

Kennesaw State University

CSMCONNECT

KSU College of Science and Mathematics

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KSU Chemistry Researcher Receives NSF Grant

*Unraveling molecules advances understanding
of chemical and biological systems*

CSMConnect is the College of Science and Mathematics (CSM) biannual newsletter designed to keep you informed of the latest activities and developments going on in the college. CSM values the networks developed with partners on and off campus. You are important in our network of partners. CSM provides students a high quality and innovative academic experience through our six minor programs, seven undergraduate degrees, and three masters programs. Students can create their own learning experience through provided tracks, research, and specialized courses. CSM is soaring into the next level of national prominence through cutting-edge research.

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Dean's Message

Kennesaw State University and the College of Science and Mathematics commitment to student success and faculty research continues as confirmed with our Carnegie classification as a R2 institution, Doctoral University with high research activity. The Carnegie Classification developed almost fifty years ago is obtained from verifiable data in the study of higher education to represent institutional differences of research studies.

Faculty research plays an important role in the University's designation as an R2 institution. The College currently has over \$11 million in active grant awards, including support from the National Science Foundation, National Institute of Health, Department of Defense, Department of Education, and other private foundations. It is through these external grants and contracts that provide faculty the funding necessary to conduct their research.

The new designation recognizes the University's level of research activity among 135 institutions in the United States with the same R2 classification. CSM regularly strives to provide enhanced opportunities for our students. Our commitment to student success has never been stronger, and our focus efforts on systematically improving student success to increase retention, progression and graduation rates for majors in the science, technology, engineering and mathematics (STEM) disciplines. Target focused advising and learning communities enhance student accomplishments. Undergraduate research plays a role in improving student success and preparedness. CSM student undergraduate research involvement is often at graduate level experiences and provides students the opportunity to solve real-world problems. Student hands-on research experiences develop knowledge and skills needed to succeed after graduation. Outside of the normal classroom setting, students participate in summer research projects and presentations through both external and internal opportunities available to students. When students take advantage of these additional opportunities, they gain a sense of confidence in their abilities as researchers and in themselves.

In this issue of CSMConnect, we are excited to share stories of only a few of our dedicated faculty and student researchers making a difference in the studies of STEM. Stay connected as KSU rises to become a top national R2 institution!

Donald McGarey, Ph.D.
Interim Dean, College of Science and Mathematics



Campus Updates

*excerpts from Written by Whitten,
the blog of Pamela Whitten, President of Kennesaw State University*

2019 Freshman Class Sets Enrollment Record

As we began the fall semester at Kennesaw State, there were a lot more students to welcome to campus. That's because, at nearly 6,500 students, the Class of 2023 is the largest freshman class in KSU history, representing a 30+ percent increase from the fall 2018 class. This is an extraordinary message about Kennesaw State University.

Why did KSU shatter all freshman enrollment records this year? First and foremost, it is a reflection of the quality and dedication of the faculty and staff who strive to create a university that places students first. It's also about the students who are the heart of this university. KSU students have an infectious energy and spirit – as we saw during the opening of school events on both campuses – and that reputation makes Kennesaw State an attractive place for prospective students to live and learn.

Much of the credit for drawing new students to our campus goes to the stellar work of the team in Enrollment Services, led by Vice President Brenda Stopher. The staff has sought to stay at the forefront of ways to successfully recruit and retain an outstanding class of students at this University. Last year, we launched additional open houses, which allowed 4,200 prospective students to visit our campuses. This represents a 356% increase over the prior year. They obviously liked what they saw. They also liked what they learned concerning the opportunities at KSU thanks to efforts of Associate Vice President for Strategic Communications and Marketing Alice Wheelwright and her team, who have made it their mission to develop, enhance and advance KSU's reputation as an outstanding place to earn an education.

First Generation Success

Students always come first at Kennesaw State. Many times, these students also come to Kennesaw as the first in their families to attend college. While we strive to unleash the potential of all our students, KSU is being recognized more frequently as a leader in helping these first-generation students find success.

The most recent recognition came from NASPA - Student Affairs Administrators in Higher Education - and The Suder Foundation, which designated KSU as a First Forward institution, making us one of only 80 schools nationwide to share best practices for helping first-generation students succeed in college and beyond.

This designation reflects some of the effective initiatives for first-generation students conducted by KSU's University College and the Division of Student Affairs. Whether first-generation students take advantage of a living-learning community, student organizations or scholarship programs, they can benefit from elements KSU has designed specifically for them. Since more than one-third of our student-body are first-generation students, it is more important than ever that these resources are in place and accessible to help them succeed.

College Briefs

KSU breaks ground on Science Lab Annex

Kennesaw State University broke ground in April 2019 on a new \$5 million addition that will enable the College of Science and Mathematics to expand biology and chemistry course offerings to students on the University's Marietta Campus. The Science Lab Annex, a 10,411-square-foot addition to the current Engineering Lab Building, is located on the west side of the campus across from the Engineering Technology Center. It will house four, 24-seat labs – two chemistry and two biology – two prep rooms and office space.



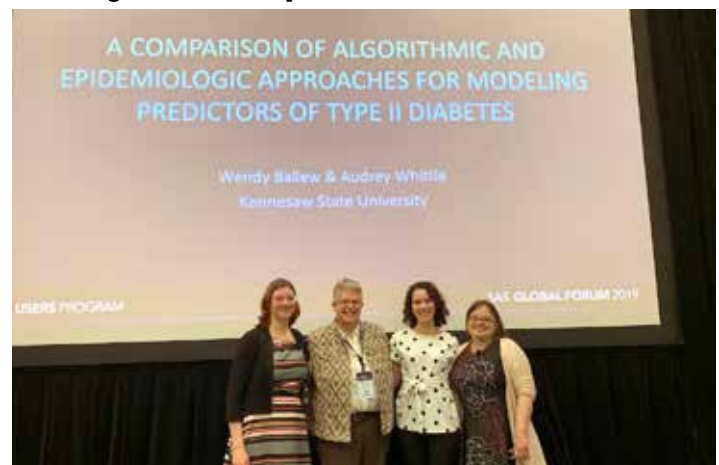
Biochemistry professor awarded NIH grant



Jonathan McMurry, professor of biochemistry at Kennesaw State, received a three-year \$395,000 grant from the National Institutes of Health in June 2019 to improve cell-penetrating peptide (CPP) technology. This is a renewal of McMurry's original grant, making it the eighth NIH award – totaling nearly \$2.5 million – that he has received since joining the KSU faculty in 2006. CPPs, short chains of amino acids, allow various molecules such as DNA or therapeutic proteins to enter cells to fight infection. Through his research, McMurry is finding ways to deliver specific biomolecular therapeutics to cells, efficiently and effectively, in an effort to combat disease.

KSU students take top honors in national analytics competition

A Kennesaw State student competition team earned second place in the SAS Student Symposium, a national analytics competition showcasing skills in the application of SAS Analytics in big data. The all-female team, named The Type III Errors, placed second in the SAS Student Symposium behind Oklahoma State University. The four-person team is composed of students Wendy Ballew, Rebekah Fallon, Audrey Whittle and Sharon Pearcey, and is led by faculty mentor and advisor Dr. Sherry Ni in CSM's Department of Statistics and Analytical Sciences.



Kennesaw State undergraduate researcher presents at Posters on the Hill



For the second consecutive year, a Kennesaw State University undergraduate researcher was selected to participate in Posters on the Hill in Washington, D.C. Jessica Castillo Reyes, one of two students from Georgia, was among a group of participants from 60 universities and colleges who presented to members of Congress, their staffs and other government officials on April 30. Reyes, a junior, shared her findings on how to support first-generation college students in the STEM (science, technology, engineering and mathematics) disciplines.

Planet Earth

Eight years ago in March 2011, the Fukushima Daiichi Nuclear Power Plant experienced a catastrophic meltdown caused by an earthquake and tsunami. When a hydrogen explosion rocked the plant's Unit 3 reactor, radioactive iodine and cesium spewed into the atmosphere, falling onto farmland in a nearby village. Daniel Ferreira, an assistant professor of environmental science, and Bharat Baruah, associate professor of chemistry and biochemistry, have been working to find a chemical extraction method that could overcome an intense chemical bond between vermiculite minerals and cesium in the soil and effectively cleanse the contaminated soil.



Gone Fishin'



Biology Professor Bill Ensign has been working with local governments over the past two decades monitoring local streams' ability to sustain aquatic life and to suggest ways to improve fish habitats. Ensign helps samples local streams with Cobb and Paulding County water authorities each summer. The sampling is mandated by the federal Clean Water Act, which requires monitoring for pollution to ensure water quality. He also looks at the kinds of fish out there and their relative abundance to get an idea of how healthy these streams happen to be.



Laser Focused

*KSU researcher awarded his first NSF grant
in plasma physics*

Kennesaw State University's Jeremy Gulley, associate professor of physics, has been awarded a three-year grant from the National Science Foundation/Department of Energy Partnership in Plasma Science and Engineering to study nanoscale laser optics.

Totaling more than \$116,000, this is Gulley's first NSF grant, which will cover his research to bridge the knowledge gap between two fields in optical physics – laser light propagation and the interaction between laser light and semiconductor nanowires. These are wires that are not visible through a conventional microscope.

According to Gulley, semiconductor wires, such as those used to make silicon transistors in computer chips, are highly prized in the electronics industry because their conductivity can be controlled, unlike metal wires such as copper. As electronic components, these semiconductor wires are increasingly shrinking in size, and as they do the behavior of the charged particles that carry the current changes dramatically.

"Even though you have the advantage of packing a lot of electronics in a very tiny space, the quantum physics behavior you begin to see is quite different from what we learn in introductory science classes," he said. "In particular, you cannot make a wire smaller than a string of atoms because the wires themselves are made of atoms."

Gulley's traditional research area has been in laser optics, more specifically what happens when powerful laser pulses are used to temporarily or permanently damage optical laboratory components. He collaborated with scientists at the Air Force Research Laboratory (AFRL) located at the Kirtland Air Force Base in Albuquerque, N.M., to perform such simulations with his calculations. His effort was funded by the U.S. Air Force as part of the Young Investigator Program and the Summer Faculty Fellowship Program.

As that funding was coming to an end, Gulley said he wanted to explore other avenues of research and found a common interest with another scientist at the Space Vehicles Directorate of AFRL, looking at how laser pulses would affect solids on the nanoscale, particularly the wires that might power optical sensors in satellites. The preliminary data for the NSF grant came out of this original work.

For his new nanoscale laser optics project, Gulley plans to write code and analyze numerical simulations with the help of KSU undergraduates in physics. He then hopes to bring this project to the experimental phase with his collaborators at the Air Force Research Laboratory in which his theoretical calculations would be compared to what is actually happening on a constructed nanowire array, a large arrangement of wires.

"I am thrilled about this NSF grant," said Gulley. "It gives me the opportunity to explore this area of research with undergraduates and expose them to a very important expanding field in both physics and optoelectronics."



KSU Chemistry Researcher Receives NSF Grant

Unraveling molecules advances understanding of chemical and biological systems

The National Science Foundation (NSF) has awarded a grant to Kennesaw State University researcher Martina Kaledin to unravel the molecules in hydrogen-bonded systems, using the University's supercomputer. The aim of the research is to contribute to the development of molecular dynamics computer simulation models, which advance scientists' understanding of chemical systems, as well as complex biological systems.

"Computational chemistry is an integral part of theoretical physical chemistry," said Kaledin, associate professor of chemistry. "Our students will receive training in computational chemistry methods through the NSF project. This is an exciting advancement for Kennesaw State."

Since every chemical element has a unique "signature," Kaledin will use the University's High-Performance Computing (HPC) cluster supercomputer to simulate and analyze the vibrational spectra displayed to help scientists better understand their observations. The HPC cluster is a set of computers networked together and designed for data-intensive computing.

Kaledin said the specific focus of her work is to study proton transfer in molecular clusters from gas-phase molecules, such as protonated water clusters, to the ion-molecular clusters which are present in the interstellar media, the space between the stars. Such chemical analysis can help scientists detect these molecules in interstellar space.

Chemists and biologists are interested in how protons move through complex chemical and biological environments. Computer simulations can probe the proton transfer mechanism using various computational methods.

One of the benefits of computational modeling is that it can be more cost-efficient and safer than traditional chemistry experiments, Kaledin explained, allowing researchers to predict the reactivity of certain compounds prior to running a chemistry experiment. The supercomputer simulations can provide a detailed microscopic view of atomic motions in molecular systems with chemical accuracy.

An important mission of this project is to train both undergraduate and graduate students. There will be special outreach to students from disadvantaged backgrounds or underrepresented groups, for example, through engagement with the Peach State Louis Stokes Alliances for Minority Participation (LSAMP) at Kennesaw State. The NSF grant will provide stipends to these students over the summer, and they will learn how to use molecular dynamics simulations to unravel the structure, dynamics and functions of certain molecular clusters.

“They will learn the principles of supercomputing, molecular modeling, interpretation of vibrational spectra and molecular visualization techniques, as well as how to analyze the energetics of chemical reactions,” she said.

Kaledin is also integrating elements of this NSF research project into her undergraduate and graduate courses, with the aim to improve science education and STEM students’ success.

“The computational modeling and simulations training for students helps to promote STEM literacy in our modern technology-driven society,” said Kaledin.

Funding for the \$232,892 NSF grant began Sept. 1 and runs through Aug. 31, 2022. research.

“The computational modeling and simulations training for students helps to promote STEM literacy in our modern technology-driven society.”



Research Potential

First KSU undergraduate to earn American Society for Microbiology fellowship

Kennesaw State University undergraduate Daisy McGrath would like to work in bioinformatics for the Centers for Disease Control and Prevention (CDC). She is one step closer to reaching that goal as the first KSU student and the only student from Georgia to receive a 2019-2020 Undergraduate Research Fellowship from the American Society for Microbiology.

McGrath, who is pursuing a bachelor's degree in biology with a biotechnology concentration and a minor in mathematics, is one of 20 students nationwide to receive this highly competitive fellowship this year.

The ASM fellowship provides McGrath the opportunity to pursue 10 weeks of full-time summer research at KSU with faculty mentor Tsai-Tien Tseng, associate professor of biology. McGrath received a stipend and travel support to the ASM Microbe Academy for Professional Development and the ASM Microbe Meeting, both in 2020.

“I feel extremely grateful to receive this national scholarship, and it makes me feel that the hard work is worth it,” said McGrath, who is from Milton, Ga. “The scholarship allows me to conduct research outside the traditional school year so I can spend more time to learn necessary skills for my career, as well as provide new insight into the ever-growing biological base of knowledge.”

Using specialized software and custom-built computers in Tseng's lab, McGrath is trying to identify the genetic composition of uncharacterized bacteriophages or phages (viruses that infect bacteria) in microbes of dairy-based homemade products such as nunu, fermented milk popular in West African countries. Since these naturally occurring biocontrol agents target specific strains, they could potentially be used in food safety applications and/or combat antibiotic resistance.

“These phages may become more ideal to use than chemicals to fight food contamination since they are natural enemies to bacteria and not harmful for human consumption,” she explained.

This research is a continuation of a project McGrath started last summer as a Birla Carbon Scholar, a scholarship program based in KSU's College of Science and Mathematics. She presented the preliminary results at the 2019 National Conference on Undergraduate Research, which was hosted by KSU, and also with Tseng at the recent 2019 ASM Microbe Meeting.

“I feel extremely grateful to receive this national scholarship, and it makes me feel that the hard work is worth it,” said McGrath

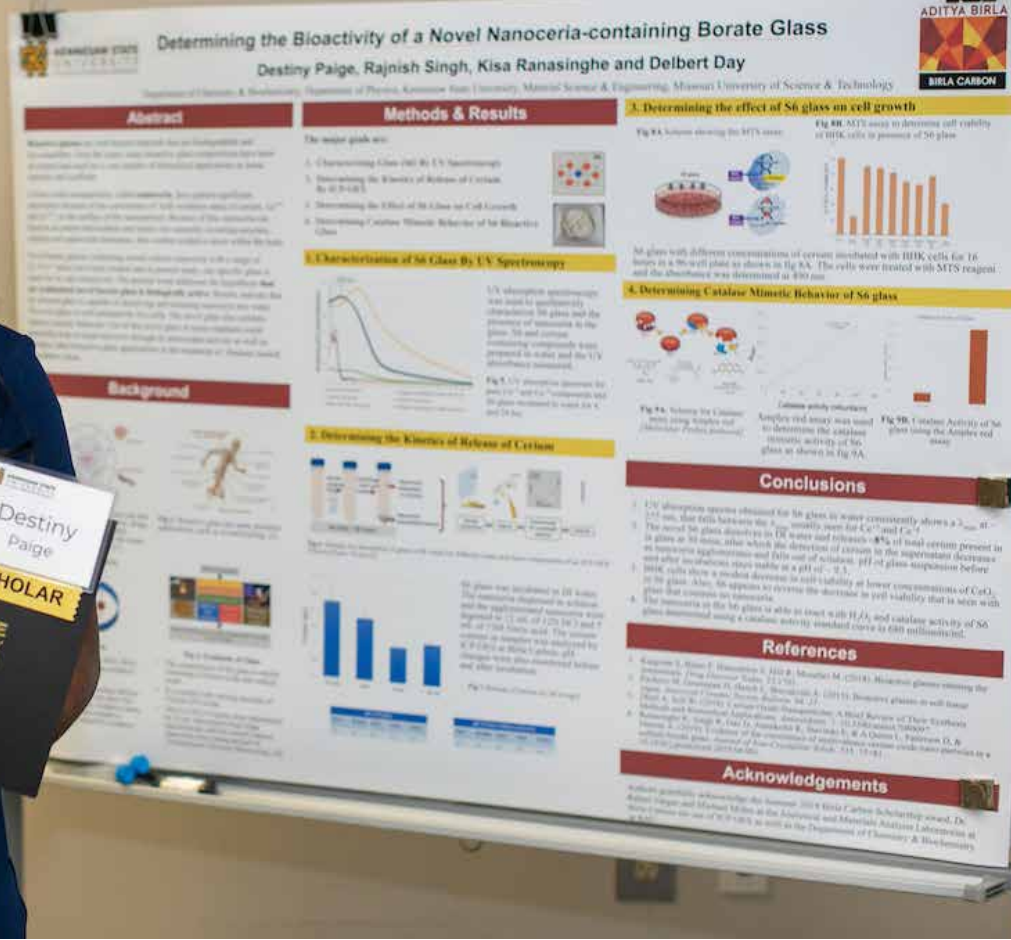
making the experience more enjoyable because I can see the different career paths I can take with bioinformatics,” she said.

McGrath, with guidance from Tseng, has also been accepted to KSU's accelerated bachelor's-master's program in integrative biology for fall semester. She is the University's first student enrolled in the accelerated graduate program, in which undergraduates take graduate-level courses during their senior years.

“I am very proud of Daisy, and I am very happy that I am able to put my own training and past experience in helping Daisy get this fellowship,” said Tseng. “My goal is to provide an environment to foster her intellectual curiosity and develop her research talents to become one of the best next-generation scientists in her field.”

McGrath said that she hopes this research will lead to a streamlined genetic sequencing methodology that can be used for detecting new phages to combat bacterial pathogens such as E. coli in other types of food.

“Undergraduate research has given me a whole different perspective on learning, changing my way of thinking and



KSU Recognizes Birla Carbon Scholars

Junior Destiny Paige wins top award during sixth annual symposium

Kennesaw State University junior Destiny Paige’s research into a new bioactive glass for use in tissue repair and drug delivery won the Top Poster Award at the Birla Carbon Symposium, at which the College of Science and Mathematics (CSM) officially recognized the 11 new Birla Carbon Scholars.

“Congratulations to all of our 11 Birla Carbon Scholars,” said Donald McGarey, the College’s interim dean. “The opportunity to work side-by-side with some of our most talented faculty members performing original research is one of the Birla Carbon Scholars partnership’s great strengths. We are thankful to Birla Carbon for their continuing support.”

In the spring, the College of Science and Mathematics selected 11 students to each receive a \$4,000 stipend to pursue their individual research interests during a unique 10-week summer program established by Birla Carbon.

In marking the sixth year of the scholars program, Birla Carbon increased the number of scholars to 11 from 10 and increased its pledge to \$275,000 to support the undergraduate research program in the College of Science and Mathematics (CSM) over a five-year period.

The applicants were chosen based on the recommendations of CSM faculty members, submission of an undergraduate research project abstract, and a GPA of 3.0 or higher. Recipients worked with their sponsoring faculty members on their proposed research projects, which this summer ran the gamut from green chemistry to muon tomography and from the identification of cardiac regulatory genes to forensic analysis of lead-free ammunition residue.

Since 2014, funding provided by the chemical manufacturer has allowed 61 Birla Carbon Scholars to participate in summer research opportunities.

This year's scholars and their faculty mentors include:

<u>Birla Carbon Scholar</u>	<u>Faculty Mentor</u>
Max Andrews	Anton Bryantsev
Braden Clinebell	Daniela Tapu
Robert Cronin	Chris Dockery
Tia Gordon	Kimberly Cortes
Rebekah Henneborn	Scott Nowak
Emma Henry	Jonathan McMurry
Tessa Jordan	Martin Hudson
Naza Okafor	Michael Stollenz
Destiny Paige	Rajnish Singh
Emma Pearson	David Joffe
Hunter Spivey	Thomas Leeper

The Birla Carbon Team judges awarded Paige, a biology major from Loganville, with the top prize for her research. In her experiment, Paige introduced a novel composition of bioactive glass containing mixed valence cerium oxide nanoparticles into hamster kidney cells. Bioactive glasses are well-known biodegradable and biocompatible materials.

“More research may ultimately lead to improved chemotherapy for diseases like atherosclerosis, cancer, heart failure, Alzheimer’s and Parkinson’s,” said Paige.

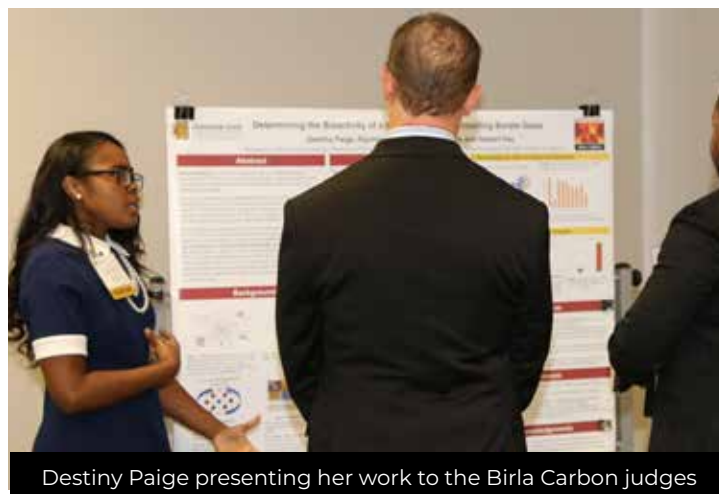
Along with the \$4,000 stipend each scholar received, Paige received an additional \$2,000 in travel funds to present her research at a national or regional conference of her choice.

About Birla Carbon:

Birla Carbon is the world’s largest producer and supplier of carbon black additives, which are used to make everything from tires to plastics, from paints to electronics. A flagship business of the \$44.3 billion Aditya Birla Group, the multinational conglomerate based in Taloja, India. Birla Carbon’s Technology Laboratories are located in Marietta and Taloja, India.



Destiny Paige working in Dr. Rajnish Singh's lab



Destiny Paige presenting her work to the Birla Carbon judges

Summer of Microbiomes

Student one of three selected nationwide for research program



Adriana Caldwell's face lights up when she talks about her favorite subject – fungi, bacteria, viruses – everything related to microbiology, her major at Kennesaw State University. Now she is spending the summer conducting microbial ecology research as one of only three students selected nationwide for a ten-week immersive Research Experiences for Undergraduates (REU) program at the University of Kansas.

Since late May, Caldwell has been participating in mentored research focused on the biodiversity of microbes in plant and soil ecosystems called microbiomes and how they can benefit agricultural production. As part of her research, she is working on microbiology ecology in prairies, an endangered ecosystem, and restoring the community of soil microbes and plants to its near-original state. The REU is sponsored by a team of researchers associated with a state-wide study of microbiomes that is funded by the National Science Foundation.

Caldwell, the only female and African-American student in this REU program, had the opportunity to work with two professors in ecology and evolutionary biology. Among the program's research and career development opportunities, she will receive one research course credit hour and participate in the

university-wide Summer Undergraduate Research Poster session at the end of July.

“I am so excited to be in this program and broaden my horizons in the microbiology field,” said Caldwell, of Stockbridge, Ga. “This summer is the perfect time for me to gain valuable experience before graduating in December when I start looking for jobs that often require some research-related experience.”

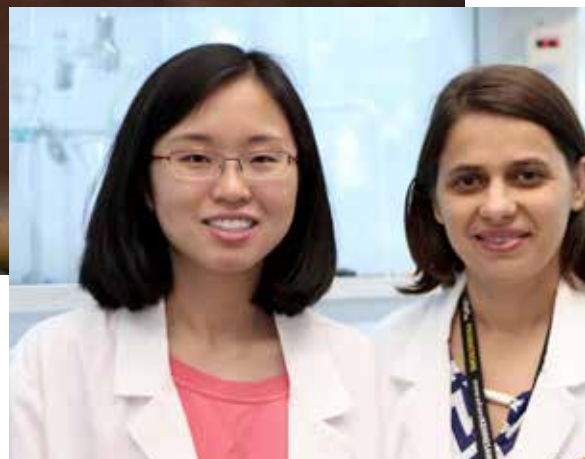
Caldwell first became involved in undergraduate research through her participation in the Peach State Louis Stokes Alliance for Minority Participation at KSU. She said that she was happy to find a faculty mentor, Chris Cornelison, a research scientist in biology, who shared her enthusiasm for microbiology.

Caldwell began working in Cornelison’s BioInnovation Laboratory in early 2018. Her research has focused on testing which agricultural wastes such as peanut or pecan shells would be best for cultivating varieties of commercially produced and locally foraged mushrooms. She presented this project in April at the 2019 National Conference on Undergraduate Research (NCUR) hosted by KSU.

“I now have a more profound appreciation of how microbiology affects every aspect of life and the hidden wonders of mycology (study of fungi) from research,” she said. “Dr. Cornelison is amazing to work with because he sees the bigger picture of what these microorganisms, which are everywhere, can really do to help plants, animals and us.”

Her love for microbes dates back to an Advanced Placement course in biology in high school when she became interested in diseases and how bacteria and viruses attack the human body. Caldwell said she would like to become a medical microbiologist to gain even more research experience before applying to medical school.

“Adriana is a highly driven and inquisitive undergraduate researcher who exemplifies what we do in the lab – use science to solve problems,” said Cornelison. “I expect her to take that motivation and passion for microbiology to the next level as she carves out a career to help people through research.”



Reagan Hooper and Dr. Daniela Tapu, Professor of

Birla Carbon Scholar pursues her passion

KSU alum takes wealth of experiences to graduate school

Reagan Hooper chose Kennesaw State University after visiting the chemistry department and meeting with several professors. She is now a graduate student in chemistry at Yale University with plans to eventually become a professor.

As an undergraduate student at KSU, Hooper's impressive ability in the chemistry lab led to her selection as a Birla Carbon Scholar. The Kennesaw State scholarship program currently provides 11 students with a \$4,000 stipend for summer research in science and mathematics. Each student works side-by-side with faculty researchers on projects dealing with topics from soil contamination to the evolution of appendages.

"I really loved my time at KSU and, especially, getting to work with chemistry professors Dr. Daniela Tapu and Dr. Martina Kaledin," she said.

"I worked with Dr. Tapu during my Birla Carbon scholarship summer, and it helped me form a great relationship with her," said Hooper, whose research involved synthesizing organic molecules called N-heterocyclic carbenes. "I know that Dr. Tapu will be a good mentor throughout my academic career."

Hooper said the Birla Carbon scholarship allowed her to pursue full-time research, solidifying her goal to go to graduate school.

"It pushed me to work harder, and, obviously, that looked good for my resume and for my hopes of getting into Yale," she said. "My research also resulted in an academic publication for me in the journal *Chemical Communications*, and that was exciting."

The Birla Carbon experience at KSU helped Hooper win admission to Yale, where she is a member of Yale's Holland Group laboratory. The group's research could one day lead to the development of a new way to produce nitrogen-based fertilizer by understanding how nature transforms nitrogen.

"We study the conversion of nitrogen in our atmosphere to ammonia that occurs in some types of little bacteria that live in the ground," said Hooper, who works in professor Pat Holland's lab at Yale.

Hooper explained these bacteria have an enzyme called nitrogenase, inside of which is an iron site where the nitrogen likely binds and is converted to ammonia.

"We are studying nitrogenase from an inorganic chemist's point of view. If we could find a way to do this conversion without relying on the bacteria, we could increase the production of ammonia without harming the environment," she explained. "This is important because ammonia is a vital building block for a lot of fertilizers that helps us grow the food that we need to support the growing population of the world."

Hooper said despite all her hard work and scholarships, she couldn't have accomplished anything without her family's support.

"I was raised in the mountains of North Georgia, where my mom is a hairdresser and my dad is a retired correctional officer," Hooper said. "And even though they didn't really understand my interest in science growing up, they always supported me. They bought me dinosaur figures and space books and gave me a microscope when I asked for one in the fifth grade."

"I would like to think my parents are proud of what I've done," she said. "They have sacrificed a lot to help me further my education. I still call my mom every night and give her a little overview of my day."



Chemistry



Growing Education

Student learning experiences are enhanced by contributions provided to the college to support our student scholarships; improve the margin of excellence; and support research endeavors and professorships to help Kennesaw State University provide a strong environment for recruitment and retention of promising faculty.

For philanthropic opportunities, contact Jada Marcum, CSM Senior Director of Development at jmarcum@kennesaw.edu or call 470-578-6877. Visit giving.kennesaw.edu for more information.

To donate to the college, visit bit.ly/GivetoCSM.



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