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Spring 2020

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Kennesaw State University, jwalls28@kennesaw.edu

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Recommended Citation

Walls, Joëlle, "Spring 2020" (2020). *The Investigator Research Magazine*. 2.
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The Investigator

RESEARCH MAGAZINE

SPRING 2020

Kennesaw State University



EXPLORING THE POSSIBILITIES OF RESEARCH

First-Year Scholars
Program launched

EXPANDING RESEARCH HORIZONS

President Pamela Whitten
shares lessons learned

FORMIDABLE R2 UNIVERSITY

Signature themes focus
KSU's research efforts
across all colleges



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Bill Diong, Associate Vice President for Research

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Mezi Mulugeta, Writer

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Marian Battle-Howard, Senior Graphic Designer

David Caselli, Photographer

Jason Getz, Photographer

Rob Witzel, Photographer

The Investigator Research Magazine (ISSN 2689-5862) is published by the Office of Research, with design and production provided by the Office of Strategic Communications and Marketing.


585 Cobb Avenue, MD 0111
Kennesaw, GA 30144
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On the Cover

EXPLORE THROUGH RESEARCH

David Jimenez always planned to participate in research during college but was not expecting to be able to begin until his sophomore or junior year. However, through the First-Year Scholars Program, he has been working in a research lab since he began at KSU in fall 2019.

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from the OFFICE OF RESEARCH



Dear readers,

We have experienced an incredible year of research growth and productivity at Kennesaw State University, including a 20% increase in external funding. With that momentum, the Office of Research has been developing programming to build a sustainable internal infrastructure for faculty, staff and students, while also strengthening and expanding connections with external partners. For example, the Office of Research Development and Strategic Initiatives was established last summer to stimulate innovation, capacity-building, and sustainability of interdisciplinary research and scholarly activity at KSU. One of the first initiatives launched was the Summer Research Fellows Program, an annual intensive professional development and mentoring program designed to help faculty successfully apply for research grants. In addition, recent changes to the sponsored programs infrastructure and the launch of Cayuse, a new comprehensive grants management system, will ensure a seamless operation between pre- and post-award services.

With KSU's elevation to R2 classification, we have also worked to envision the university's future through brainstorming sessions with faculty and leaders over the past year. Through this strategic planning process, the following research themes have been identified: Biomedical and Health Services, Computing and Technology, Sustainable and Safe Communities, and Human Development and Well-Being. New initiatives, such as research networking events, and funding opportunities, such as the Interdisciplinary Innovation Initiative, have been established around these signature themes. KSU's many research centers and institutes, including the A.L. Burruss Institute of Public Service and Research, the Analytics and Data Science Institute, and the newly created Institute for Cybersecurity Workforce Development, further enhance our interdisciplinary focus.

Most importantly, our faculty, staff and students are engaging in important areas of scholarship, making impactful discoveries. We invite you to explore this latest edition of The Investigator as we celebrate their accomplishments and ongoing efforts to improve the quality of life in our local communities and beyond.

Sincerely,

A handwritten signature in black ink that reads "PSCorso".

Dr. Phaedra Corso, Vice President for Research



Dear readers,

We are proud to present the spring issue of The Investigator, giving you an inside look into the varied research and scholarly activities taking place at Kennesaw State.

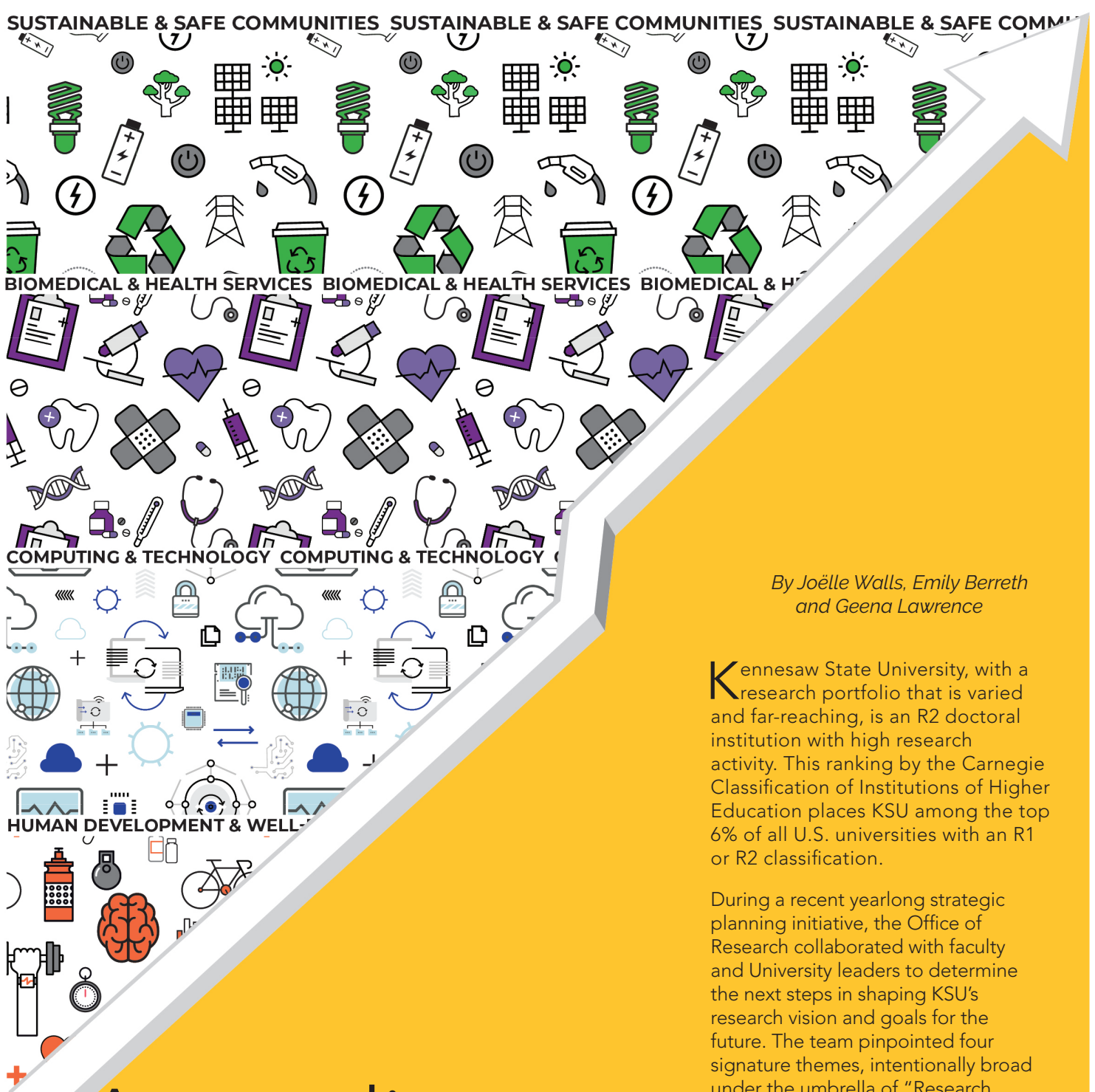
In a new interview, President Pamela Whitten discusses KSU's growing research reputation and lessons learned from her own experiences as a researcher and mentor. Similarly, our cover story follows three First-Year Scholars as they explore the possibilities of research in Martin Hudson's lab through a new Office of Undergraduate Research initiative.

This publication would not have been possible without the contributions of the editorial team, including undergraduates Kaelyn Ireland, Geena Lawrence, Landon Mion and Mezi Mulugeta, as well as the creative services team. They brought the stories of KSU's amazing researchers and scholars to life!

Happy reading!

A handwritten signature in black ink that reads "Joëlle Walls".

Joëlle Walls, Editor



*By Joëlle Walls, Emily Berreth
and Geena Lawrence*

Kennesaw State University, with a research portfolio that is varied and far-reaching, is an R2 doctoral institution with high research activity. This ranking by the Carnegie Classification of Institutions of Higher Education places KSU among the top 6% of all U.S. universities with an R1 or R2 classification.

During a recent yearlong strategic planning initiative, the Office of Research collaborated with faculty and University leaders to determine the next steps in shaping KSU's research vision and goals for the future. The team pinpointed four signature themes, intentionally broad under the umbrella of "Research with Relevance," so that individual colleges and units could develop their own strategic niches as well as opportunities for cross-disciplinary collaborations.

The KSU researchers featured in the following vignettes are already focusing their efforts in each of these areas – Sustainable and Safe Communities, Biomedical and Health Services, Computing and Technology, and Human Development and Well-Being – contributing meaningful impacts locally and beyond.

Ascending as a **Formidable R2 University**

Signature themes focus KSU's research efforts across all colleges



SUSTAINABLE AND SAFE COMMUNITIES

Energy-Efficient Eco-Factories

Global trends indicate that increasing energy demands, particularly in manufacturing, are bringing significant challenges to the forefront that must be addressed to ensure an environmentally friendly future while maintaining production rates that meet consumer needs.

That is why David Guerra-Zubiaga, assistant professor of mechatronics engineering in KSU's Southern Polytechnic College of Engineering and Engineering Technology, is exploring new methods and techniques to reduce energy consumption in manufacturing to support the next generation of sustainable eco-factories.

"It is important for young engineers to understand the need to improve productivity in manufacturing companies and make responsible decisions, contributing to a better place to live for the future," he said.

Guerra-Zubiaga's work has included examining diverse strategies in machining operations, using design of experiments to analyze important parameters in obtaining up to 15% energy reduction through the utilization of different machining strategies.

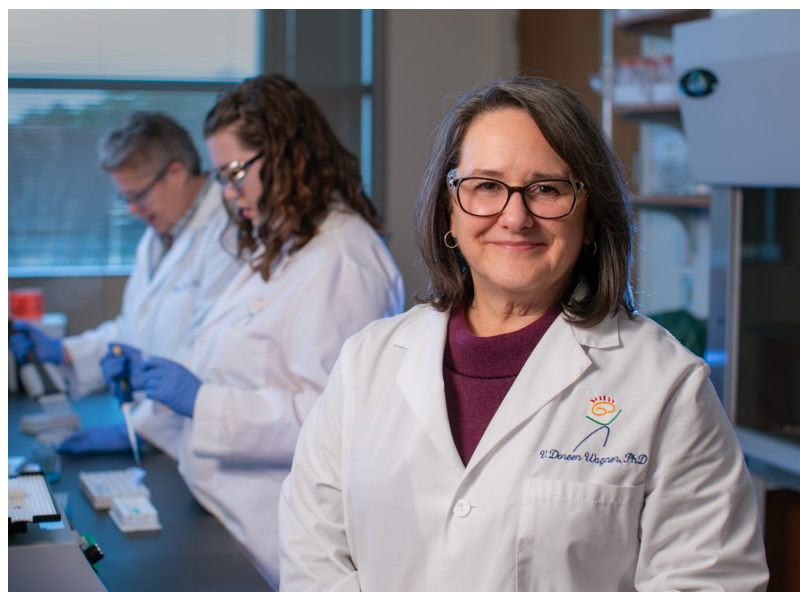
Design of experiments is a systematic method used to determine the relationship between factors affecting a process and the output of that process in order to optimize the output. Those results were published in the *International Journal of Computer Integrated Manufacturing* in 2018.

"Since manufacturing engineering encompasses a wide range of manufacturing processes, energy consumption is not only important in machining,

but also in manufacturing integrations processes," explained Guerra-Zubiaga. "My current research is trying to provide a new framework and strategies regarding the energy consumption of industrial robotics."

Graduate research assistant Kimberly Luong, who worked on this next phase in the fall, said that the amount of energy consumed by industrial robots make up about 8% of all energy consumed in the manufacturing process. With that, the number of new robot installations has risen exponentially, with at least 500,000 new robots being added each year.

Both researchers agree that their results – soon to be published – can have major impacts on both a company's profit margin and its sustainability level to continue producing goods at a given rate in an eco-friendly manner.



BIOMEDICAL AND HEALTH SERVICES

Stress-Free Brains

Doreen Wagner has over 35 years of experience in the health care field, ranging from perioperative staff nurse to patient safety system coordinator in the acute care setting. Now as professor of nursing in KSU's WellStar School of Nursing, she is most interested in researching the science of nursing.

"Furthering my education opened my mind to all that nurses can do – and it is a lot more than many nurses even recognize," she said. "But at the top of my

concerns are patient safety and keeping the patient as the primary focus in the delivery of nursing care.”

With that in mind, Wagner has been conducting research on the relationship between perioperative care and patient outcomes as related to the consequences of stress and anxiety caused by the trauma of surgery. Perioperative care refers to the care provided before and after surgery, the critical time to prepare patients both physically and psychologically.

“My research expertise is in the quantitative study of perioperative temperature regulation and the issues related to stress in the interactions between psychological processes and the nervous and immune systems,” she explained. “I also look at physiological biomarkers, such as the levels of cortisol, a hormone usually released into the bloodstream at times of stress to help our bodies respond to stress and danger.”

According to Wagner, post-operative delirium (confusion) is the most common post-operative complication in older adults, affecting up to 72% of surgical patients. Unplanned perioperative hypothermia, an unexpected core temperature decrease, is a common surgical complication that has been reported as a trigger for post-operative delirium.

Wagner’s recent study has illustrated for the first time the relationship between the two phenomena among adults undergoing non-cardiac surgery. She pointed out that since anesthesia and infections can cause delirium, especially in patients with higher risk factors, and certain types of anesthesia make delirium worse, it is important to conduct assessments.

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My research expertise is in the quantitative study of perioperative temperature regulation and the issues related to stress in the interactions between psychological processes and the nervous and immune systems.

— Doreen Wagner



COMPUTING AND TECHNOLOGY

Data-Driven Society

Every day, there are 2.5 quintillion bytes of data generated, from online purchases and patients’ digital records to emails and social media posts. By 2025, 49% of data in the world will be stored in public cloud-based platforms, according to the International Data Corporation.

When Reza Parizi, assistant professor of software engineering, began his career at KSU in 2017, he felt that there were untapped research opportunities to explore related to today’s fast-paced, data-driven world. He immediately created the Decentralized Science Lab (dSL) in the College of Computing and Software Engineering, a research hub composed of faculty, students and industry partners focusing on decentralized computing, a paradigm shift in data transfer and storage.

“Everything started with bitcoin!” he said. “The enabling technology behind bitcoin (known as blockchain technology) is fascinating and revolves around the idea of removing the person in the middle, and letting end users be in charge of handling transactions transparently.”

Parizi explained that blockchain, as one of the decentralization-enabling techniques, is a method for storing data in which individual data blocks are connected in chronological order, creating a chain of separate and therefore tamper-proof secure information. Unlike conventional data storage systems with a central location or control, these decentralized systems and software can only be accessed by the people who create and manage them.

For example, one of the lab projects KSU students are involved with focuses on the use of a decentralized authentication and security process for health care

practitioners and patients to access medical records within distributed hospital networks. If a patient switched doctors or transferred to a different hospital, this decentralized system makes it possible to retrieve the patient data from anywhere efficiently and securely.

"The dSL lab provides research and development-based solutions that bridge the gap between the current state of decentralized software and systems and a future in which mass adoption is possible," he said.



HUMAN DEVELOPMENT AND WELL-BEING

Impacting Public Health

Editor's Note: It is with our deepest sympathy that the Office of Research at KSU sadly reports the untimely passing of Louise Lawson, which occurred immediately prior to the publication of this magazine. The following vignette highlights the important contributions she and colleague Nicole Ferguson were making to public health research through statistical analysis. Dr. Lawson will be greatly missed by her family, friends, colleagues and students.

Louise Lawson, a professor in the Department of Statistics and Analytical Sciences prior to her passing, said that she discovered an interest and talent in researching human diseases and began conducting research full time for the first few years of her career as an epidemiologist.

“

The enabling technology behind bitcoin is fascinating and revolves around the idea of removing the person in the middle, and letting end users be in charge of handling transactions transparently.

— Reza Parizi

She soon missed teaching and was able to combine her interests when KSU offered such a position, and became director of the Human Studies Lab at KSU, a teaching and research computer laboratory conducting medical and other public health research.

The lab, co-directed by Nicole Ferguson, associate professor of statistics, was originally formed to explore questions related to growth in infants born prematurely. For research purposes, lab members have access to a large dataset of anonymous medical records for more than 1 million infants in neonatal intensive care units (NICUs) around the U.S., representing approximately 20% of all NICU records in the U.S.

"Our research is focused primarily on studying the treatment of diseases in humans. Our undergraduate and graduate students work with us in using statistical programs to analyze medical record data in order to describe trends or help make recommendations related to the research question," said Lawson. "We are using data to make a difference in human lives."

For example, the researchers were recently awarded more than \$300,000 by the Gerber Foundation to study classifications used to determine appropriateness of growth in premature infants and how these growth curves can predict which infants are most at risk. They plan to standardize the classifications, using epidemiological techniques to help better identify those infants most at risk.

In the past few years, the lab has partnered with additional external collaborators on projects such as studying pulmonary function in older adults.

"We have a great deal of flexibility to answer clinical questions as they arise," Lawson said. "We cannot make good decisions without good research."

EXPANDING RESEARCH HORIZONS

President Pamela Whitten shares lessons learned

By Joëlle Walls

Since Pamela Whitten became president in July 2018, Kennesaw State University has achieved significant milestones on its way to becoming a formidable presence in the research landscape of higher education.

In fall 2018, the Carnegie Classification of Institutions of Higher Education elevated KSU to an R2 designation as a doctoral institution with high research activity, the second-highest classification for research institutions in the country. The change in classification placed KSU among only 6% of universities to have the R1 or R2 designation.

Then, KSU served as the backdrop in spring 2019 for the National Conference on Undergraduate Research, with KSU being the first Georgia university to host the largest interdisciplinary event of its kind in the U.S.

The fall semester followed with the unveiling of KSU's refreshed institutional brand, including the increased focus on "Research with Relevance" as a university-wide touchstone to guide KSU's future. That renewed emphasis, combined with a yearlong strategic planning initiative led by the Office of Research, resulted in the emergence of four broad research themes: Biomedical and Health Services, Computing and Technology, Human Development and Well-Being, and Sustainable and Safe Communities.

In an interview with *The Investigator*, Whitten discussed KSU's growing research reputation and shared lessons learned from her own experiences as a researcher and mentor.



Q: What positive changes have you seen at KSU regarding research and scholarship?

A: There has been a trajectory in recent years pointing to the growing priority of conducting research and scholarship at KSU. Our status change to R2 in 2018 provided us with the formal external validation of what we were already doing and helped us look at new ways to move forward as a research university.

Tied to that recognition is the responsibility of creating the appropriate infrastructure and culture to support our faculty and students in their research and scholarly activities. I am happy that we recruited an exceptional vice president for research, Dr. Phaedra Corso, to lead those efforts. She not only has the vision and know-how to get the necessary everyday practical tasks completed, but also has the imagination and mindset to push past the limits and explore the possibilities in taking KSU to the next level.

We also started collaborating strategically in identifying KSU's interdisciplinary research themes and research productivity goals. The four themes identified are broad and versatile so that they can be applied to research efforts across all our colleges. It is important for this long-term planning to evolve as we continue data collection and dialogue with the colleges and departments about their current and potential strengths.

The four themes are key elements that match our mission to provide hands-on research experiences and opportunities for applied research discoveries, which can be immediately implemented in schools, hospitals, businesses and communities to improve the quality of people's lives.

Q: What excites you the most about the future trajectory of the university as a student-centered, research-driven R2 institution?

A: Being both student centered and research driven merges instruction with discovery in exciting ways at KSU. We are always student centered and always looking to improve the kinds of experiences we offer to our students. These experiences can range from engagement in the classroom with expert faculty scholars to engagement in the field through research teams, project-based learning and forums for sharing research, to name a few.

KSU is on a transformative path of growth and innovation to strengthen the academic opportunities for our undergraduate and graduate students while supporting our faculty scholars in their individual and collaborative work. Our goal at KSU is to create a strong, robust experience for our students and a

supportive infrastructure to facilitate faculty success – all while making discoveries that can be beneficial and impactful to society.

Q: What advice would you give to undergraduates who are interested in conducting research or who are currently engaged in research at KSU?

A: I would encourage students to start as early as possible to get the most out of their experiences. They should already network to find opportunities for research experience. Talking with their peers and professors about their ideas and interests can lead to meeting the right people. It will help them discover their real interests.

Q: What advice would you give graduate students who would like to pursue research and scholarship as a career in academia or industry?

A: I would give the same advice I gave for undergraduates. It is important to start early in order to obtain exceptional, robust experiences and to find ways to discover those opportunities. I encourage graduate students to network at conferences and related events and interact with professors with similar research interests or backgrounds. I would also recommend that the students play different roles on the continuum of research, ranging from selecting the initial idea and generating a hypothesis to designing the methodology and writing results of the data. Participating on grant-writing teams also prepares students on how to write proposals and how to find external funding to match their research interests.

Q: You are a researcher yourself. Would you mind sharing what you enjoy about research and any upcoming trends you see in your area of health care and technology?

A: Research is a rewarding, yet challenging, experience that allows you to investigate meaningful subjects and discover information and trends to better inform or find solutions. My area of focus has been telemedicine, which provides tremendous opportunity to help doctors and others achieve health care goals.

I believe the focus in health care and technology will be figuring out more effective ways to deliver health care options. This would include looking at more formalized methods of communication and technology solutions related to access that are cost-effective and demonstrate better health outcomes. With each passing year, more and more people are familiar with the technology that could make this a reality. Finding a balance between efficacy and affordability in health care access would be ideal.



Exploring the Possibilities of

RESEARCH

First-Year Scholars
Program launched

By Kaelyn Ireland and Geena Lawrence

The First-Year Scholars Program, established in fall 2019, is igniting students' interest in research by helping them connect with experienced faculty mentors. That is the reasoning behind the design of this unique program, according to Amy Buddie, director of undergraduate research at Kennesaw State.

"Studies suggest that early engagement in research is associated with positive outcomes, such as improved retention, progression, graduation rates and increased enrollment in graduate school," said Buddie, who is also a professor of psychology. "Students strengthen skills such as critical thinking, public speaking and writing."

For the past 15 years, KSU has provided opportunities for students to engage in mentored research and scholarship across disciplines and participate in all phases of the research process. Buddie said that it was logical to take the next step and expand the research experiences to focus on first-year students.

"We hope that this early undergraduate research experience will set the foundation for future success for these First-Year Scholars," she said. "The skills they are building now are more typically learned as juniors and seniors. This experience will be invaluable to them moving forward in their college careers."

Through a competitive process, the program pairs students with faculty mentors who guide them on research in their respective fields. The students, who each receive a stipend, serve as apprentices actively engaged in the faculty mentors' projects for a year, and present their results at the annual Symposium of Student Scholars at KSU in late spring.

Ten professors who were already involved in undergraduate research were chosen by Buddie for the pilot year. These professors come from various disciplines, ranging from art and design to exercise science and sport management. They also receive professional development funding to be used for their projects during the academic year.

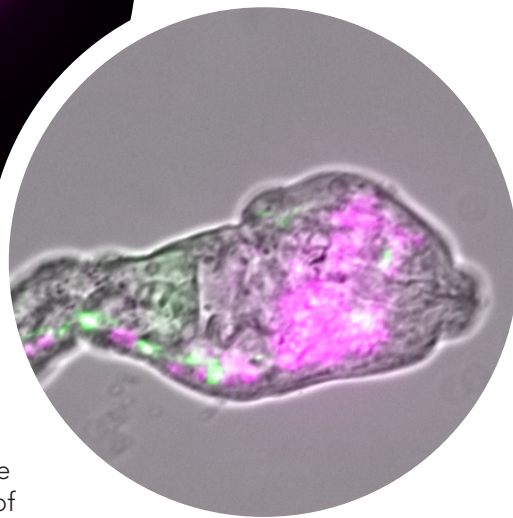
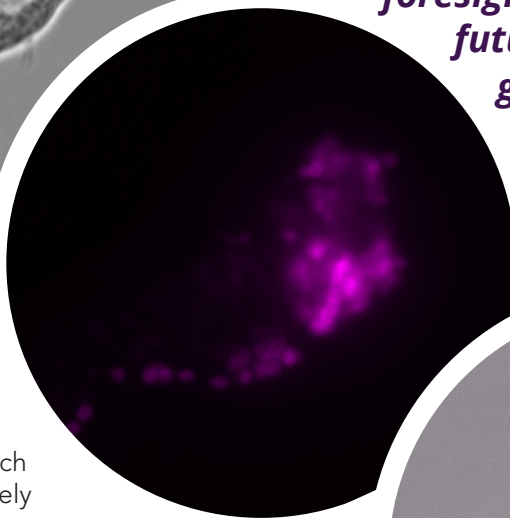
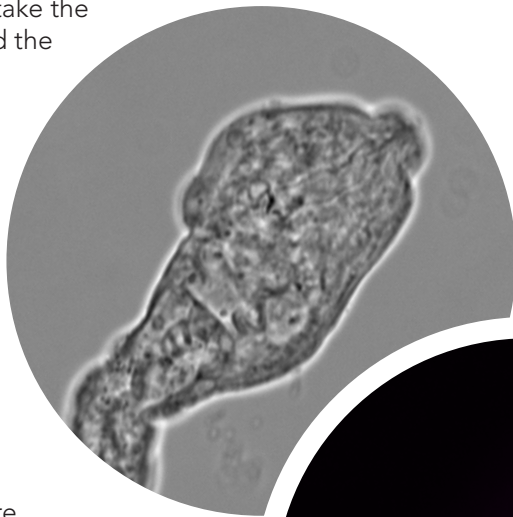
Martin Hudson, a popular mentor choice among the first-year students, is a neuroscientist studying nervous system development in nematodes (worms) and stem cells.

In the end, three applicants – Michaela Crego, a biochemistry major from Lilburn, Georgia; Lauren James, an environmental science major from Cumming, Georgia; and David Jimenez, a microbiology major from Eastanollee, Georgia – were chosen. There was only one problem: the First-Year Scholars Program could only fund one student per research mentor. Luckily, Hudson had a research grant that he was able to use to support the remaining two students.

“

I am happy with the resulting group, as they are diverse in terms of majors and talents, and they each bring something different to the laboratory. The First-Year Scholars demonstrate great passion for their work, as well as foresight about their future research goals.

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"I am happy with the resulting group, as they are diverse in terms of majors and talents, and they each bring something different to the laboratory. The First-Year Scholars demonstrate great passion for their work, as well as foresight about their future research goals," Hudson said.

For the First-Year Scholars Program, Hudson is currently focusing on two projects with his students. The projects include investigating how cells become neurons in the nervous system and how they navigate, making the right connections to communicate to other cells in the body. Transcription factors, proteins that bind to DNA and control which genes are transcribed into RNA, are crucially important to this process and are a major focus of Hudson's research.

Hudson conducts these studies with the hope of understanding the genetic origins behind human neurological disorders. He uses small nematodes, or worms known as *C. elegans*, which are extremely easy to maintain and perform genetic manipulations on, as a tool for his studies.

Worms share many of the same genes as humans, so information discovered about the worm can be applied to human systems. To study a worm's neurophysiology, he and his team use a noninvasive way of recording cellular activity via a high-end microscope and computer imaging.

Crego, who always knew she had a passion for biology, is responsible for taking pictures of the worms at different magnifications on the specialized microscope to get a better look since the *C. elegans* have transparent bodies and are only one millimeter in length.

"Learning some basics immediately grabbed my attention because there is so much more to learn with these worms than many people think," said Crego.

James said her favorite task is imaging worms that fluoresce different colors under the right conditions to observe the worm's inner workings highlighted by the colors.

"I feel that working in a lab has reaffirmed my desire to conduct research in my field of environmental science, and I will continue to seek out similar opportunities in the future," said James.



Michaela Crego, David Jimenez and Lauren James are gaining valuable undergraduate research experience in their first year at KSU.

Jimenez, who would like to pursue a doctorate in microbiology, prefers picking the worms, which takes patience and a very steady hand to accomplish quickly.

"I have always loved biology, but the First-Year Scholars Program opportunity took it to a new level," said Jimenez. "It was my first real experience looking into the unknown. I get to see things every day that 99% of people may never see in their lives. I find that amazing!"

Although Hudson has only worked with these students for one full semester thus far, he said he plans to challenge them more in the lab. By giving the students their own projects, they will be able to practice accountability and focus, two important traits of a researcher.

"I'm really interested in developing the next generation of scientists," said Hudson. "My philosophy is to start a research career early. Students are poised to gain more skills if they spend more time working in a laboratory. Some of these skills are rare in undergraduates and make them more competitive applicants should they choose to pursue a Ph.D."

THE OTHER PARTICIPANTS INCLUDE:

First-Year Scholar

Nathaniel Anderson
Ronit Barman
Anna Conroy
Cooper Freeman
Agazeet Haile
Nadia Moore
Anh Nguyen
Isabella Rosinko
Diana Salamaga

Major

mechanical engineering
computer science
exercise science
computer game design & development
anthropology
civil engineering
accounting
anthropology
civil engineering & architecture

Research Mentor

Ayse Tekes
Jennifer Willard
Garrett Hester
Rongkai Guo
Sohyun An
Giovanni Loreto
Darlene Rodriguez
Terry Powis
Philip Kiernan

DUAL ROLES

COLLEGE DEANS AS RESEARCHERS

SHAWN LONG

Organizational Communication Scientist



As dean of the College of Humanities and Social Sciences, Shawn Long must know how to communicate and build community within the largest college at Kennesaw State University.

His background in organizational communication and organizational science gives him the necessary dynamic perspective in leading an organization with a broad and varied range of disciplines and interests.

"Organizations are everywhere," he said. "We spend most of our adult lives in some form of organizations, which are dependent upon people interactions. Therefore, I am really concerned with the overall health and well-being of an organization and its citizens."

Long describes himself as a phenomenologist, a scientist who studies phenomena or observable events through the lived experiences of individuals interacting with those situations.

"My research area mainly focuses on the everyday practices and processes of communication and how those dynamics unfold in different areas, particularly when technology is involved," said Long, also a professor of communication.

According to the U.S. Bureau of Labor Statistics, over 26 million people are now working virtually at least part of the time, about 16% of the total workforce.

"We often look at the scholarship of virtual work, like most organizational studies, in a positive light rather than look at the germane, day-to-day routines that

are not necessarily always stitched together with happiness and prosperity," he said.

From studying open-ended survey questions to analyzing photographs of home-based offices, Long has found that virtual workers are often lonely and feeling isolated, as they are unengaged in the social interactions prevalent in face-to-face organizational culture.

"The informal organization is equally as powerful as, or more powerful than, the formal organization and virtual workers often miss out on those informal and relational communication opportunities with colleagues, supervisors and clients that make the workplace social interactions personally enjoyable and professionally advantageous," he said.

For example, Long explained that virtual workers are less likely to be promoted at the same rate as their face-to-face counterparts who are steadily climbing the corporate ladder. In comparison, the titles will change for virtual workers, but they are stuck on a horizontal platform, still doing the same work in the same way with not many options available for promotion.

Moreover, the perception of virtual workers, although changing since it is becoming a more commonplace trend, is flawed. Long found that many managers in organizations, such as high-tech and financial institutions, are rescinding virtual work opportunities because they feel that the employees are not being as productive or are taking advantage of the system.

Long recommends that managers put forth more investment in their employees, providing a robust support infrastructure and communication portal between the face-to-face and remote workers. Managers need to be more transparent to virtual workers about job expectations and promotions.

"My favorite part of the research is how the virtual workers are very much interested in my projects," said Long. "If I can contribute to the larger conversation, then I am doing my job, not as a disciplinary scholar but as a researcher who is making a difference."

By Joëlle Walls

IAN FERGUSON

Engineer, Physicist and Materials Science Researcher



Throughout his electrical engineering career, Ian Ferguson has operated under the philosophical framework that lifelong learning is paramount when tackling problems that are becoming increasingly complex, requiring both an analytical mindset and a creative spirit. In his case, it's also an appreciation for the poetic word.

"I wanted to be a professor since I was 12, even though I did not know what that entailed at the time," Ferguson said. "Now I understand that it is about the journey. The sense of success comes from the ability to work with multiple people in multiple different places through shared goals to achieve the innovations you hope will improve the quality of our lives."

Ferguson joined KSU as dean of the Southern Polytechnic College of Engineering and Engineering Technology last summer. His plans include growing the interdisciplinary focus of research and graduating more integrated engineers who can impact the changing profession from many different perspectives.

"I tell people I have a research expertise, but my expertise is research," he said. "Even in research, you must be willing to continue learning and exploring everything so you can take your research in new directions."

A physicist by training, Ferguson has spent more than two decades moving fluidly between academia and industry on two continents. He describes his research as "innovation in device functionality through materials research."

Ferguson controls the flow of electrons through a device or circuit made up of compound semiconductor material, such as gallium nitride or zinc oxide, in the development of devices ranging from detectors and sensors to light-emitting diodes (LEDs) and solar cells.

The arrangement of atoms in the solid material, usually crystalline structures, helps determine the material's physical characteristics. Small traces of impurities can have a dramatic effect on the semiconductors' electrical and optical properties, allowing for customization to a specific need.

"Early in my career, we used various techniques to build these structures, creating layers in different ways," he said. "But often what was unique about these materials was that we were synthesizing crystals or structures that do not exist in nature but can still have some type of functionality, either defined by something specific to the material itself, in the material structure, or a very simple device structure."

Ferguson is most interested in the next generation – compound semiconductors – with faster-moving electrons, resulting in higher processing speeds with less energy consumption. They are already used as power amplifiers for smartphones and other wireless devices. These materials and devices have formed the backbone of new solid-state lighting sources that are now prevalent in the marketplace.

"The continuity you can see throughout my research career has been possible because I use a problem-based approach – moving in and through problems," he said.

Today, Ferguson's work has moved toward controlling the spin of electrons in compound semiconductor materials and devices at variable temperatures within an emerging field called spintronics, which has applications for new information-processing technologies, such as quantum computing.

"As an experimentalist, I have been able to employ a more general creative process," Ferguson said. "It does not matter where you started in your educational journey, but it matters what you do."



A LAND OF RESEARCH OPPORTUNITY

*KSU Field Station offers
interdisciplinary options*

By Landon Mion

The Kennesaw State University Field Station, a 25-acre property 2 miles from the Kennesaw campus, offers an outdoor space for interdisciplinary research opportunities and a living learning laboratory for researchers, educators and students.

"Most universities have some space for research – oftentimes natural settings for the agricultural sciences," said Field Station Operations Manager Michael Blackwell.

"However, this property, with a flexible landscape of diverse areas, can provide infinite possibilities for multidisciplinary projects."

The site officially opened last summer under the auspices of the Office of Research. The Field Station is also a member of the Organization of Biological Field Stations, a nonprofit organization supporting environmental research, education and public understanding.

"We hosted an open house at the end of last year to start building up campus awareness about the potential for faculty and students to think in broader terms how their projects and research interests can be amplified by integrating the Field Station into their work," he said. "I encourage the KSU community to visit us, and I welcome the opportunity to discuss promising research ideas with faculty and students from all disciplines."

The KSU Field Station is currently supporting research activities ranging from forensic anthropology to biotechnology applications. In line with KSU's research goals, the following projects are already using the resources of the Field Station to advance their disciplines and contribute to communities at large.

SAVING THE AMERICAN CHESTNUT

The surprising discovery of two wild American chestnut trees at the KSU Field Station was the catalyst for a new area of research in conservation. Known as the “eastern redwood,” almost 4 billion American chestnut trees once covered the eastern U.S. The near extinction of this tree, caused by a fungal disease introduced to the U.S. in the early 1900s, was the most dramatic biological and environmental disaster of the 20th century.

“American chestnut trees provided a huge benefit to the United States,” said Kyle Gabriel, a research scientist in KSU’s BioInnovation Laboratory. “In addition to their importance to wildlife, they also supported the livelihood of many Americans by providing a source of hardwood for furniture and housing, and their nuts as a plentiful food source.”

Teaming up with Blackwell, the two received a grant from The American Chestnut Foundation (TACF), which originally confirmed the identification of the trees through genetic testing. Their grant is to explore innovative biotechnologies to improve the survival of laboratory-propagated plantlets developed for disease resistance. They have also just started a collaboration with TACF to plant a blight-resistant American chestnut orchard at the Field Station for future restoration efforts.

AUTOMATED MUSHROOM PRODUCTION

The American Mushroom Institute reported that mushroom sales accounted for more than \$1.2 billion in U.S. economic impact, with over 929 million pounds produced in 2017 alone. Now Gabriel is using innovative technology to help expand the opportunities for mushroom production in unlikely places, such as urban environments and nonarable lands.

“Mushrooms provide unique nutritional, medicinal and economic benefits, yet their demand still exceeds their supply. We are developing tools to cultivate mushrooms in any environment by utilizing insulated, environmentally controlled shipping containers that can be transported by land, sea and air,” he said. “We’re also utilizing low-value agricultural wastes, such as inedible plant materials, as growth substrates to boost both profitability and sustainability.”

Gabriel first began mushroom cultivation as a hobby when he was an undergraduate. He created a cultivation chamber in his closet with a rudimentary hardware and software system he developed to automate the process of mushroom growth.

The current version of the automated mushroom production process is taking place in a shipping container at the KSU Field Station. Gabriel

designed the embedded environmental control system with software he developed, called Mycodo, which can autonomously monitor and regulate the growing conditions for mushrooms – temperature, humidity and carbon dioxide concentrations.

FORENSIC ANTHROPOLOGY FIELD LAB

Alice Gooding, forensic anthropologist for the state of Georgia, connects her professional experiences to her current position as assistant professor of anthropology at KSU. Her latest initiative is the opening of the Forensic Anthropology Field Lab (FAFL) at the Field Station.





FAFL includes a variety of open, wooded and underground environments to facilitate cutting-edge research and training in clandestine grave recovery.

"The goals of FAFL include providing training and education to current KSU students as well as professional training for law enforcement and medical examiners in our local area and across the state," said Gooding. "We also conduct research related to forensic anthropology."

Gooding plans to teach a class on forensic anthropology field techniques at the Field Station. This course will expose students to the role of forensic anthropology in the investigation and recovery of clandestine burials. The FAFL research activities will also include an experiential learning component in which undergraduates can play an integral role in the research process for academic credit and/or experience.

"One of our first projects will involve testing some methods that are used to find possible burial sites," she said. "These methods can be used above the ground to test whether there are anomalies in the soil to determine if there is something underneath prior to digging."

URBANIZATION AND THE IMPACT ON STARLINGS

Integrative behavioral ecologist Sarah Guindre-Parker is interested in the adaptability of animals when faced with unpredictable environmental challenges. New

types of food sources or habitats found in urban settings, for example, can provide wildlife with these essential benefits but also introduce new risks.

As assistant professor in the Department of Ecology, Evolution and Organismal Biology, Guindre-Parker and her students have set up a colony of bird nest boxes for European starlings at the KSU Field Station. The team will be able to monitor behavior and reproductive success in an urban agricultural setting compared with primarily urban or agricultural sites.

Guindre-Parker explained that starlings are convenient to study because they are common pests known to readily take up residence in human-made boxes. This bird is also found in many diverse habitats, making it possible to examine how factors such as food scarcity or weather patterns affect the breeding and survival of birds and other animals.

Although starlings are not of conservation concern, insight from this research will provide a basic understanding of how city life affects wildlife.

"By studying European starlings, I can answer general questions about how urbanization and novel environmental challenges influence birds in the hopes that results from my research on European starlings can help us build more sustainable cities for other species of birds as well," she said.



NANO MATERIALS BY DESIGN

Inorganic chemist
recognized
for his research

By Heather Hankins

Altug Poyraz studies nanomaterials in the broad areas of inorganic materials design, synthesis and characterization. For these efforts, his research is getting attention at the university and national levels.

In fall 2019, Poyraz, assistant professor of inorganic chemistry, was recognized for his research contributions at Kennesaw State's John C. Salerno Memorial Research Symposium. In his second time presenting at the symposium, Poyraz earned the John C. Salerno Prize for Research Achievement.

"The symposium is a great opportunity for us to share our recent research with other faculty and students," he said. "More than anything, recognition of my research by my peers is a great motivation for me and my research students. It shows us that we are headed in the right direction in terms of conducting impactful research at KSU."

Showcasing a cross-section of KSU faculty research, the symposium was launched in 2018 to honor the academic legacy of Salerno, the Neel Distinguished Chair in Biotechnology, prior to his death in 2015.

Poyraz discussed his work on cathodes, the positive end of the battery. He and his research group explored innovative cathode materials using functional nanomaterials, such as transition metal oxides, as part of their goal to develop functional nanomaterials with controlled physicochemical, structural and morphological (form) properties.

He explained that the research has implications for many battery applications, such as grid-scale energy

storage and other rechargeable battery systems.

Now he is looking into petroleum-based research thanks to an American Chemical Society Petroleum Research Fund grant. The award provides seed money to recipients to initiate new research directions, including funding for equipment and supporting undergraduate and graduate students.

Poyraz's expertise in transition metal oxides will be used to inform his research group in the synthesis of nanoporous carbon materials from petroleum coke, a byproduct of the heavy-fuel upgrading process in oil refineries. He said such carbon and carbon-based nanomaterials are increasingly gaining popularity in many areas of science and engineering.

"Petroleum-derived research goes beyond energy research into chemical manufacturing research, which affects many aspects of everyday life," said Poyraz. "This grant will allow me to gain the experience to expand my research into these new areas and pursue related funding opportunities."

Poyraz has already enhanced his research repertoire for finding funding by participating in the 2019 Summer Research Fellows Program, a new Office of Research initiative to support faculty in pursuit of external funding.

"KSU provides a great environment for early-career faculty and students who like to do research by providing support, funding and encouragement," he said.

Beyond THE DESKTOP

RESEARCH COMPUTING RESOURCES SUPPORT COMPLEX PROJECTS

By Heather Hankins

Kennesaw State University is home to the High-Performance Computing (HPC) cluster, which supports various research projects conducted by faculty and students. The specialized technology resources and technical expertise are coordinated by a partnership between the Office of the Chief Information Officer (CIO) and the Vice President for Information Technology, as well as the Office of the Vice President for Research.

The HPC cluster is a collection of separate servers interconnected on an isolated, fast network. One main computer manages the users' data and software and schedules user jobs across more than 50 individual computers that are performing the computational tasks. Currently, over 150 researchers use these nodes configured for central processing unit intensive computation, high memory computation and graphics processing unit computation.

This shared resource is freely available to all KSU faculty and their designees engaged in research activities. Researchers with grant awards can partner

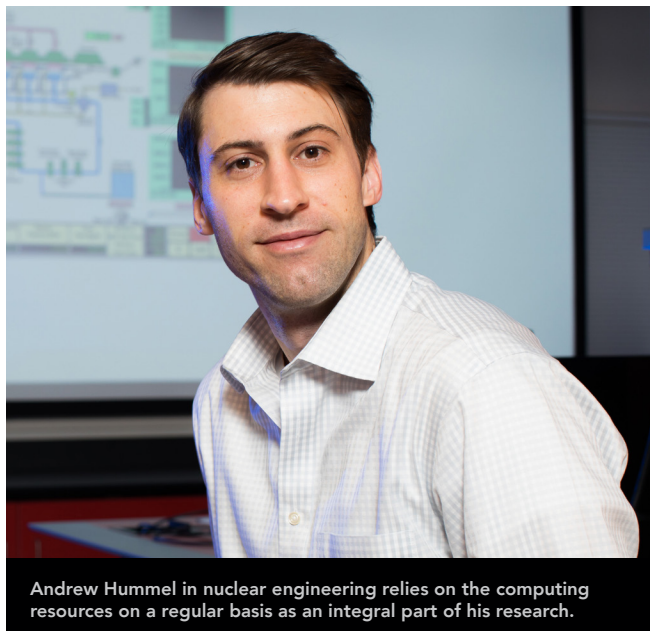
with University Information Technology Services (UITs) to acquire HPC nodes for either their sole access or inclusion into the general pool.

"My goal is to assist researchers in their use of computation resources able to construct, analyze and interpret their complex data. For me, supporting research could mean anything from offering individualized training to new users, to helping procure new software, to writing custom code for special projects," said Tom Boyle, research computing coordinator in the Office of Research. "I am excited to be part of a service that is monitored and maintained by dedicated HPC staff members so KSU researchers can use their time to focus on their primary research."

Andrew Hummel, assistant professor of nuclear engineering, is part of the Nuclear Energy, Science, and Engineering Laboratory (NESEL) at KSU. He is currently using the supercomputer in the development of a microreactor concept for deployment to remote areas.

He explained that microreactors are the size of a large trashcan and can produce several megawatts of power, making them easily portable to remote sites, such as military bases, where the existing infrastructure may not support the power demands of larger reactors.

"My team, as well as several national labs and private companies, is developing practical designs that balance low costs, ease of manufacturing and, most importantly for nuclear energy, robust safety feedback mechanisms," he said.



Andrew Hummel in nuclear engineering relies on the computing resources on a regular basis as an integral part of his research.

A key part of this reactor modeling is the use of the Monte Carlo N-Particle Transport (MCNP) code, an open source code developed by the Los Alamos National Laboratory.

This code is included on the HPC cluster and enables Hummel and his team to track many particle types, such as photons and neutrons, over broad ranges of energies. Hummel pointed out that many iterations must be run in order to bring the results to acceptable levels due to the probabilistic nature of the code.

"Having access to a massive parallel and robust HPC system reduces the computation time needed, and allows for many independent simulations to run simultaneously," he explained. "Therefore, NESEL research requires an HPC system to be successful."

NESEL is composed of four faculty, each with a different specialty, and more than a dozen students. They use the research computing resources on a regular basis since their research areas require high-speed processing of complex computations.

"Everyone at the research computing center has been incredibly helpful and responsive to my needs as a researcher. They are quick to obtain new software licenses and install whatever packages the students or faculty need," said Hummel. "This interdisciplinary resource has only enhanced the possibilities of the types of computational calculations we can do."

Martina Kaledin, associate professor of chemistry at KSU, is also using the University's supercomputer as an integral component of her research. As a computational chemist with training in theoretical physical chemistry, she uses the supercomputer to calculate and analyze vibrational spectra of small gas-phase molecules in hydrogen-bonded systems.

These simulations require exact descriptions of atomic interactions derived from multiple sources, including numerical methods, commercially available software and program codes developed in Kaledin's laboratory.

"Modeling and simulation are extremely important tools in the chemical sciences. Adequate computing resources enable us to solve computational problems of different sizes and complexity," Kaledin said. "Investment in the computational resources at our institution improves the competitiveness and science leadership of KSU to conduct fundamental research."

Kaledin also uses the HPC cluster in the classroom in which students learn about computational chemistry methods, the Linux operating system and the basics of supercomputing. She also leads directed applied

research courses in which students receive training in computational chemistry methods, run simulations on the HPC system, analyze and visualize data, and write research reports for publication in a variety of peer-reviewed journals.

"Developed computational chemistry skills, with the assistance of the HPC cluster, will enhance students' skills and abilities essential for their research opportunities," she said. "Students who worked with me either pursue graduate studies or careers as pharmacists, pediatric dentists or research scientists in national laboratories."



Martina Kaledin's recent NSF grant for her computational chemistry project includes using the University's supercomputer.

A recent National Science Foundation grant will help further Kaledin's research in contributing to the development of molecular-dynamics computer simulation models, which in turn advance scientists' understanding of chemical and biological systems. The funding includes stipends for undergraduate and graduate students who receive training in computational chemistry methods as they conduct research.

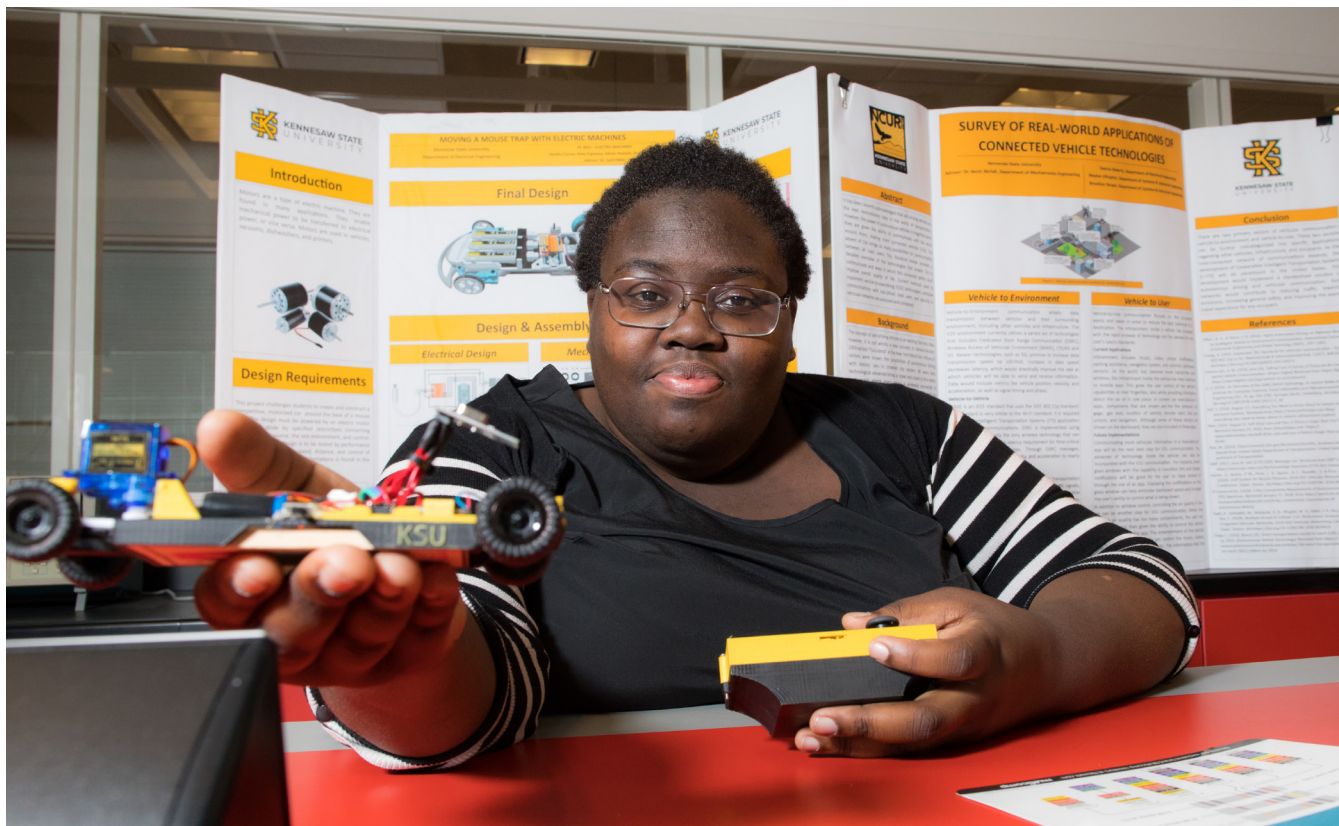
"This project and others like it allow students to work on interdisciplinary research that combines computer science with the physical sciences," she said. "Such experiences can prepare students for any career."

Since its original funding by the Office of the CIO in 2013, the HPC cluster has been maintained and improved upon through continued CIO funding and from end-of-year proposals for University funds. In fall 2019, 15 new computer nodes were added to support student- and classroom-based research.



NSF grant to fund engineering scholarships

By Joëlle Walls



Kennesaw State University was awarded a \$997,000, five-year grant from the National Science Foundation (NSF) to improve gender diversity among the institution's engineering programs and to increase degree success for academically talented students with demonstrated financial need.

Led by Lori Lowder, assistant dean for accreditation and assessment in KSU's Southern Polytechnic College of Engineering and Engineering Technology (SPCEET), the grant will fund scholarships for first- and third-year engineering majors. Wraparound services will support the students, who will participate in academic and co-curricular activities.

"Not only do we want our students to gain hands-on experiences that will make them better engineers, but we also want to create a more inclusive academic environment that takes shape around those experiences," said Lowder.

The grant was made possible through NSF's Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) program, which aims to increase the recruitment, retention and graduation of high-achieving, low-income students in STEM through financial and programmatic support. The S-STEM program will build upon several successful programs already in place at KSU. The grant will also support STEM outreach efforts, networking opportunities with industry partners and undergraduate research experiences facilitated by SPCEET faculty.

The other co-investigators include Chan Ham, department chair for mechatronics engineering; Renee Butler, associate dean for academic affairs; Tris Utschig, director for scholarly teaching in KSU's Center for Excellence in Teaching and Learning; and Valmiki Sooklal, associate professor of mechanical engineering.



Researcher studies the effectiveness of active learning classrooms

By Geena Lawrence

Tiffany Roman, assistant professor of instructional technology in the Bagwell College of Education (BCOE), is interested in creating classroom spaces that allow children to be active, engaged learners. Roman works with graduate research assistant Candice Taylor to research how students and teachers interact in an active learning space and how teaching and learning is shaped according to the affordances available within a given learning environment.

"An active learning space includes the interactions between learners and instructors, which are facilitated through technologies or other objects that can be moved around or rearranged to create a variety of environments for different types of learning," said Roman. "Active learning is an environment that creates and supports collaboration, group work and movement."



Roman's extensive research on active learning spaces when she was in graduate school inspired her to apply for an Active Learning Grant from the Steelcase Corporation, a grant that would provide furniture, tools and on-site services to install such a classroom at a school. Roman reached out to her former student, Taylor, who currently serves as the science instructional coach at Marietta Middle School, and the school principal, Dayton Hibbs, about partnering on this project.

"As a researcher, I really believe in empowering K-12 teachers and giving back to students at Title I schools as a means of supporting partnerships with our community members," explained Roman. "Marietta Middle School was the perfect partner for this project because of its proximity to Kennesaw State, its lack of active learning spaces for science classes, and its existing partnerships with Bagwell

for student teaching and field experiences for undergraduate pre-service teachers."

In May 2019, Marietta Middle School was awarded \$67,000 from the Steelcase Corporation, one of only 12 recipients selected out of almost 1,000 applicants. The active learning space was installed over the summer within an eighth grade physical science/English as a second language (ESOL) classroom.

"The goal for this two-year research project is to see how learners, particularly English language learners, engage with peers, teachers, and the physical affordances of an Active Learning Classroom (ALC) within a STEM learning environment and what student learning gains are made, if any, through the intervention of an ALC redesign," Roman said.

With Taylor, who is currently pursuing an education specialist


degree at KSU, research data will be collected through a variety of measures, including in-person observations, existing student test scores, interviews with the lead teacher and videos of the students interacting within the new learning space, to examine how their learning experiences within the space and academic achievement are impacted.

"We are so grateful for the opportunity to investigate the impact of not only the active learning space itself on our eighth grade physical science students, but also how the space, paired with the elements of quality three-dimensional science instruction, sets the stage for increased student collaboration, communication, and active thinking and learning," said Taylor, who previously earned a master's degree in education from KSU.



Interdisciplinary Team Makes Waves In Phytoplankton Monitoring

By Kaelyn Ireland



Undergraduate research continues to expand through interdisciplinary opportunities at Kennesaw State University. One example is an impactful project that was headed by Lisa Adams, who previously served as associate professor of biology and biology education at KSU.

In fall 2019, Adams, also the associate director of the University Honors Program, brought together seven Honors students from three different majors in the STEM fields (science, technology, engineering and mathematics) for a project-based research course she developed and taught.

"I am fascinated by our dependence on water and everything that lives in it, from floating phytoplankton to fish, so I thought it would be an amazing learning experience for students to get out of the classroom and investigate the condition of a nearby body of water that has been impacted by development," said Adams.

Adams, along with biology majors Julia Aguirre, Maitri Patel, Grace Fatoyinbo, and Courtney Johnson and environmental science major Riley Spruiell, have been monitoring the water quality of Stadium Lake, taking samples each week. The local reservoir is located behind Fifth Third Bank Stadium on the Kennesaw campus.

Students on the monitoring team said they have enjoyed applying knowledge gained in their other classes as well as learning new skills. Several agreed that one of the interesting parts of working on this research has been the opportunity to see organisms, described in other classes, appear in the collected water samples.

The team was virtually trained by the National Oceanic and Atmospheric Administration's Phytoplankton Monitoring Network (PMN) to identify specific photosynthetic microorganisms that live in the water, including blue-green algae, that can be potentially harmful – or even deadly – to animals that ingest them. As a result, Stadium Lake became Georgia's first freshwater PMN site.

"We are witnessing our inland bodies of water suffering from harmful algae blooms more frequently as our summers get warmer and we continue to develop our land and fertilize our lawns," explained Adams.

The team saw evidence of the changing climate during the first sampling session at Stadium Lake after their PMN training. They were able to recognize the blue-green algae bloom and communicate the potential danger to the appropriate authorities so that signs were installed near the lake, warning people and their pets to avoid contact with the water.

To tackle challenges associated with sharing and visualizing the data, Adams also recruited computer science majors Wade Kaiser and Francis Littig. As part of the project-based research course, they worked on improving the data-entry features of SPLASSH, a crowdsourcing platform about water, under the direction of Adams, founder and project lead.

The team's research poster abstract, listing the students as co-authors, was accepted for presentation at the Ocean Sciences Meeting held in February.



FALSE ALARM?



By Geena Lawrence

The people of Hawaii woke up on a Saturday morning in 2018 to disturbing news – take cover from an incoming missile. However, it was inaccurate because the wrong button was pressed, causing the emergency alert system to become compromised. Now Hawaiians face the fear of not knowing which alerts are credible.

Amy Woszczynski and Andy Green from the Coles College of Business are working together to research the pitfalls caused by unreliable emergency alerts such as the Hawaii incident.

“Some emergency alert systems have an easily identifiable vulnerability that can be exploited for malicious intent because the system is managed through a publicly accessible online portal,” said Green, lecturer of information security and assurance. “People rely on the trustworthiness of the messages sent and on the systems to work as intended, when necessary. So having these systems publicly exposed on the internet is an unnecessary risk.”

To complete this research, Kelly Dodson and Peter Easton, who were pursuing bachelor’s degrees in information security and assurance, counted the number of systems that were publicly accessible and checked each link to verify the results. The two, now alumni, also analyzed top technology firms’ websites to review what protocols were already in place so that similar protections could be implemented for all systems.

One way to safeguard the emergency alert systems is to publish a policy on Coordinated Vulnerability Disclosure, a process by which individuals can report software vulnerabilities to the appropriate managers of the alert systems.

“The intent of this research is to encourage and recommend policies, such as Coordinated Vulnerability Disclosure, to be required and put in place to protect the data in the systems,” said Woszczynski, professor of information systems. “It is also crucial that the policies provide strategies for anyone to report these security issues without any legal repercussions and to prevent false alerts in the future.”

Two articles were published on this research in top peer-reviewed journals, *Government Information Quarterly* and *Communications of the Association of Information Systems*. Both professors hope their ongoing research will help address some of the larger issues brought on by these cybersecurity challenges.



EDUCATING beyond the NEST

By Landon Mion

“Being an educator led me to want to study my research methods and figure out which ones are the most effective.”



Geography professor Vanessa Slinger-Friedman employs unique learning experiences with more student engagement through the Scholarship of Teaching and Learning (SoTL), a growing body of research in higher education that addresses teaching practices. SoTL is a systematic approach for educators to evaluate different teaching methods, or pedagogies, to deliver impactful instruction and share the results of this research in peer-reviewed publications.

For those efforts, Slinger-Friedman received the 2016 Regents' Scholarship of Teaching and Learning Award, one of the highest honors for faculty at Georgia colleges and universities.

“Being an educator led me to want to study my research methods and figure out which ones are the most effective,” said Slinger-Friedman. “I saw the anecdotal impact of being intentional in my teaching when I created dynamic learning environments conducive to active participation and engagement in experiential opportunities.”

To promote such engagement, Slinger-Friedman has implemented activity-based field trips into her geography courses at Kennesaw State. In her course on local and global sustainability, she has taken her students to various sites that promote sustainability practices. They have visited West Rock Recycling facility, Keep Cobb Beautiful, and Southface Institute, a nonprofit organization that leads sustainability initiatives in the built environment.

Currently, Slinger-Friedman has teamed up with Jason Rhodes, lecturer of geography, to work with students to design and create a food forest at the KSU Field Station. A food forest is a constructed ecosystem of edible plants to match the conditions and diversity of natural ecosystems.

The development of the 1/8-acre food forest provides the addition of a living learning lab for relevant courses taught across multiple KSU departments, demonstrating the possibilities of sustainable food production to mitigate climate change and promote food security.

“By utilizing SoTL, I have been able to bring environmental education for sustainable development to my students in a more meaningful way,” Slinger-Friedman explained. “My ultimate goal is to enable my students to see how they can get involved and how they can become stakeholders and change-makers in sustainability issues by experiencing and assessing the practice of sustainability in a number of real-world contexts.”



College celebrates

"Research in the Arts"

By Kaelyn Ireland

Last fall, the College of the Arts (COTA) launched the "Research in the Arts" initiative, in which a variety of events were established through COTA's new Research Advisory Board, chaired by Philip Kiernan, associate professor of art history.

For example, Anjan Chatterjee from the Penn Center for Neuroaesthetics recently gave "The Aesthetic Brain" lecture, discussing his groundbreaking research on the connection between art appreciation and the brain. The first Kennesaw State University Research in the Arts Colloquium was held in November, showcasing KSU faculty research, combining the traditionally distinctive arts and sciences.

Andrea Knowlton, assistant professor of dance, presented how she infuses her dance and film with science and technology. Her 2013 work "Influential Body" incorporated wearable electronics to produce a live sound score to accompany the choreography produced by the dancers' movements. Knowlton said working with the technology presented some challenges; the music produced by the movement had to be as pleasing as the visual effects.

"When we go outside of our bubble and open our minds to information and inspiration from different genres, we open ourselves to new processes and approaches," she said.

"It is these cross-disciplinary conversations that really fuel me as an artist."

That is why undergraduate research is also an integral part of the COTA curriculum. Students can share original art-based research at undergraduate research forums, held twice a year.

"The goal is to mentor and support students so that they may then present at off-campus professional conferences, such as the National Conference on Undergraduate Research (NCUR)," said Jessica Stephenson, COTA interim associate dean and professor of art history. She added that over 150 COTA students participated in NCUR events last year at KSU.

Sydney Everett, a theatre and performance studies major from Macon, is one of 19 COTA students who had abstracts accepted for presentation at NCUR 2020. She first presented her work on late 19th-century fashion, particularly on the significance of bustles, at an undergraduate research forum.

"These projects allow students to combine skills, and often multiple disciplines, to create new works of art and art scholarship that would not be the same without these influences," said Stephenson.





Statistically speaking at R Day

By Kaelyn Ireland

"Do y'all play video games?" was the question Christen Knight posed to attendees as they glanced at her poster during R Day 2019, which showcased the flexibility and diversity of student analytics and data science work at Kennesaw State University.

Knight, a recent psychology graduate from Euahlee, Georgia, then followed up with asking about the attendees' favorite video games, and one popular answer was shooter games, a subgenre of action video games. She became interested in studying video games after learning that many of her dance students, who are in their early adolescence, preferred mature titles such as Call of Duty.

Knight looked at the age and content ratings established by the Entertainment Software Rating Board for high-selling games, as well as evaluating critic and player ratings. Based on rank data, she found that shooter games were the most popular genre, followed by role-playing games (RPGs), with a tie between action and racing games.

Knight, who earned a minor in statistics, said she was proud to present the data with new research methods she learned in the first undergraduate course of its kind offered at KSU: Nonparametric Statistical Methods. She plans to return to KSU to enroll in the master's program for applied statistics and analytics.

For Kara Heller of Canton, Georgia, her corporate analysis internship at Cobb Electric Membership

Corporation (EMC) provided her with the research idea she ultimately pursued. Cobb EMC wanted to identify electric vehicle owners so the company could market its NiteFlex plan, a time-of-day plan that provides free electrical power between midnight and 6 a.m., to these customers.

Heller, who graduated in December with a bachelor's degree in computational and applied mathematics, created a model to predict whether customers owned electric cars, with 76% accuracy. She explained that through targeted marketing to these customers to shift power usage to "off-peak" times, less power may be needed at "peak" times. This would prevent the need to bring additional higher-cost power-generation facilities online to meet peak needs and would save Cobb EMC money, which they could pass on to the customer.

Heller, who placed third in the undergraduate poster category at R Day, is eager to continue her career as an analyst and said one possibility would be to continue working in utilities.

The Department of Statistics and Analytical Sciences hosts the R Day event every year, in which undergraduate and graduate students deliver research presentations on a variety of topics, united by their utilization of the commonly used open-source statistical software called R.



During the R Day awards ceremony, Kara Heller (left) was recognized by Cheryl Pressley from the Southern Company, one of the event sponsors.



KSU and Cobb County Safety Village to partner on technology safety program

By Emily Berreth

In an exciting new collaboration, Kennesaw State's Southern Polytechnic College of Engineering and Engineering Technology is partnering with the Cobb County Safety Village (CCSV) to develop a student-designed living research lab that will be used to support technology research by both faculty and students.

Billy Kihei, assistant professor of computer engineering at KSU, will lead the efforts to develop opportunities for both students and faculty to create a technology-safety learning area at the CCSV. Some areas of interest include drone safety, electronics safety and battery safety. He said the three-year project will have cross-college support, with the first key faculty partner already identified: Sanjeev Adhikari, assistant professor of construction management in the College of Architecture and Construction Management.

"The final installation is envisioned to be a KSU-branded tiny home that is student-generated inside and out. We want to give our architecture students the opportunity to influence the design and construction, and our engineering students to build solar and water systems," explained Kihei. "Business students can produce marketing materials, while computer and

software engineering students can create virtual reality or augmented reality experiences for visitors, and that's just the beginning."

In addition, KSU collaborators will work with Allison Carter, CCSV director, to explore the possibility of using the village as a testing location for training artificial intelligence algorithms through interdisciplinary research involving engineering, data science/analytics and computer science.

"I am very excited about this collaboration with KSU and professor Kihei and engaging another age group of students to learn at the safety village," said Carter. "As we already educate second and fourth graders in Cobb at the Safety Village, we can now expand our reach. This will be a unique project to add to our safety village and will provide ideas for other villages to consider."

The CCSV, located in Marietta, is comprised of reduced-scale buildings and streets, which are part of the learning experience for various safety programs. Using a hands-on approach, the Safety Village offers citizens the chance to learn how to protect themselves and others from accidental death, injury or destruction of property.





Johns Creek native Alex Resnick is still an undergraduate, but he has already received a job offer from a nuclear consulting company.

"Engineering, like research, is all about problem-solving," he said. "A lot of what the nuclear consulting company liked about my application and resume was that I had high-level research experience. The company really liked that because the job requires not only the content knowledge, but also the critical thinking and creativity necessary in finding solutions."

As a senior mechanical engineering major, he has been conducting research regarding the use of a laser 3D printing system to create carbon nanostructures, known for exceptional structural stability and durability. He said that these structures may help advance the development of future products, such as wearable devices and flexible electronics.

Resnick emphasized the importance of his research by comparing it to the industrial revolution in which steel manufacturing methods were enhanced to allow for mass production. Steel, consisting of iron and other elements, such as carbon, can now be found in just about everything.

"Carbon nanostructures are the next major material," said Resnick. "In the next 10-15 years, graphene, found in carbon nanostructures, will be in all cell phones and other electronics as a result of graphene's electrical and thermal conductivity properties that currently exceed the standards of what is found in the market today."

Resnick won the Best Oral Presentation Award in STEM for this project at the Georgia Undergraduate

Research Conference, a regional multidisciplinary conference held in the fall. His research was also accepted for presentation at the 2019 and 2020 National Conference on Undergraduate Research.

"There are few opportunities for undergraduate students to really challenge themselves to better understand the world," he said. "Undergraduate research opens the door and shows the way to further possibilities in graduate school and beyond."

Resnick attributes his initial involvement in undergraduate research at Kennesaw State to Eduardo Farfán, professor of nuclear engineering. Farfán suggested Resnick join his nuclear research group after doing well in his class. Resnick then met his soon-to-be faculty mentor, Jungkyu (Justin) Park, assistant professor of mechanical engineering.

"Dr. Park is one of the few professors who will actually sit down and work with you," said Resnick. "The impact of a good faculty mentor cannot be understated, as it makes or breaks the student researcher."

In the three years the two engineers have worked together, Resnick has published multiple papers, attended numerous professional conferences and toured the U.S.

"Alex published two papers in peer-reviewed journals that are highly rated in the area of nuclear research," said Park. "On one paper, Alex was the first author; I believe this is very rare as an undergraduate student."



By Mezi Mulugeta

Lynn Sladek strives to teach about the potential risks that come with pregnancy. When she served in the military in health care administration, she became interested in maternal health and wanted to become a care provider, assuming she would be a nurse midwife. After the military, Sladek enrolled in the WellStar School of Nursing at Kennesaw State University and took Yenupini Joyce Adams' women and health class, which changed her outlook.

"It was like my whole world opened up because I realized it is not just by providing direct patient care that I can help influence maternal health outcomes," she said. "There is this whole other world of research where I can be an influence, and I was really called to that."

Sladek, who recently graduated, approached Adams, assistant professor of nursing, after the course finished to express how she inspired her. During that conversation, Sladek learned of Adams' research on Ghanaian midwifery, particularly assessing the midwives' depth and breadth of knowledge of postpartum complications.

"I am happy to hear that the class opened Lynn's eyes to the possibility of doing research and influencing policy," Adams said.

At the center of Sladek's research is a quest to improve the quality of care provided to women after childbirth. In their study, 246 Ghanaian midwives who worked in four hospitals providing inpatient maternity services, responded to questions assessing their knowledge. Sladek focused on one section – postpartum risks and care – to determine the degree to which that knowledge plays a role in the decision-making process for providing treatment.

"Dr. Adams' assessment is based on the 'three delays framework,' in which (1) delays in deciding to seek help, (2) delays in reaching a health care facility and (3) delays in providing adequate care to patients, can lead to maternal deaths," explained Sladek. "The number one indicator for an adverse maternal outcome is any delay in seeking and receiving treatment."

She hopes that targeted interventions to reduce the number of health care providers in Ghana with minimal knowledge of postpartum complications will translate into a decline in Ghana's maternal mortality ratio, which may be applicable in other countries.

"Specifically, this topic falls under maternal mortality, and so even though the research takes place in Ghana, we have a lot to learn in the U.S. as well," Sladek said. "Although Ghana's maternal mortality ratio is declining at an insufficient rate of 1%, it is declining, unlike the maternal mortality ratio in the U.S., which is increasing. We have so much to learn and to research because there are huge gaps in maternal health research."

Sladek, whose abstract was accepted for presentation at the 2020 National Conference on Undergraduate Research, added that this project is a great opportunity to spread awareness and potential solutions on postpartum complications, the leading cause of maternal deaths worldwide, most of which are preventable.

Sladek's aspirations include pursuing a career as a nurse researcher.





FABRICS

Flexible Architectural Basis Reinforcement in Concrete Structures

By Joëlle Walls with contributions from Jennifer Harb

I really love the culture at Kennesaw State," said Nadia Moore, a sophomore from Dunwoody, Georgia, who is pursuing a degree in civil engineering with an architecture minor.

In a short time at the university, Moore has been building up her academic resume, putting her on the path to a solid career in structural engineering.

Attending a seminar about research on the Marietta campus put her in contact with Amy Buddie, the director of KSU's Office of Undergraduate Research, who worked with her one-on-one to find a mentor. She ultimately applied and was accepted into the First-Year Scholars Program.

"Nadia's application stood out among many for her passion, interest, and commitment," said Giovanni Loreto, assistant professor of architecture who serves as her research mentor.

Moore currently participates in a research project on novel construction materials led by Loreto, exploring the possibilities of a more sustainable, low-cost approach in the production of concrete structures. Traditional methods involve a wood formwork, a permanent or temporary mold into which concrete is poured, which results in the usual rigid concrete structures found in most buildings and homes.

"Instead of wood, we use materials such as fabric in a concrete formwork, which creates some really cool shapes and curves that you would not normally see in concrete," she explained.

"The texture is also different, and the fabric formwork creates non-rigid structures because of its high flexibility."

"You learn a lot through research. For example, from one day of research on this project, I learned much more about concrete than I ever had before," she said. "So I am really excited to learn about the different aspects of structural engineering and getting to see the architecture because, as a civil engineer, I do not get to see much architecture."

Moore acknowledges that her two biggest KSU influences thus far have been Loreto and Roneisha Worthy, assistant professor in civil and construction engineering. Since Moore was interested in a major that would include more of the design aspects, Worthy suggested that she consider switching majors from environmental to civil engineering.

Loreto, a structural engineer with an architectural foundation, convinced her to obtain a minor in architecture in order to be a well-rounded industry professional.

"Nadia brought an incredible energy into my research group, and I am happy to see her hard work being recognized in national venues like the National Conference on Undergraduate Research," said Loreto.

"This project especially made me love civil engineering," added Moore. "I cannot wait to do it for the rest of my life!"



U.K. Musical Aesthetic

By Geena Lawrence

Danny Howes has more than 30 years of experience as a musician, touring internationally as a guitarist in multiple bands. He brings this unique global background to his research and his classes as the associate director and senior lecturer for the Joel A. Katz Music and Entertainment Business Program (MEBUS) in the Coles College of Business.

Howes, also a recent graduate of the Master of Arts in Integrated Global Communication program (MAIGC) at Kennesaw State, has been researching the global flow of U.K. entertainment media and how the U.S. is influenced by those media messages.

"Through doors opened by Joel Katz and the MEBUS program, I have been fortunate to lead the London study abroad trips in which MEBUS students have the opportunity to explore England's rich musical heritage from the perspective of the entertainment business," said Howes. "During those trips, and during my MAIGC research in the U.K., I was able to add to my research with interviews from a wide variety of entertainment industry professionals."

The impressive list of interviewees included executives, academics and entrepreneurs, such as veteran "Abbey Road" producer Tony Clark and Sony Music branding guru Fred Bolza.

Howes said that he began his research with the idea of "reverse colonialism," or reverse media flow, in which media created in the U.K. is exported for consumption in the U.S. From his interviews, he found that many Americans are fascinated with the media from the U.K.

because it is immensely different from what the U.S. produces in terms of film, television and music.

"As a U.S. musician who has always loved British music, my research became specifically about the U.K. musical aesthetic, which is something to marvel at considering the many decades of 'British invasions' and the diversity of musicians ranging from the Beatles to Ed Sheeran," he said. "Their music not only inspires their fans, but also touches upon their own stories about growing up in such a unique country."

Through his research, Howes hopes to show that music is much more than entertainment. Music is embedded with cultural values and local meanings, as well as national identity. In this way, musical expression can help increase awareness of other cultures, which allows people to have a better understanding of one another.

Howes is continually inspired by working with MEBUS students and is excited to share his unique global music industry perspective. He plans to involve his students in future entertainment research projects.

"It is invaluable for students to become involved with research opportunities so they do not get stuck on a vertical staircase toward graduation, because research can also spark a passion for learning," he said. "For humanity to move forward, you must examine things and find out why they happen. The 'why' question is very important to answer because it gives us the power to make a difference."



RESEARCH FOR THE WIN!

By Landon Mion

Jessica Rudd, a doctoral student in analytics and data science, shocked her competition of friends and family when her 2019 March Madness selections topped theirs despite her lack of basketball knowledge.

Rudd said she did not have a passion for basketball, but she did have a passion for winning. Her competitive nature led her to use data and analytics to produce a winning bracket.

"Some of my family members finally took interest in my research after hearing about my bracket," she said.

She explained that her lack of bias in college basketball probably gave her an advantage in making her tournament bracket since she looked explicitly at the datasets. "Computers and algorithms are not biased, but people are," she said.

Rudd decided to conduct research around the tournament because she wanted to be that person who had a successful bracket while lacking the knowledge most fans possess. She consulted often with Gene Ray, director of the Center for Statistics and Analytical Research, to determine if her research ideas were coherent.

"I really enjoy working with Dr. Ray because he has a way of validating my statistical thinking while also encouraging me to 'make it my own,'" she said.

Rudd pointed out that the probability of getting a perfect bracket is less than 1-in-9 quintillion, which is exponentially more difficult than winning the lottery. It is unrealistic to expect anyone to pick a perfect bracket, regardless of their expertise.

"Picking a perfect bracket is just next to impossible," she said. "Even if someone achieved such a miracle, a huge amount of luck had to have played a part in it."

Uncontrollable factors, such as player injuries and officiating decisions, influence the outcome of each game. Other factors that cannot be quantified in the dataset include the style of play each team runs.

"Models are meant to help you make informed decisions based on the data you have," she said. "Informed decisions do not necessarily mean the exact outcome. In this case, an informed decision has a higher probability of success than a 50-50 chance."

Rudd, whose bracket fell just outside of the top 1% of all brackets, has been at Kennesaw State University for the last four years pursuing similar research questions, translating data into information for solving problems in areas such as health care, finance and, in this case, sports.

Her love for statistics began at the Centers for Disease Control and Prevention, where she was a biostatistician and epidemiologist in the Division of Viral Diseases for nearly 10 years. Now as she is working on her dissertation, Rudd emphasized that her interdisciplinary research experiences have broadened her career options.

"I always had an inquisitive mind, wanting to ask questions and find things out instead of looking for answers in a textbook," she said. "While the world always offers new learning opportunities, I can now explore it more fully through analytics and data science."



Computer Science

Improving Business Processes Through Machine Learning

By Amanda DesLauriers

Many organizations and companies reach out to take advantage of the university's research resources and expertise to help them better serve their customers and achieve their goals.

Frank Ziller, chief information officer of Intelliteach and alumnus of Southern Polytechnic State University, approached Kennesaw State with such a problem he hoped could be solved. Intelliteach, an Atlanta-based company employing over 250 people locally and 650 people globally, has a primary function of being a managed service provider offering legal and financial services for over 300 global law firms.

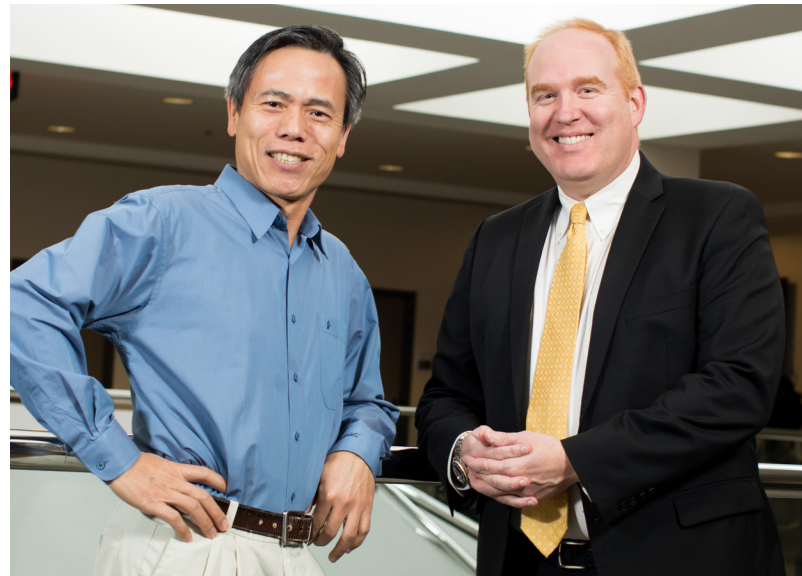
While these services might seem straightforward, there are many moving pieces behind the scenes that can lead to complications. Intelliteach receives over 50,000 IT service tickets to process each month. Once a client submits an IT service ticket to Intelliteach, the ticket must be quickly classified into one of over 20,000 different categories based on the problem statement defined by the user.

IT service desk employees retrieve procedures in knowledge databases to solve the IT issues based on these ticket categories. Misclassified service tickets can lead to delays, which, in turn, causes frustration on all sides.

Ziller approached Jon Preston, dean of the College of Computing and Software Engineering (CCSE), about contracting the skills of faculty and students. Preston connected Ziller to Dan Lo, professor of computer science, who tackled the project with his research assistants.

"I recommended Dr. Lo because he has a proven track record in working on research projects of this nature using big data analytics and machine learning," said Preston, also a professor of gaming. "This project shows how CCSE research among faculty and students helps advance opportunities in applied computing and business analytics."

Lo and his team of undergraduate and graduate students first had to gather as much information as possible from Intelliteach's dataset of almost 50 million records of issues from a five-year period. They used data analysis techniques, such as clustering and pattern definition, and evaluated the business process to determine the optimal categories relevant to the IT issues.



This analysis helped prevent duplication of categories as well as streamlining the knowledge databases that provided the IT solutions. Based on this information, Lo and the team developed a program in which artificial intelligence can automatically classify the information associated with each service ticket.

"The machine learning algorithm that we applied to the dataset ensures the accuracy of ticket classifications, decreasing human error and improving the response time in solving the IT issues," said Lo. "While the project is still in beta testing, this automated process seems to be one of the best ways to increase efficiency in Intelliteach's business processes, as well as increase the quality of customer service provided."

Preston and Lo said that they were pleased with how the project progressed and the end results. The research led to a presentation, titled "An Architecture for Categorized Service Requests by Using Deep Learning Models in IT Service Management Platforms," at the 2019 Association for Computing Machinery Southeast Conference.

The project also resulted in a presentation, titled "An Empirical Study on Application of Big Data Analytics to Automate Service Desk Business Process," at the 2019 Annual Computer Software and Applications Conference of the Institute of Electrical and Electronics Engineers (IEEE) as well as a published paper with the IEEE.



MATHEMATICS EDUCATION

By Joëlle Walls

Meaningful Connections to Culture, Equity and Social Justice

In the next two decades, current minority racial groups will reach majority status, according to a recent U.S. Census Bureau report. With that rapid change in the nation's demographics comes the increased demand to better prepare teacher candidates in engaging these diverse learners, including bilingual students.

As an associate professor of mathematics education, Marrielle Myers seeks to bring forth more of the learners' experiences, shaped by their diverse backgrounds, cultures and languages, into the teaching and learning process.

"Mathematics is typically viewed as devoid of culture. However, algorithms, language, problem context and participation styles are all tied to culture," explained Myers. "To ensure equitable access and outcomes, our future teachers must be able to understand the ways in which culture is deeply intertwined with mathematics teaching and learning."

To that end, Myers received an internal grant from the Office of Undergraduate Research in fall 2018 to start her inquiry by including three education students as collaborators. Following a summer book club that addressed diversity and teaching mathematics for social justice, each student evaluated an aspect of mathematics instruction in her respective host schools during the yearlong student teaching experience, culminating with presenting at the 2019 National Conference on Undergraduate Research.

Myers pointed out that there are many contextual elements of educational research not usually present in other disciplines. The student researcher, in a classroom of another teacher, must interact with the children, their families and caregivers, and the school's leadership.

"As the students completed their projects, I was also interested in how I could support them in that process," she said.

Now with an Office of Research internal grant, Myers has expanded her focus to include partnerships between teachers, parents, students and communities, creating a model of engagement in which all stakeholders are connected with their students' mathematics learning opportunities.

Part of that engagement involves hosting math nights at partner schools so that parents can discuss the authentic mathematical experiences they have within their homes and communities, their children's strengths, and the challenges they face.

Myers then supports teachers and student teachers who, in turn, develop rich mathematical tasks that emerge from the assets families and children possess.

"My long-term research goals are to prepare teachers to teach math in meaningful ways," said Myers. "To achieve this goal, there must be a radical shift in teacher preparation programs and current classrooms, with all stakeholders learning to work together in the best interest of the learners."



ALUMNI USE KSU RESEARCH EXPERIENCES TO EXPAND CAREER OPTIONS

By Landon Mion



Bat Community Hero

While studying for her master's degree in integrative biology at Kennesaw State, Kelly Lutsch could usually be found in culverts and under bridges, searching for hibernating bats. She was looking for signs of white-

nose syndrome, a fungal disease responsible for the rapid decline of tricolored bats.

"White-nose syndrome is a disease devastating the bat population in numerous areas of the United States," said Lutsch. "But southern Georgia was a big question mark for us."

That is why Lutsch spent most of her time in the southern coastal region of Georgia looking for bats susceptible to the disease as well as determining whether the pathogen that causes the disease was present in the bat habitats. Once the bats were identified, she and her team began collecting and analyzing hundreds of environmental samples.

"Our research at KSU aimed to address the knowledge gap regarding bat use of culverts in coastal Georgia," she said. "Areas we thought bats would not inhabit or disease would not prosper was just not true. Taking a critical look at disease movement throughout an area that is seemingly unsuitable is incredibly important for bat conservation in Georgia."

Her interest in white-nose syndrome and her graduate school interview with Chris Cornelison, director of the BioInnovation Lab, ultimately led to her decision to attend KSU. Lutsch and Cornelison combined their varied backgrounds in ecology and microbiology to conduct the research.

"My experience at KSU prepared me to multitask and collaborate with different types of people who may not necessarily work the way I do or think the way I do," Lutsch said.

After graduating last summer, Lutsch joined the Houston office for Western EcoSystems Technology Inc. as a bat biologist and field coordinator.



Advocate of Wi-Fi Connectivity

Electrical engineering graduate Kara Dees is so excited that her research on Wi-Fi connectivity in rural Georgia has led to meetings with Lt. Gov. Geoff Duncan, Executive Director of the Rural

Broadband Program Deana Perry, and state Sen. Steve Gooch, who sponsored a bill to allow the state to create its own broadband maps.

All four are interested in expanding broadband deployment in Georgia, especially rural areas because of the way the Federal Communications Commission (FCC) maps broadband availability from census data. Dees explained that if one residence or business has broadband access, then the whole census block is considered broadband accessible.

As Dees was pursuing her statistics minor, she became passionate about solving this problem when she heard that a classmate had to walk to the end of his driveway to log in to Desire2Learn, KSU's learning platform, because of an inadequate internet connection.

"My research shows that about one-third of rural area residents and one-quarter of metro area residents do not have access to wireless internet in their homes," she said. "That is why I wanted to identify the counties that had more than 500 KSU students to figure out what broadband options were available."

Dees tested the upload and download speeds of publicly available Wi-Fi at the main libraries of the two largest cities in each county. She found that in general, the download speeds were much slower than FCC requirements.

"Hundreds of thousands of federal, county and sometimes municipal dollars are being applied to libraries, but not for internet connection," she said. "People with public-only internet access need to have the appropriate resources."

Dees, who presented her project at KSU's R Day, is currently a researcher for the Information and Communications Laboratory at the Georgia Tech Research Institute.



BRIDGES PROGRAM ALUMNI SCORE NIH FELLOWSHIPS

By Kaelyn Ireland

Verra Ngwa and Juan D. Rodriguez, two alumni of the first cohort of Kennesaw State's Peach State Bridges to the Doctorate program, received the Ruth L. Kirschstein Predoctoral Individual National Research Service Award from the National Institutes of Health (NIH). The fellowships support mentored research training for recipients in specified health and related fields while they are pursuing their doctoral research.

"These fellowships will fund the remainder of their doctoral studies and were the result of proposals they developed and submitted on their own," explained Jonathan McMurry, Bridges to the Doctorate program director and professor of biochemistry at KSU.

Both alumni say the Bridges to the Doctorate program helped prepare them for their doctoral studies.



Understanding Cancer Cell Growth

"I did not feel like I was ready for graduate school before this program," Ngwa said. "I enrolled in the chemical sciences master's degree program at KSU so that I could gain more research experience."

She joined McMurry's laboratory, which focuses on biomolecular interactions. With his mentorship, Ngwa was able to build a "bridge" to a doctoral program.

"Verra is one of the best students to ever have come through my lab," said McMurry. "I am proud to have played a small part in training a new scientist who will spend her career helping to understand and cure disease."

Ngwa, who also earned her bachelor's degree in chemistry from KSU, is now enrolled in the cancer biology doctoral program at Vanderbilt University.

"I really wanted to go into research so I could understand the causes and biology of cancer," she said. "Since losing my mother to breast cancer, I have had a personal interest in this research."

Ngwa is studying how glutamate, a chemical that nerve cells use to send signals to other cells, can reduce cancer cell growth and the progression of cancer.

Ngwa's plans include becoming an independent primary investigator, conducting more cancer research to increase understanding within her field, and giving back to the community.



Exploring Cell Development Functions

Rodriguez earned his bachelor's degree in biomedical science in Puerto Rico and worked as a technician in Miami before enrolling in the Bridges program to pursue a master's degree in integrative biology.

"I thought that a master's program would help improve my writing in English," Rodriguez said, calling KSU his "steppingstone" to the doctoral program. "A master's degree is not required for a Ph.D., but in my case, it made a huge difference."

Rodriguez worked with Susan M.E. Smith, professor of biology and Foundation Fellow, attributing his overall growth to the individualized mentoring and professional development advice Smith and the rest of the department provided.

"Juan is creative, intelligent, hardworking, and most impressively, has a mature understanding of and true dedication to science," said Smith.

Rodriguez, considering a career in academia, is now pursuing a doctorate in genetics and molecular biology at Emory University. Working with nematodes (worms), Rodriguez studies how epigenetic modification, nongenetic influences on gene expression, can regulate cell specification so that a cell becomes a muscle cell rather than a skin cell, for example.

"I would like to understand how the cells know which path they need to follow during their development and specification, whereas a mistake in their path could lead to diseases," he said.



Research Administration

Phaedra Corso
Bill Diong
Heather Hedgepeth

Research Operations and Communications

Jonathan Coker
Joëlle Walls
Geena Lawrence
Landon Mion

Research Development and Strategic Initiatives

Evelina Sterling
Natasha Williams
Jennifer Harb

Research Compliance

Kristine Nowak
Christine Ziegler
Portia Twidt

Sponsored Programs

Carolyn Elliott-Farino
Lynn Sotillo
Amanda DesLauriers
Kimberly Hunt
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Undergraduate Research

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Intellectual Property Development

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A.L. Burruss Institute for Public Service and Research

Christy Storey
Kelleigh Trepanier
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Ashley Crawford
Ryan Falvai
Akilah Hairston
Lisa Ferer
Monica Stopar
Marshal Chaifetz

Affiliated Faculty

Kyle Gabriel
Allison Garefino

Fiscal Services – Grants and Contracts Accounting

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