graduate students present research at national conference

Fort Valley State University graduate students Tony Hazard, Kianna Lyte and Phaneendra Batchu (pictured from left) present their research at the 2019 Annual Meeting and Trade Show of the American Society of Animal Science (ASAS).

Fort Valley State University graduate students Tony Hazard, Kianna Lyte and Phaneendra Batchu (pictured from left) present their research at the 2019 Annual Meeting and Trade Show of the American Society of Animal Science (ASAS).

Three Fort Valley State University graduate students spent a week of summer break presenting their agricultural research at a national conference in Austin, Texas.

Animal science graduate students Kianna Lyte, Tony Hazard and Phaneendra Batchu gave poster presentations during the 2019 Annual Meeting and Trade Show of the American Society of Animal Science (ASAS) held July 8-11.

Lyte presented her research on "Effects of Substitution of Corn and Soybean Meal with Dried Distiller's Grain with Solubles (DDGS) in a Legume-Based Diet on Lamb Feed Intake, Body Weight Gain and Blood Metabolites." She will soon attend the Ross University School of Veterinary Medicine in Saint Kitts.

Hazard researched the "Effect of Feeding 'Serala' Sericea Lespedeza Hay on Indicators of Gastrointestinal Parasitism in Goats."

Batchu's presentation focused on "Diet and Preslaughter Stress Effects on Gut Microbial Populations and Meat Quality Characteristics in Goats."

"When our graduate students present their research at premier scientific conferences such as the American Society of Animal Science's national meeting, it helps them build confidence as researchers," said Dr. Thomas Terrill, a FVSU professor of animal science.

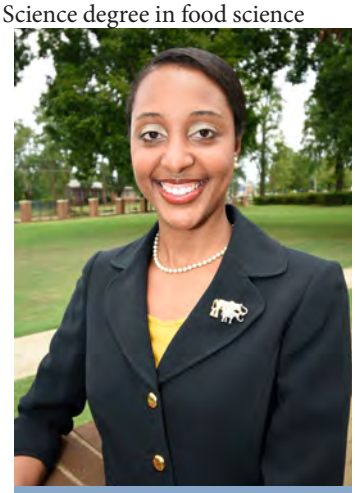
Terrill, also the coordinator of the Master of Science in Animal Science Program, said the students are able to make contacts for future job opportunities or further graduate work. "They demonstrate the excellence of agricultural research at FVSU to a national audience," he added.

The ASAS fosters the discovery, sharing and application of scientific knowledge concerning the care and responsible use of animals to enhance animal and human health and well-being. For more information, visit https://bit.ly/1niB0AD.

Family and Consumer Sciences Department welcomes Dr. Francine Hollis

Dr. Francine Hollis was recently appointed the chair and associate professor for Fort Valley State University's Family and Consumer Sciences (FACS) Department.

Hollis earned her Bachelor of Science degree in food science and technology from Alabama Agricultural and Mechanical University (Alabama A&M) in 2008. She also earned a doctorate degree in food science and technology with a concentration in sensory science from Cornell University in 2011.



Dr. Francine Hollis was recently appointed department chair for Family and Consumer Sciences at Fort Valley State University.

Since 2013, Hollis served as assistant professor and assessment coordinator in the department of food science at the University of Tennessee until accepting the position of department chair at FVSU.

The Huntsville, Alabama native is no stranger to FVSU. From 2012-2013 she served as an assistant professor in the FACS Department. The Cornell University alumna said her experiences at FVSU played a role in in her decision to return.

"I had a wonderful relationship with the individuals in the department, and I was able to see areas of opportunity where the department could grow while I was here. Now that I have acquired additional training and experience, I see it as a great opportunity to help the department reach higher levels of excellence in academic experiences and the training we provide to students," Hollis said.

Hollis said her primary goal is to heighten the department's effectiveness in three areas beginning with improving the academic experience for students. Secondly, she would like to improve core values with innovative programs and research. Thirdly, she aspires to enhance the department's community and global partnerships.

She emphasized how improving academic experiences, core values and global partnerships is critical for student retention, building and improving the reputation of the department, and showcasing FACS' impact and contributions to FVSU.

She also said that food, nutrition, health, financial planning, hospitality management and fashion design are some of the areas touched by FACS that can lead to unlimited career opportunities.

"Family and Consumer Sciences is and will continue to be a highly relevant area that crosses all fields. It's a field that involves looking at the science and art of individuals living and working in a complex environment," Hollis said.

Hollis is married to Rachad Hollis, and they are the parents of a son, Aiden.

For more information about FACS, call (478) 825-6234.

AGRICULTURAL RESEARCH STATION
FORT VALLEY STATE UNIVERSITY
1005 STATE UNIVERSITY DRIVE
FORT VALLEY, GEORGIA 31030-4313

FVSUag™

COLLEGE OF AGRICULTURE, FAMILY SCIENCES AND TECHNOLOGY

AG.FVSU.EDU

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the bases of race, color, national origin, age, disability, sex, gender identity, religion, reprisal and, where applicable, political beliefs, marital status, familial or parental status, sexual orientation, or all or part of an individual's income is derived from any public assistance program, or protected genetic information in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases will apply to all programs and/or employment activities.) If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html, or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter to us by mail at U.S. Department of Agriculture, Director, Office of Adjudication, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, by fax (202) 690-7442 or email at program.intake@usda.gov. Individuals who are deaf, hard of hearing, or have speech disabilities and wish to file either an EEO or program complaint please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish). Persons with disabilities who wish to file a program complaint, please see information above on how to contact us by mail directly or by email. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.) please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). USDA is an equal opportunity provider and employer. Fort Valley State University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award baccalaureate and master's degrees. Contact the Commission on Colleges at 1866 Southern Lane, Decatur, Georgia 30033-4097 or call 404-679-4500 for questions about the accreditation of Fort Valley State University. Fort Valley State University is an affirmative action, equal opportunity institution and does not discriminate against applicants, students or employees on the basis of race, gender, ethnicity, national origin, sexual orientation, religion, age, disability or marital or veteran status.