

# STEM

## UN-Conference

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Friday, March 5, 2021 | 9 am – 5 pm

*This conference offers a space for all KSU faculty to come together (virtually), spark new ideas, and generate new synergies for research.*

# Research Spotlight

9:00 am - 11:30 am

## ***Supersensitive correlation imaging with quantum states of light***

Presentation – [Join now](#).

9:00 to 9:12 am

Author: Jianming Wen, CSM/Physics

Other authors: Yanhua Zhai

*The production of entangled paired photons by simply focusing a laser light onto a nonlinear crystal grants grand success in testing quantum theory but also enables a novel and powerful approach in imaging. This latter development is further boosted by the emergence of single-photon-sensitive cameras that are capable of characterizing spatial correlations and high-dimensional entanglement. Over decades efforts, new techniques have been proposed and demonstrated including ghost imaging of objects -- in which the quantum correlations between photons reveal the image from photons that have never interacted with the object -- or imaging with undetected photons by constructing nonlinear interferometers. Of importance, quantum approaches in imaging can also lead to substantial improvements in displaying fine features of the object that are challenging to conventional imaging systems. These improvements are revealed through the image contrast, resolution enhancement, and sensitivity that surpass the classical limit and acquisition of sub-shot-noise phase or amplitude images. In this talk, we will discuss the applications of quantum states of light for advanced imaging techniques, which are expected to hold great practical applications across a number of different fields ranging from physics, electrical engineering, biology, chemistry to medicine.*

## ***Fabrication of Polymer Modified Transparent Wood***

Presentation – [Join now](#).

9:12 to 9:24 am

Author: Bharat Baruah, CSM/Chemistry and Biochemistry

Other authors: Kelsey Peacock

*Currently, modified wood (MW) has emerged as a popular substrate for optoelectronics, energy storage, and biomedical devices. The delignified wood can be infiltrated with a refractive index-matched polymer to fill in the lumen pores, and the resultant material is transparent wood (TW) after drying. We plan to impregnate the delignified wood with a polymer such as poly-albumen (PA) and polyurethane (PU) to create TW. We hypothesize that PA and PU will create durable TW and be further modified to fire-retardant and electrically conducting wood. The three objectives are: i) creating TW by infiltrating delignified wood with PA and PU, ii) modify TW with a metal-organic framework (MOF) to furnish fire-retardancy, iii) and create a TW with electrical conductivity by incorporating silver nanowires (AgNWs). Such MW would have tremendous potential in optoelectronics, energy storage, and biosensors. We characterize samples with FTIR, Raman, UV-vis DRS, XRD, TGA, and SEM.*

*Keywords: Natural wood, Transparent wood, Fire-retardant, Polyurethane, MOF, AgNWs.*

## **Investigation of the Antifungal and Anti-Aflatoxigenic Potential of Plant-Based Essential Oils against *Aspergillus flavus* in Peanuts**

Presentation – [Join now](#).

9:24 to 9:36 am

Author: Premila Achar, CSM/Molecular & Cellular Biology

Other authors: Pham Quyen<sup>1</sup>, Emmanuel C. Adukwu<sup>2</sup>, Abhishek Sharma<sup>3</sup>, Huggins Zephaniah Msimanga<sup>4</sup>, Hanumanthu Nagaraja<sup>5</sup>, and Marikunte Yanjarappa Sreenivasa<sup>5</sup>

*Aspergillus species are known to cause damage to food crops and are associated with opportunistic infections in humans. In the United States, significant losses have been reported in peanut production due to contamination caused by the Aspergillus species. This study evaluated the antifungal effect and anti-aflatoxin activity of selected plant-based essential oils (EOs) against Aspergillus flavus in contaminated peanuts, Tifguard, runner type variety. All fifteen essential oils, tested by the poisoned food technique, inhibited the growth of A. flavus at concentrations ranging between 125 and 4000 ppm. The most effective oils with total clearance of the A. flavus on agar were clove (500 ppm), thyme (1000 ppm), lemongrass, and cinnamon (2000 ppm) EOs. The gas chromatography-mass spectrometry (GC-MS) analysis of clove EO revealed eugenol (83.25%) as a major bioactive constituent. An electron microscopy study revealed that clove EO at 500 ppm caused noticeable morphological and ultrastructural alterations of the somatic and reproductive structures. Using both the ammonia vapor (AV) and coconut milk agar (CMA) methods, we not only detected the presence of an aflatoxigenic form of A. flavus in our contaminated peanuts, but we also observed that aflatoxin production was inhibited by clove EO at concentrations between 500 and 2000 ppm. In addition, we established a correlation between the concentration of clove EO and AFB1 production by reverse-phase high-performance liquid chromatography (HPLC). We demonstrate in our study that clove oil could be a promising natural fungicide for an effective bio-control, non-toxic bio-preservative, and an eco-friendly alternative to synthetic additives against A. flavus in Georgia peanuts (accepted for publication- Journal, IF 4.6).*

1.Undergrad, KSU, 2. UK, 3 & 5. India, 4. Biochem & Chem, KSU

## **Using Technology to Minimize the Hawthorne Effect in Pediatric Gait Analysis**

Presentation – [Join now](#).

9:36 to 9:48 am

Author: Mark Geil, Wellstar HHS/Exercise Science and Sport Management

Other authors: Leila Rahnama

*Background: The Hawthorne Effect occurs when participants alter their behavior when they are aware that they are being examined. The effect has been reported in many experiments, including gait analysis, and is considered an important source of bias that might impact both clinical and research results. Cognitive distraction is one potential solution to reducing the Hawthorne effect during gait analysis, but it is challenging in children, and can, in itself, alter gait. This study investigated the carryover effect of an alternative low-immersion virtual reality intervention on gait patterns and subjective feelings in typically developing children.*

*Research Question: Will a low-immersion virtual reality intervention change feelings and gait patterns in children in a laboratory setting, potentially reducing the Hawthorne Effect?*

*Methods: Typically developing children aged 5-13 participated in a standard laboratory gait analysis before experiencing a game in which they viewed their motion on monitors around the lab as that of a cartoon avatar in a 3D virtual environment. Following this intervention, standard walking trials were repeated. In addition, participants completed a survey of their feelings about the study both before onset and after completion.*

*Results: Thirty-one children participated in the study, 16 females and 15 males, mean aged 9.1 years. Arm swing, proposed as a measure of how relaxed and natural gait was, increased significantly following the intervention. The effect was more pronounced in females and younger children. Participants felt significantly happier, more excited, less scared, and less sad after the intervention. Changes in feelings were not closely*

associated with changes in kinematics.

*Significance: This study suggests that gamification may reduce the Hawthorne effect and potentially produce more natural gait in children. The game intervention had a carryover effect, producing changes in gait even after the intervention was removed.*

### **Mobile data collection system for next generation transportation asset management system**

Presentation – [Join now](#).

9:48 to 10:00 am

Author: Parth Bhavsar, SPCEET/Civil and Environmental Engineering

Other authors: Yusuf Mehta<sup>1</sup>, Nidhal Bouaynaya<sup>1</sup>

*The Transportation Asset Management is one of the important sub systems to manage, maintain, and operate the transportation system. To support new technologies and maintain optimal performance of legacy systems, the asset management sub-system must be equipped with tools and technologies that optimize existing resources and provide necessary decision support. The Transportation Systems Management & Operation (TSM&O) center significantly relies on information and decision support provided by the asset management sub-system.*

*The Safety Service Patrol (SSP) operators (similar to Highway Emergency Response Operators (HERO) in GA) provide assistance to commuters in New Jersey for 16 hours in a typical weekday. This assistance is provided for various activities such as changing a flat tire and making minor repairs. With the evolving computing and communication technologies, these SSP vehicles can be utilized to automatically perform additional tasks such as collecting pavement and infrastructure data for asset management.*

*The primary objective of this project was to develop an affordable and portable solution to convert existing department of transportation DOT vehicle fleet into mobile data collection units. The research team has developed and evaluated a working prototype of the mobile data collection system that includes pothole detection sensor and traffic count sensor. To maintain the affordability without compromising the quality of the data, the research team focused on developing AI algorithms. Specifically, distributed machine learning framework was utilized to reduce the processing at the sensor node and improve quality of the outcome. This system can convert existing vehicle into mobile data collection unit. This unique characteristic can enable any DOTs, county and/or local municipalities to collect high resolution, location specific data for various current and future transportation system applications at a significantly lower cost. This system can become the backbone for current and future TSM&O centers and an essential subsystem for future smart cities.*

1. Rowan University

### **Exploring the applications of fractional differential equations (FDE) in ecotoxicological risk assessment**

Presentation – [Join now](#).

10:00 to 10:12 am

Author: Nicholas Green, CSM/Ecology, Evolution, and Organismal Biology

Other authors: Somayeh Mashayekhi<sup>1</sup>

*Anthropogenic pollution poses a serious threat to organisms around the world. A key step in managing these threats is estimating how individuals and populations might respond to chemical exposures using stochastic simulation modeling. One of the most important frameworks for risk assessment modeling is the General Unified Threshold of Survival, or GUTS model. In GUTS, harm to individuals is estimated via a series of ordinary differential equations (ODE) representing mechanisms driving internal concentration of the pollutant and the resultant effects over time. Within a population model, individual-level effects are aggregated to allow estimation of the potential effects of exposure on a population or community. The ODE at the core of GUTS were derived from standard toxicological models, which apply differential and integral calculus to biological phenomena. However, fractional differential equations (FDE) and the fractional calculus more generally have been shown to capture physical and biological phenomena better than integer*

order calculus. The fractional calculus generalizes derivatives and integrals to non-integer order. We are developing a version of GUTS using FDE (FGUTS) to harness these mathematical developments and improve upon the predictive utility of the GUTS model for risk assessment. Performance of the new FGUTS model will be evaluated by comparing its ability to predict lethal effects of pesticides and other toxins on standard invertebrate and fish test species to the performance of the conventional GUTS model. To our knowledge this is the first application of FDE in ecotoxicology and our findings will be relevant to regulatory agencies tasked with model- and science-based environmental risk assessment.

1. Mathematics, KSU

### **Acoustic Performance of Face Masks and Shields in a Classroom Setting**

Presentation – [Join now](#).

10:12 to 10:24 am

Author: Laura Ruhala, SPCEET/Mechanical Engineering

Other authors: Richard Ruhala

*This research seeks to quantify acoustical effects as they relate to speech intelligibility and communication degradation for educators and students having to wear face masks and/or shields during the COVID-19 pandemic. With virtually all K-12 and collegiate programs requiring facial coverings in face-to-face courses to minimize the community spread of COVID, there is a need to better understand the acoustical effects that these face coverings have on speech communication. Interdisciplinary mechanical and electrical engineering faculty and students have collaborated to use an acoustic head and torso simulator (HATS) and sound level meter to evaluate some of the most popular face masks and shields. This research involves placing facial coverings on the HATS and using it as a controlled and repeatable artificial voice and sound source. Last fall, experiments were conducted in a classroom within KSU's Engineering Technology Center, where the classroom capacity pre-pandemic was 40. This initial research study phase was completed with the assistance of two highly engaged and involved undergraduate students. Analyses of white noise signals indicate that speech acoustics above 1500 Hz are degraded due to the wearing of face masks. Additionally, clear and hard plastic coverings were found to amplify sound near 1000 Hz, further distorting the acoustics. These acoustic properties are being compared to documented droplet transmission properties of face masks and/or shields. Analyses will also be focused on the effects of facial coverings on artificial and English, male and female speech that was emitted from the HATS. Plans are to procure, instead of renting, the HATS equipment to create a listening study in a classroom, with significantly more voice samples, to further determine the effects of facial coverings on speech intelligibility. This study is both timely and urgent so that suggestions can be made regarding face covering options and their related acoustic properties.*

### **Cost Effective way of measuring athlete muscle's stiffness with the effect of fatigue**

Presentation – [Join now](#).

10:24 to 10:36 am

Author: Muhammad Salman, SPCEET/Mechanical Engineering

Other authors:

*Athletes of every type experience fatigue in their muscles during their exercise. Determining the point at which failure will occur is simple, however it could result in injury for the athlete. Typically, the point of fatigue is found by the athlete repeating the exercise until they are physically incapable of continuing. While it does not take much to understand the feeling of fatigue, it's more to understand why it occurs. Using shear wave propagation and accelerometers, a model can be depicted of muscle fatigue of an athlete by viewing the strain and velocity of waves propagating through the muscle before, during, and after the lifting of a weight. It has been found that the stiffness found by this surface wave method is in agreement with the research studies done in the past using the Ultrasound and the MRI (Magnetic Resonance Imaging) techniques. Stiffness of the biceps increases when the weight is lifted the effect of lifting the weight on the stiffness before and after has been investigated. This method is a cost effective, minimally noninvasive and an in-vivo method to measure the muscle stiffness which is an important criteria of diagnosing the muscle health. This process demonstrates mechanical engineering techniques that can be applied to and be beneficial to health fields, such as how to maximize muscle efficiency.*

## **Intercultural Competence Intervention and Assessment Program**

Presentation – [Join now](#).

10:36 to 10:48 am

Author: Awatef Ergai, SPCEET/Industrial and Systems Engineering

Other authors: Shane Peterson, Sabine Smith, Ginny Zhan

*For American companies to remain dynamic, innovative, and competitive in the global market, a skilled, interculturally prepared, and diverse engineering workforce is crucial. However, thus far, preparing engineering graduates with technical skills has been the dominant focus for most U.S.-based engineering programs including Southern Polytechnic College of Engineering at KSU. Therefore, the ultimate objective of our study is to prepare engineering graduates who possess not only a specific technical skill set, but who can work and communicate effectively in diverse teams. Our research project involves an intervention program that would encourage students to practice intercultural competence and communication skills in teamwork and would assess the effectiveness of this program. We propose an integrative and inclusive approach in articulated sequences with multi-pronged assessments throughout the curriculum, which will bring about the desired changes in the institution in the long run. We are conducting a pilot study this Spring to examine the effectiveness of the proposed intervention and assessment program in a project-based engineering course (ISYE 3125: Statistical Quality Control). Our proposed intervention and assessment program will utilize the Story Circles (SC) method developed by Deardorff, tailored to the context of an engineering course at KSU. Based on the goals of the SC instrument, we created specific guidelines for IC and communication skills development for student team usage. A mixed-method and sequenced approach will be used to carry out the series of assessments during the spring semester, using Qualtrics and MSTeams. The assessments include surveys, recordings, and student, peer, and course evaluations. We believe this pilot study is a critical step in our overall research project: the results will inform us of the effectiveness of the research design and enable us to make necessary changes and modifications as we expand our program to other courses and disciplines at our institution. In addition to the methods and research design, our presentation will include initial results of the pilot study.*

## **The physics and chemistry behind short-time mammalian cell volume control: a mathematical approach**

Presentation – [Join now](#).

10:48 to 11:00 am

Author: Yizeng Li, SPCEET/Mechanical Engineering

Other authors: N/A

*Mammalian cells actively regulate their volume to maintain proper cell function. On the time scale where protein production can be neglected, water flow in and out of the cell determines the cell volume variation. Water flux follows hydraulic and osmotic gradients, the latter of which is generated by the various ion channels and transporters in the cell membrane. Compared to the widely studied roles of sodium, potassium, and chloride in cell volume regulation, the effects of proton and bicarbonate is less understood. In this talk, I will discuss the application of mathematical models on analyzing how proton and bicarbonate, combined with sodium, potassium, chloride, and buffer species, regulate cell volume upon ion channel and transporter inhibition. The model includes a number of common, widely expressed ion transporters and focuses on obtaining generic outcomes. Results show that the intracellular osmolarity remains almost constant before and after cell volume change. The steady-state cell volume is independent of water permeability. In addition, to ensure the stability of cell volume and ion concentrations, it is necessary for cells to develop redundant mechanisms of ion homeostasis, i.e., multiple ion channels or transporters are involved in the flux of the same ion species. These results provide molecular mechanisms of cell volume regulation with additional implications for water-drive cell migration.*

## **Deep Learning Architectures Inspired by Model-Based Algorithms for Compressed Sensing Reconstruction Applications**

Presentation – [Join now](#).

11:00 to 11:12 am

Author: Craig Chin, SPCEET/Electrical and Computer Engineering

Other authors: N/A

*The proposed project seeks to design deep learning architectures for the purpose of improving the accuracy and speed of image reconstruction for signals acquired via the compressed sensing (CS) approach. These architectures will not be based on more common architectures such as convolutional neural networks or adversarial networks but will derive their structure from the model-based optimization algorithms originally used to perform image reconstruction of CS signals.*

*The compressed sensing (CS) approach involves signal acquisition at a sampling rate much smaller than the Nyquist's rate. This is followed by signal reconstruction using an iterative optimization algorithm. The motivation for using this approach in the field of biomedical imaging has been to reduce signal acquisition times for MRI examinations and to reduce radiation dose for CT examinations.*

*Traditional CS reconstruction algorithms utilize a model-based approach to define the optimization problem, which has the advantage of generalizable reconstruction performance but the disadvantages of degraded reconstruction accuracy due to limited model complexity as well as slower reconstruction speed due to requiring multiple iterations for convergence. Deep Learning models have high complexity and greater accuracy, but are more susceptible to over-fitting, which means poorer generalizability. The motivation for using the proposed hybrid approach to image reconstruction is devise a method that integrates the merits of data-driven and model-based approaches.*

*Previous attempts at creating deep learning networks as unrolled versions of model-based optimization techniques have demonstrated some success in terms of reconstruction performance. My preliminary investigation involves designing a novel deep learning network that mimics the iterative steps of plug-and-play reconstruction algorithms.*

## **Chemical Biology of NEU-4438, a Lead Anti-Trypanosome Drug**

Presentation – [Join now](#).

11:12 to 11:24 am

Author: Amrita Sharma, CSM/UGA

Other authors: Michael Cipriano<sup>4</sup>, Lori Ferrins<sup>3</sup>; Michael Pollastri<sup>4</sup>; Stephen Hajduk<sup>4</sup>, Kojo Mensa-Wilmot<sup>1,2</sup>

*Trypanosoma brucei causes the disease, Human African Trypanosomiasis (HAT), in regions of sub-Saharan Africa. Current drugs for treatment of HAT have undesirable properties, so there is a need to identify safer alternatives; SCYX-7158 (acoziborole) is in clinical trials. Since *T. brucei* is a eukaryote microbe the chance of resistance emerging against any drug is substantial, dictating a necessity for continued effort to find new leads for anti-HAT drug development. We showed that NEU-4438 is an orally-bioavailable lead for anti-HAT drug development. To assess its potential for further development, we compared NEU-4438's modes of action to those of SCYX-7158, using a multi-disciplinary approach involving drug perturbation, hypothesis-generating proteomics, chemical, and molecular biology. Following 6 h of treating trypanosomes with pharmacologically equivalent concentrations (i.e., delayed cidal concentrations), NEU-4438 and SCYX-7158 selectively reduced steady-state levels of 68 and 92 unique proteins, respectively. Pursuing hypotheses formulated from the drug-perturbed proteomes, NEU-4438 interfered with DNA biosynthesis, and prevented trypanosome entry into S-phase. In contrast, SCYX-7158 inhibited mitosis, and blocked protein translation. Finally, SCYX-7158 prevented endocytosis of both haptoglobin-hemoglobin and transferrin, whereas NEU-448 only perturbed uptake of transferrin. We surmise that SCYX-7158 and NEU-4438 have different modes of molecular action in the African trypanosome, implying that development of NEU-4438, an established lead drug, deserves to progress in the drug development pipeline as a potential anti-HAT agent. At the same time, our unexpected findings that SCYX-7158 inhibits translation of polypeptides, and endocytosis of proteins with GPI-anchored receptors highlights a need for new studies to fully understand that drug's molecular mechanisms of action.*

1. University of Georgia, Department of Cellular Biology, Athens, GA 30602 USA
2. Kennesaw State University, Department of Molecular and Cellular Biology, Kennesaw, GA 30144 USA
3. Northeastern University, Department of Chemistry & Chemical Biology, Boston, MA 02115 USA
4. University of Georgia, Department of Biochemistry and Molecular Biology, Athens, GA 30602 USA

# Lightning Talks

1:00 pm - 2:15 pm

## Tag along with NSF

### **Academic Leadership and STEM Inclusion**

Presentation – [Join now](#).

1:00 to 1:12 pm

Author: Dianhan Zheng, CHSS/Psychological Science

Other authors: Ordene Edwards, Sarah Holliday

*Women and ethnic minorities are disproportionately underrepresented at various academic positions and levels in STEM fields, especially in senior ranks. Such underrepresentation is also observed among STEM students. One of the NSF's 10 Big Ideas, NSF INCLUDES, aims to enhance STEM inclusion and empower STEM diversity. The long-term objective of our interdisciplinary project to develop, implement, and validate leadership development and mentoring programs that will facilitate the advancement of underrepresented STEM faculty and students at KSU and collaborating institutions.*

*To support this objective, we propose two specific aims. First, we will determine how academic leadership can enhance the development and well-being of underrepresented STEM faculty. A key leadership concept we will focus on is servant leadership, which is characterized by a leader's other-orientation, consideration for follower's welfare, and prioritizing followers needs. Building on organizational leadership theories, we hypothesize that department chair's servant leadership is positively related to desirable work outcomes experienced by female and other underrepresented STEM faculty members. Second, this research will examine how these positive outcomes of servant leadership on underrepresented faculty may trickle down to underrepresented STEM students, creating a caring and supportive climate at all levels in STEM departments. We hypothesize that servant department chairs encourage underrepresented faculty members to engage in servant teaching and mentoring, which will enhance underrepresented STEM student's academic experiences.*

*We plan on collecting qualitative and quantitative data through focus group interviews and surveys. Our goal is to collect pilot data from KSU and various other institutions and submit a full proposal to the NSF ADVANCE program, which aims to broaden the implementation of research-driven organizational change strategies that promote equity in academic STEM. We hope to present this research idea at the KSU Interdisciplinary STEM UN-Conference to receive feedback and to seek collaborators who are interested in STEM inclusion research.*



## **Strain Effect on Thermal Conductivity**

Presentation – [Join now](#).

1:12 to 1:24

Author: Jungkyu Park, SPCEET/Mechanical Engineering

Other authors: N/A

*We employ molecular dynamics simulations to explore the effect of tensile strain on the thermal conductivity of carbon nanotube (CNT)-graphene junction structures. Two types of CNT-graphene junctions are simulated; a seamless junction between CNT and graphene with pure  $sp^2$  covalent bonds, and a junction with mixed  $sp^2/sp^3$  covalent bonds are studied. The most interesting observation is that the thermal conductivity of a CNT-graphene junction structure increases with an increase in mechanical strain. For the case of a (6,6) CNT-graphene junction structure with an inter-pillar distance (the length of graphene poor between two CNT-graphene*

*junctions) of 15 nm, the thermal conductivity is improved by 22.4% with 0.1 tensile strain. The thermal conductivity improvement by mechanical strain is enhanced when a larger graphene floor is placed between junctions since a larger graphene floor allows larger deformation (larger tensile strain) without breaking bonds in the junction structure. However, the thermal conductivity is found to more strongly depend on the C-C bond hybridization at the intramolecular*

*junctions with pure  $sp^2$  hybridization showing a higher thermal conductivity when compared to mixed  $sp^2/sp^3$  bonding regardless of the amount of tensile strain. The obtained results will contribute to the development of flexible electronics by providing a theoretical background on the thermal transport of three-dimensional carbon nanostructures under deformation.*

## **Controlling Charge Transport in Self-assembled Electronically Active Systems**

Presentation – [Join now](#).

1:24 to 1:36 pm

Author: Bo Li, SPCEET/Mechanical Engineering

Other authors: N/A

*Society is facing a technological revolution in information processing led by artificial intelligence. Conventional computers based on von Neumann architectures are not well-adapted for processing large scale information in parallel, which is essential for artificial intelligence applications. On the other hand, the neuronal network architecture in the brain is a remarkably efficient platform for information processing. However, it has proven to be extremely difficult to build such architectures using silicon-based electronics due to the limitations of 2D lithographic fabrication methods. To this end, crafting integrated circuits via self-assembly of functional nanomaterials using a bottom-up paradigm provides a promising solution to these technological challenges. My goal is to pioneer new advances in supramolecular and nanomaterials assembly to create 3D self-assembled architectures for information processing and sensing.*

## **Sustainability and Success in STEM**

Presentation – [Join now](#).

1:36 to 1:48 pm

Author: Tiffini Jones, CSM/Ecology, Evolution, and Organismal Biology

Other authors: N/A

*This study explores the experiences that lead females to participate and succeed in STEM fields. The central research question of whether exposure to sustainability values during one's childhood, educational, or professional settings broaden participation, increase retention, and/or create opportunities for contribution from females into STEM fields is investigated. The literature review examines historical perspectives of historically underrepresented groups in STEM, national demographic statistics, along with educational and social factors which influence females in STEM. The intersectionality of African-American females is highlighted as a unique group which could benefit from more directed programming and further research. Mixed methods research and analyses applied in this study incorporates both quantitative and qualitative*

measures of assessment to better understand the relationship sustainability played in life experiences of females and how it influenced educational and professional outcomes. This study confirmed the body of research of best practices to increase diversity in the field. Additionally, since females have a greater social imperative associated with their career objectives, the inclusion of humanities and sustainability themes are measures which can broaden participation in the STEM fields. Seeking to understand how affinity to nature affected these metrics, all participants understood and appreciated the correlation between nature and STEM. A curricular innovation model, STEAMS, is introduced to articulate a diverse transformative STEM pedagogy inclusive of liberal arts and sustainability themes. Exposure to sustainability education through the STEAMS curriculum model is presented as a means to broaden participation, increase retention, and create opportunities for females to contribute to the STEM fields.

## Tool Innovation

### **Let's discuss how NMR can help you with your research.**

Presentation – [Join now](#).

1:48 to 2:00 pm

Author: Thomas Leeper, CSM/Chemistry and Biochemistry

Other authors: N/A

*NMR is not just for structure determination. It is a versatile platform for biophysics and chemistry with applications that also include: diffusion coefficient measurement in polymers/biomolecules, measurement of internal motions/dynamics, quantification/observation of weak binders including protein-ligand interactions, drug discovery, sample quality control/validation, and many more. This talk will briefly highlight how recent upgrades to the KSU NMR facility may be useful to your biochemistry, molecular biology, and chemistry research and support of proposal writing.*

### **Measurement of Cardiac Functions in Freely Walking Fruit Fly Using Motion Compensation and Fluorescent Microscopy**

Presentation – [Join now](#).

2:00 to 2:12 pm

Author: Dal Hyung Kim, SPCEET/Mechanical Engineering

Other authors: N/A

*The cardiac functions in an animal dramatically change while exercising. The body requires adequate oxygen supply to exercise properly, and it would eventually affect cardiac functions. Cardiac research using a fruit fly has been highlighted because the basic element of heart functions and development are conserved even though the heart structures are different from those of vertebrates. The major barrier deterring the investigation of cardiac functions in a fruit fly is the motion restriction, which requires immobilization of the subject because most current methodologies are utilizing optical microscopies such as a fluorescent microscope and optical coherence tomography. However, the immobilization process may cause short-term, long-term, or permanent damages to the subject from physical tethering or anesthesia, which makes longitudinal experiments difficult. Notably, measuring the cardiac functions in a freely walking fruit fly using the microscope can be difficult since the field of view of the microscope is limited for a moving subject.*

*The ultimate objective of this project is to develop a novel robotic and optical imaging system to understand the cardiac functions in a freely walking fruit fly without tethering. This project will integrate state-of-the-art robotic technologies into the biomedical application, which enables us to investigate the undiscovered cardiac functions of a fruit fly while freely behaving. The proposed project will allow various longitudinal experiments because temporal or permanent damages during immobilization can be avoided. Furthermore, the proposed project can be extended to other organs such as the brain and small-scale animals if the optical path is secured for optical imaging. Throughout this project, a new paradigm of cardiac-related studies using a freely behaving insect will be developed, which will transform research of a small-scale behaving insect and enrich the understanding of the related research field.*

# Different Bright Idea

## **Documenting Discovery, Developing Diversity: An Interdisciplinary Approach to STEAM Abroad**

Presentation – [Join now](#).

1:00 to 1:12

Author: Seneca Vaught, CHSS/Interdisciplinary Studies

Other authors: Ernesto Silva, Bobby Gutierrez

*We will discuss using diverse cohorts of faculty and students using interdisciplinary STEAM (science, technology, engineering, and math in dialogue with the arts and humanities) approaches to democracy, human rights, and women's empowerment.*

*Our theory proposes creating documentary shorts about project-based study abroad experiences will change the way that students and faculty think about education abroad and the kinds of collaborations that are possible across academic fields and international borders. We'll share several of our experiences working with multidisciplinary study abroad teams in Semester at Sea, Peru, and Ecuador.*

*Specifically, we have seen how study abroad programming can be a central component in getting faculty, staff, and students to understand the need for collaboration and application of disciplinary content in complex, real-world projects. Our students and faculty in all disciplines need a more holistic understanding of the social environment in which research is conducted and a critical understanding of diverse global perspectives. Working with faculty on research projects in study abroad programs that are designed to immerse students in diverse cultural and methodological approaches offers a transformative pedagogy that benefits everyone.*

*To work toward this vision, our goal is to increase and diversify the number of students who study abroad at Kennesaw State by proposing more interdisciplinary, multi-country programs that incorporate multidisciplinary project-based learning. To achieve this goal, we must expand our institutional capacity for study abroad programming and integrate strategic objectives across the curriculum to engage the diverse needs of key stakeholders: full and part-time faculty, underrepresented student populations (e.g., women, diverse racial/ethnic groups, first-generation college students, and economically disadvantaged persons), international partners, and core institutional stakeholders.*

*We would like feedback on the pedagogical approach we have outlined as well as inquire about potential collaborators from persons in attendance.*

## **Patient Centered Transportation**

Presentation – [Join now](#).

1:12 to 1:24

Author: Parth Bhavsar, SPCEET/Civil and Environmental Engineering

Other authors:

*We are trying to solve the aging population's access to nonemergency medical transportation (NEMT). The transportation to and from healthcare facilities is one of the key barriers identified by several researchers. In the NEMT field there exists a divide between patients, healthcare facilities, and transportation providers. The cost of transportation to life-saving treatments is prohibitively expensive for many patients who lack a vehicle of their own. Inexpensive transportation does exist, but it is often inconvenient or unreliable, and does not always accommodate the needs of the infirmed or elderly. Furthermore, no service exists which aims to personalize the experience of travelling to the healthcare facility so that the patients feel comfortable and confident for the upcoming medical appointment. The ridesharing model can be utilized to develop affordable access to medical transportation. However, researchers have found that affordable rides alone will not be able to reduce the missed non-emergency appointment rate. This suggests that the solution must address patient's comfort, patient's economic conditions, and patient-driver behavior. Our innovation is a Patient Centered Transportation (PaCT) that focuses on improving (1) patient's comfort level when travelling*

to and from the healthcare facility without compromising affordability of the trip and (2) reducing triage time to improve doctor-patient time by integrating in-home and in-vehicle health sensor data.

### **Differencing with two variables simultaneously**

Presentation – [Join now](#).

1:24 to 1:36

Author: Tsz Chan, CSM/Mathematics

Other authors:

Let  $f(x)$  be the displacement function. To find velocity, one computes  $g[x,y] = (f(y) - f(x))/(y - x)$ , the first divided difference. To find acceleration, one computes  $h[x,y,z] = (g[y,z] - g[x,y])/(z-x)$ , the second divided difference. One can generalize this recursively which has application to numerical analysis and other areas. In this talk, I would like to share the idea of doing differencing on two variable functions like  $f(x+a, y-b) - f(x,y)$  which has application in number theory. I am wondering if this idea could be useful in other areas and welcome any inputs from KSU colleagues.

### **Physics and your body**

Presentation – [Join now](#).

1:36 to 1:48

Author: Prabha Padukka, CSM/Physics

Other authors:

Physics is said to be one of the most challenging subjects for many students in universities and colleges. Not only do many students fail to perform well in Physics courses, but also they find it is quite difficult to glide through the semester easily when they are taking a difficult course like physics. Although a majority of students finds it difficult to be successful in Physics courses, some students get through it very easily. Thus, it is worth to do more research on this different performances of students and the results of such a study will be useful for improving teaching/learning environment.

Problem solving is one of the primary tools faculty use to assess students in Physics. Generally, students need to use their cognitive skills, analytical skills and critical thinking skills when they work on Physics problems. This study focuses on observing how the human body functions when attempting Physics problems and understanding how those functions make an impact on student's success.

This research study will be carried out in two stages. During the first stage, a group of KSU students who are taking Introductory Physics courses will be considered. While they are attempting Physics problems the functions in their bodies will be observed. For an example, how their blood pressure level, vital signs and blood sugar levels changing during the problem solving process.

As the second stage, the sample spaces can be expanded to other institutions and include more diverse group of students. In addition, at this stage, another important observation will be made. That is the function of the brain. It will be interesting to see how the brain is functioning when you attempt problems.

### **Unravelling the mysteries of ant morphological diversity**

Presentation – [Join now](#).

1:48 to 2:00

Author: Clint Penick, CSM/Ecology, Evolution, and Organismal Biology

Other authors: John Paul Hellenbrand<sup>1</sup>

From a distance, and ant does not look like much more than a black speck crawling across the pavement. But if you take that same ant and look at it under a microscope, an incredible amount of detail is revealed. Taxonomists have created nearly 100 terms to describe the surface textures that decorate ant bodies, but the function of these textures remains a mystery. We are now developing a universal classification system for ant cuticle patterns and are beginning to apply machine learning techniques to classify the micro-sculpturing

*patterns of nearly 16,000 ant species. Our primary interest is in understanding how and why these patterns evolve. Here we will discuss our current hypotheses about how micro-sculpturing could influence abrasion resistance, structural mechanics, and insect-microbe interactions. We will also discuss past collaborations with artists to develop insect-inspired textile designs as well as the potential for new collaborations.*

1. MSIB Student in EEOB

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