UNDERGRADUATE RESEARCH DAY

APRIL 11, 2022

University of Missouri System

COLUMBIA | KANSAS CITY | ROLLA | ST.LOUIS

Dear Legislators,

As the state's only public research university, our students are provided unique opportunities to work alongside our talented faculty to conduct cutting-edge and groundbreaking research on our four campuses every day. These experiences, which range from science to medicine to the humanities, help to prepare our students for graduate and professional studies at prominent universities as well as careers in leading industries.

The University of Missouri System Undergraduate Research Day at the Capitol illustrates these student accomplishments and allows our elected officials to see, firsthand, the exciting innovations taking place at the University of Missouri-Columbia, University of Missouri-Kansas City, Missouri University of Science and Technology and the University of Missouri-St. Louis.

Enhancing student success and outcomes are central to our commitment to excellence in higher education. Thank you for joining us for this event and learning more about our undergraduate researchers who will also serve as the next generation of leaders.

Sincerely,

MUN Y. CHOI, PHD

President
University of Missouri

C. MAULI AGRAWAL, PHD

Chancellor
University of Missouri-Kansas City

MOHAMMAD DEHGHANI, PHD

Chancellor
Missouri University of Science and Technology

KRISTIN SOBOLIK, PHD

Chancellor
University of Missouri-St. Louis

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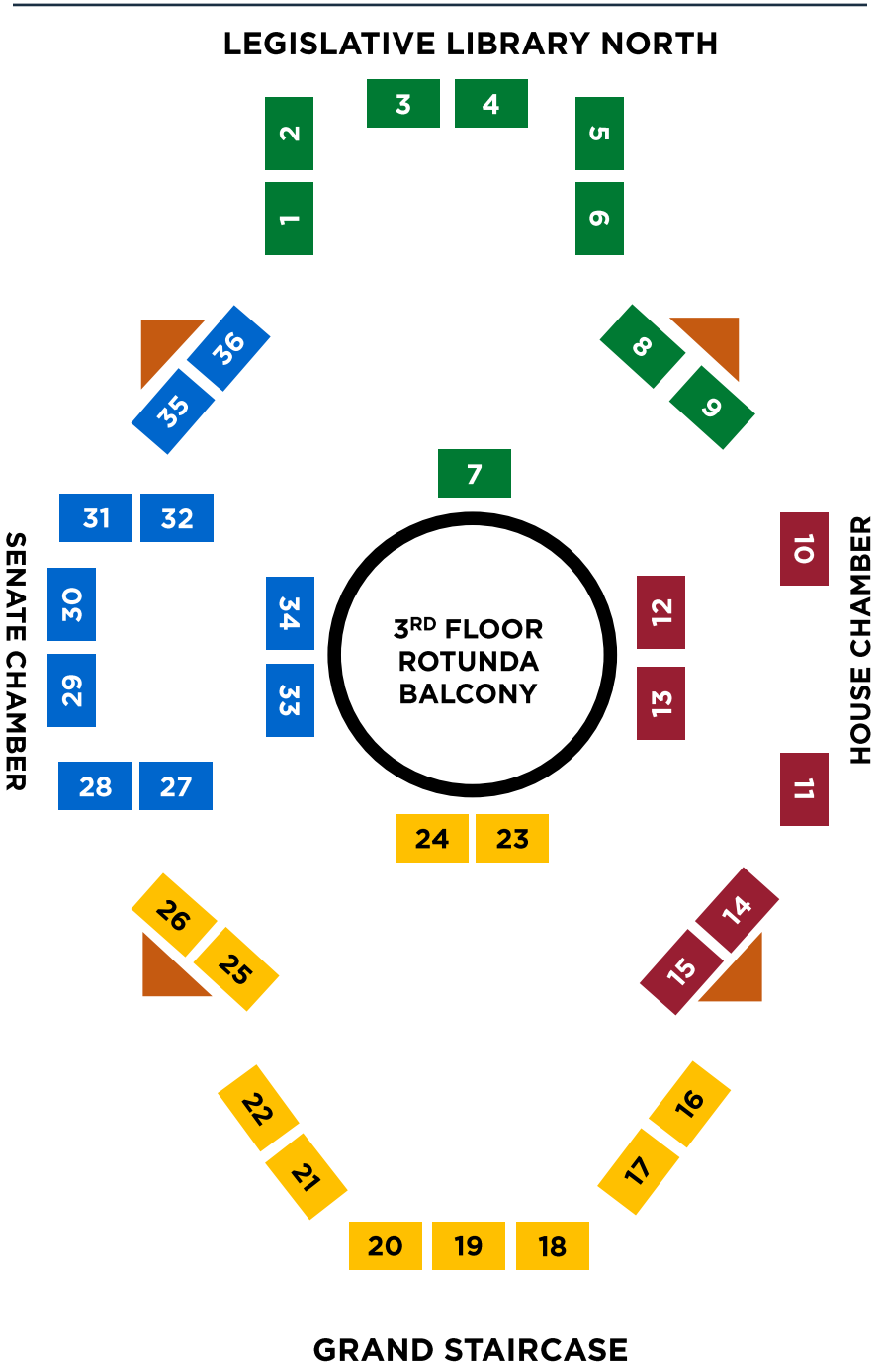
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SENATE CHAMBER
HOUSE CHAMBER
GRAND STAIRCASE

POSTER NO. 16

New sustainable pasta products using waste products from soy manufacturing

ANNIE CASBURN

Shawnee, KS

co-author, poster no. 17

Senate District 19
House District 45

MAJOR
Biological Engineering

FACULTY MENTOR
Kiruba Krishnaswamy

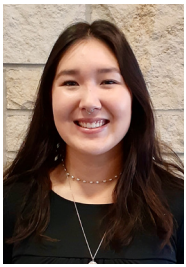
MENTOR'S DEPARTMENT
Biological Engineering; Food Science

FUNDING SOURCE
MU College of Engineering, Undergraduate Research Fellowship

With a growing population and new constraining environmental factors, there is a demand for more food options that are both sustainable and nutritious. The purpose of this project is to enhance the formula of noodles from a combination of semolina and soymeal, and to fortify the noodles with a B vitamin. Soymeal is a byproduct of the manufacturing of soybean flour, making it a promising zero-waste food additive. In addition to a control pasta made from 100% semolina, I tested combinations of 75% and 25%, 50% and 50%, and 25% and 75% of semolina and soymeal, respectively. After collecting the samples of each combination, a series of characterization tests were conducted, including color value, moisture content, thickness, water absorption index, water solubility index, cooking time, weight gain, and texture analysis. These characterization tests ensure the product would be desired by consumers. Upon completion, the data from each sample will be compared to results from commercially available pastas to determine the best formula for the noodles. The Food Engineering and Sustainable Technologies lab at Mizzou continues to work to engineer nutritious foods from ingredients that were once considered 'waste.' The next step in my research will be to fortify the new pasta product with vitamin B to make it more nutritious.

POSTER NO. 16

New sustainable pasta products using waste products from soy manufacturing



MORI HODEL

Fenton, MO

co-author, poster no. 17

Senate District 22
House District 97

MAJOR
Biological Engineering

FACULTY MENTOR
Kiruba Krishnaswamy

MENTOR'S DEPARTMENT
Biological Engineering; Food Science

FUNDING SOURCE
MU College of Engineering, Undergraduate Research Fellowship

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POSTER NO. 16

New sustainable pasta products using waste products from soy manufacturing

HALLE REACH

Kansas City, MO

co-author, poster no. 17

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MAJOR
Biological Engineering

FACULTY MENTOR
Kiruba Krishnaswamy

MENTOR'S DEPARTMENT
Biological Engineering; Food Science

FUNDING SOURCE
MU College of Engineering, Undergraduate Research Fellowship

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POSTER NO. 17

Watershed Models as Tools for Developing Effective Pollution Reduction Plans

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Columbia, MO

Senate District 19
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Biological Engineering

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MENTOR'S DEPARTMENT
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FUNDING SOURCE
MU College of Engineering, Undergraduate Research Fellowship

Supplying clean water, disposing of wastewater, and limiting chemical runoff are ongoing challenges for maintaining healthy ecosystems in the United States. Effective and long-term sustainable solutions are needed to conserve limited freshwater resources. Of greater concern to stakeholders is how to identify areas where land conservation plans can be implemented to limit pollution runoff. Here, we are developing computational models to simulate watershed runoff and chemical transport processes to (i) identify areas with excessive pollution runoff, and (ii) develop land management plans to reduce pollution.

In this project we are developing watershed simulation models to evaluate and compare water and chemical transport in several priority watersheds in Missouri. Our goal is to use publicly available information, combined with mathematical models, to assess present-day water quality. Once developed, we will compare the simulated water and pollution loads predicted by the model with current observations. Differences between predicted and observed values will help us identify data gaps and develop plans to collect missing information. We hope to utilize these realistic and reliable models to develop conservation plans for the priority watersheds.

Our modeling approaches could be utilized for other streams and water systems. Our hope is that once the watershed models are developed, they could inform the Clean Water Act's (section 319) nine-element watershed management plans - a type of clean water plan that provides ways to assess community water quality concerns and strategies to address them.

POSTER NO. 18

3D Modeling of Cities for Virtual Environments

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Architectural Studies

FACULTY MENTOR
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MENTOR'S DEPARTMENT
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FUNDING SOURCE
National Science Foundation and Dept. of Energy grants to mentor

Modeling and simulation of large urban regions is beneficial for applications ranging from infrastructure planning to training artificial intelligence (AI) for autonomous navigation systems (ground vehicles and aerial drones). Simulated urban environments, which can be viewed in virtual reality (VR), augmented reality (AR) or mixed reality (MR or XR), are rapidly changing as innovations in display technologies, graphics processors and game engine software present new opportunities for incorporating modeling and simulation into engineering workflows. We developed a modular visual processing software workflow for creating urban-scale, real-world accurate synthetic environments. Game engine software have plug-in support for a variety of virtual environments and typically model the scene as meshes. I evaluated four meshing algorithms for representation accuracy, as well as several city-scale meshes imported into Unity for assessing the validity of the immersive experience. The evaluation was done using an error metric that calculates the distance between the recreated synthetic environment and the ground-truth environment. Some of the algorithms have a small error metric, but the quality is bad. Poor quality is reflected by visualization of holes and blobs in the model or an inability to apply high resolution textures to the mesh. Depending on the end application, larger error metric may be tolerable. We give recommendation on meshing algorithms for applications that can and cannot tolerate holes in the mesh and applications that require the highest visual quality meshes. We conclude that meshing on city-scale data presents many challenges that a single algorithm cannot overcome. Future work includes developing more robust texture mapping algorithms to overcome the challenges we encountered.

POSTER NO. 19

The efficacy of selected fungicides for the protection of wine grapes in Missouri

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MENTOR'S DEPARTMENT
Plant Science and Techonolgy

FUNDING SOURCE
Grape and Wine Institute

Grapevine trunk diseases (GTD) are a considerable economic concern to the Missouri grape and wine industry. GTD is slow-growing and causes indirect damage to the grape vine that is often not directly visible to the grower. Fungi in the genus *Pestalotiopsis* will, in addition to causing GTD, also cause damage to grape leaves that result in fruit rot.

There are very few fungicides labeled for GTD. One new systemic fungicide, Rhyme (active ingredient, flutriafol, Frac code 3), is not yet approved for use in Missouri. The objective of this experiment was to assess the effectiveness of Rhyme and six additional fungicides for the control of *Pestalotiopsis spp*. by observing rates of berry fruit rot. Norton berries collected from collaborating growers were first washed and allowed to air dry. Five small pinpricks were made in the skin of the berries before submerging them in a 106 conidia/L *Pestalotiopsis spp*. solution. After inoculation, the berries were allowed to air dry and then treated with one of the seven fungicides at the labeled field rate. The berries were maintained in petri dishes at 25 C until the infection rate was evaluated after 48-72 hours. There were three replications per treatment with each rep having five berries. Fruit rot infection rates differed significantly among fungicides. Captan, Manzate, and Pristine provided the best protection against *Pestalotiopsis spp*. infection. The infection rate among berries treated with Rhyme was 81.7%, demonstrating ineffective protection against fungal infection. Future research will determine the efficacy of Rhyme fungicide and other selected fungicides for the control of *Pestalotiopsis spp.* in grapevine trunks to manage GTD.

POSTER NO. 20

Falling into the same patterns? An examination of minority portrayals in social identity-focused news outlets

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FUNDING SOURCE
Arts, Social Science & Humanities (ASH) Program Scholarship

Research shows mainstream news outlets showcase mostly negative portrayals of minority characters. Members of minority groups seek out content that aligns with their social-identity, so our study focuses on whether these social-identity focused news outlets offer more positive portrayals of minority characters. The current study examines portrayals of minority characters (with a focus on Latinos and Blacks) in eight prominent minority-focused news outlets. Drawing from one year of archived news content from four Latinx-focused (Al Dia, Latina.com, Latino Voices, and News Taco) and four Black-focused (Black Voices, Blavity, the Grio, and the Root) online news media outlets, our research team documented 1,781 prominent characters (meaning they were mentioned at least three times in the article with up to a maximum of four people counted per article). We hypothesized that these minority-focused news outlets would have more minority characters than in mainstream news media, and portrayals of these minority characters would be more positive than in mainstream news media. The results of our research support both of our hypotheses. Latinx and Black-focused news media offer an alternative to the more degrading portrayals of minorities in traditional news media. While Black and Latinx-focused news outlets provide more positive and more numerous portrayals of their target audience, these effects are not present for other minority groups such as Asian Americans and Native American, meaning these outlets can still work towards greater inclusivity. Our future research will investigate whether these more positive portrayals can lead to positive effects on the target audience (e.g., increased group- and self-esteem).

POSTER NO. 21

Stream Metabolism: The Breath of Urban Streams

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School of Natural Resources

FUNDING SOURCE
National Institutes of Health Maximizing Access to Research Careers (MARC) grant

Like individual organisms, ecosystems can have a metabolism. For streams, metabolism reflects how oxygen is generated and used. Stream metabolism is a good reflection of ecosystem health, as changes to oxygen influence the well-being of plants, microbes, and animals (ex. fish kills). Most of the organisms contributing to changes in oxygen reside in the streambed and the sediments. In this study, we investigated the relationships between land use and stream metabolism in two urban streams: one with a history of mining (Lone Elm Creek, Joplin, MO) and one without (Flat Branch Creek, Columbia, MO). Heavy metals accumulate in sediments where they can negatively impact the microbes and other aquatic organisms that reside there. In the Southwest Missouri Tri-State Mining District, abandoned mine entrances continue to discharge contaminated water into nearby streams, including Lone Elm Creek. We collected temperature and dissolved oxygen (DO) from both streams every five minutes for three months. DO showed a strong daily pattern, with lower oxygen at night and higher levels during the day. Flat Branch Creek had higher levels of DO than Lone Elm Creek, most likely due to colder waters from more canopy cover. Flat Branch has larger daily swings in DO (~13 mg/L) compared to Lone Elm's (~10 mg/L). As large fluctuations in DO are not seen in Lone Elm, heavy metals may be impacting the streambed organisms consuming and producing oxygen. This study seeks to improve the understanding of how the overall health of these freshwater bodies relates to land use practices.

POSTER NO. 22

The Effect of Official Corruption on Trust in Government

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Jeff Milyo

MENTOR'S DEPARTMENT
Economics

FUNDING SOURCE
MU Honors College, Cherng Summer Scholars

Two topics that seem to be at the root of current political discourse are official corruption and public trust in government. With a curiosity as to the connection between these two issues, the purpose of my project has been to see whether higher rates of public corruption result in lower levels of public trust in government. For this project, official corruption was defined as the number of prosecutions and convictions of government officials on corruption charges in each state between 1987 to 2017. Trust in government was measured by a compilation of three different surveys that asked about individuals' trust in their state governments conducted within that same time frame. While controlling for other variables, we found that convictions, but not prosecutions, predicted levels of trust in government in our sample. However, given the results of the hypothesis testing, this relationship cannot be extended outside of our sample and therefore makes it not meaningful. A variable that stood out, though, was the respondent's identification with the controlling political party in that state. It showed that a person's affiliation with the controlling political party in their state has a larger impact on their trust in government than any other. To conclude, the level of corruption has little, if any, effect on people's trust in government. Rather, partisanship and political polarization are the primary determinants of one's trust in their government.

POSTER NO. 23

Overview of radiopharmaceuticals: bifunctional N2O2 Schiff base ligands for 99mTc and 186Re

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House District 35

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Silvia Jurisson

MENTOR'S DEPARTMENT
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FUNDING SOURCE
MU Honors College, Stamps Scholars

Technetium (Tc) and rhenium (Re) are metals that have radioactive isotopes useful to medicine. Technetium-99m allows imaging of the body and a radioactive rhenium isotope can destroy cancer cells. Attaching molecules to these metals can give them desirable properties. Any molecule that attaches to a metal is known as a ligand. Some of these ligand-Tc-99m combinations have been used for a long time in diagnostic nuclear medicine. One class of Tc-99m compounds are used for heart imaging and multidrug resistant tumor imaging. My research has worked to develop compounds that use rhenium with the ligands already designed for technetium. Combining the two metal compounds has the benefit of allowing them to serve as both therapeutic (kill cancer) and diagnostic (allow imaging) radiopharmaceuticals . These 'theranostics' allow more specialized care and better patient monitoring.

The development of these compounds requires a molecule, like an antibody, that directs it to harmful cells, and then binds to them carrying the radioactive payload with them. In this way, only cancer cells are irradiated, and healthy cells are unharmed. Previous experiments have shown that changes to the ligands influences their ability to stay bound to the radioactive metals. I prepared several model ligands to better understand what factors impact this stability. The non-radioactive rhenium complexes were characterized using a variety of chemical techniques. Synthesis of the technetium-99m complexes allowed me to evaluate stability over 24 hours. Thus, several new considerations needed for the development of potential Tc and Re radiopharmaceuticals can be made.

POSTER NO. 24

Complex mutation patterns of SARS-CoV-2 Omicron: Evading antibodies without losing receptor recognition

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MENTOR'S DEPARTMENT
Molecular Microbiology and Immunology

FUNDING SOURCE
National Institutes of Health grant to mentor

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) rapidly evolves to produce new variants, each with a unique set of genetic mutations. Most recently, a new Variant of Concern (VOC) designated Omicron (B.1.1.529), has been observed to be more infectious and able to avoid natural immune responses created through vaccination or earlier infections. Coupling experimental data with the use of bioinformatics and artificial intelligence (AI) techniques that involve database searching and predictive computations, we provide in-depth explanations for the effects of the unique mutations possessed by VOC. Our results showed that several of Omicron's unique (signature) mutations, cause very rapid (nanosecond) shape-changes in the area of the spike protein where it interacts with host antibodies. These rapid shape changes may allow the virus to avoid interacting with antibodies but maintain its ability to bind with receptors, the molecule where virus lands on host cells. In doing so, vaccine effectiveness is hindered as well as the effects of being previously infected. We have conducted similar molecular dynamics studies for all signature mutations observed in Omicron variants and provided analyses on the effectiveness of current vaccines. Specific mutations resulting in significant position changes are indeed noted and thus deemed as more relevant given their more infectious nature. In conclusion, our results show that a subtle change in the structure of the spike protein can result in compromised effectiveness of vaccination or prior infections. Future research to develop new boosters in response to novel variants should consider mutations in the spike protein.

POSTER NO. 25

Utilizing plant stress responses to clean up polluted soils

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House District 83

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FACULTY MENTOR
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MENTOR'S DEPARTMENT
Biological Sciences

FUNDING SOURCE
National Science Foundation and Dept. of Energy grants to mentor

Anthropogenic factors such as climate change, harsh agricultural practices, and mining have contributed to increases in salt concentrations (salinization) and heavy metal contamination. Halophytes are plants with various adaptations that allow them to survive and reproduce in saline conditions. By studying halophytes, we hope to get a clearer idea of how we can use plants to improve soil pollution. The general mechanisms that allow halophytes to tolerate salt are thought to have evolved to deal with other stressors, like heavy metals, and plants with these traits could be utilized to extract salt and heavy metals from affected soils in a process called phytoremediation. We plan to develop Sea Rocket (*Cakile maritima*) in the Mustard family as a model system to understand mechanisms of salt and cadmium uptake and tolerance, as it has been shown to accumulate both. As part of this study, we have hydroponically grown *C. maritima* in different stress treatments using salt and cadmium. As the plants uptake the pollutants, the conductivity of the hydroponic solution changes. We have developed methods to track these changes in real-time using conductivity sensors. In addition, we have sampled root and leaf tissues at various time points and will measure salt and cadmium uptake using elemental analysis. Highly saline environments drastically lower crop yields, leading to major economic losses, and elevated levels of toxic metals are carcinogenic in the environment. Uncovering the mechanisms behind salt and cadmium tolerance is the first step towards developing new solutions for phytoremediation.

POSTER NO. 26

Measuring gene activity of bone-building cells in a mouse model of brittle bone disease

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Ste. Genevieve, MO

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House District 116

MAJOR
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FACULTY MENTOR
Charlotte L. Phillips

MENTOR'S DEPARTMENT
Biochemistry; Child Health

FUNDING SOURCE
National Institutes of Health Maximizing Access to Research Careers (MARC) grant

Healthy bones allow us to play sports, walk, and even type on a computer. When the integrity of bone is compromised, these simple tasks can cause bones to break. Our lab studies the heritable brittle-bone disease called osteogenesis imperfecta (OI), which causes fragile bones. Using a type of mouse that has OI (*oim*), we sought to investigate if bone building cells were doing their job correctly. Bone is a composite of minerals and the protein collagen, and OI is often due to defects in type I collagen genes (*Col1a1 or Col1a2*). A third important gene, the *Runx2* gene, is responsible for the formation of osteoblasts, the cells responsible for building bone. To determine if the *Runx2* gene and the type I collagen genes, *Col1a1and Col1a2*, make a normal amount of protein in OI, we used a technique known as RT-qPCR. We collected osteoblasts from the skull bones of 7–10 day old oim and normal mice. We grew the osteoblasts and on days 1, 7, 14, and 21, used RT-qPCR to measure protein products of *Runx2*, *Col1a1*, and *Col1a2* genes. We found that all three genes produced lower levels of protein in oim mice compared to their normal mouse counterparts. Further testing will need to be completed to confirm these findings, but preliminary data suggests that fewer osteoblasts are formed, and less bone is produced, which could contribute to the severe fragility observed. These findings could be translated to other diseases such as osteoporosis to find a more effective treatment.

POSTER NO. 27

Falls in Older Adults: Preventing Risks with Physical Activity and Cycling

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Stockton, MO

Senate District 28
House District 128

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Public Health

FACULTY MENTOR
Joseph Lightner

MENTOR'S DEPARTMENT
Nursing and Health Studies

FUNDING SOURCE
UMKC SUROP Grant

In the United States, adults aged 65 or older (older adults) are at an increased risk of injury from a fall. Reducing an individual's risk of falling is crucial to avoiding an injury or fatality. Older adults with higher physical activity (PA) through behaviors such as cycling are less likely to fall. This study aimed to compare the PA and balance of older adults who regularly cycled to older adults with little to no reported PA and the number of self-reported falls. Older adults (n=46) were largely recruited from online groups and flyers placed at local community centers. Participants were divided into cyclists (n=19) and noncyclists (n=27) based on regular cycling activity. Each participant completed a one-time visit to fill out a series of surveys, including the Activities-Specific Balance Confidence (ABC) scale, and performed a balance assessment. Each individual also received a Garmin Vivofit 4 accelerometer to track PA. Survey answers and PA data were analyzed using IBM SPSS 27.

On average, cyclists recorded more weighted active minutes (89.98 minutes) than noncyclists (47.61 minutes). An analysis of the recorded data of noncyclists showed a significance ($p=0.003$) between weighted active minutes and the number of self-reported falls, while cyclists did not show significance. Additionally, scores from the ABC also yielded a statistical significance for balance. Decreasing the risk of a fall is crucial to avoiding injury in older adults. Cyclists show to have increased PA and fewer reported falls on average. Increased balance and physical activity have potential benefits for adults at risk of falling during daily life.

POSTER NO. 28

Impact of COVID-19 Pandemic on Middle Aged and Older Adults' Physical Activity Levels

MAYA BAUGHN

Independence, MO

Senate District 11
House District 21

MAJOR
Health Sciences

FACULTY MENTOR
Amanda Grimes

MENTOR'S DEPARTMENT
Nursing and Health Studies

FUNDING SOURCE
UMKC Retirees Association Scholarship in Aging Research

Physical activity is important for middle aged and older adults to maintain physical and mental health and is a protective factor for viral infections. As a result of its importance, it is vital to understand barriers to physical activity and if trends of low physical activity have continued throughout the pandemic. Therefore, the purpose of this study is to qualitatively explore the impact of the COVID-19 pandemic on middle aged and older adults' physical activity nearly 6 months into the pandemic. Undergraduate students conducted interviews with adults aged 50+, asking how their activity was impacted due to the COVID-19 pandemic. Approximately 230 interviews were conducted with a diverse sample of participants from the Midwest (22.5% Black and 11.0% Hispanic).

Overall, most older adults interviewed (54.6%) reported no change in their physical activity, often reporting that their work kept them active. Additionally, a total of 42.7% of the sample reported decreases with 27.8% of reported decreases being from Black and 10.3% from Hispanic respondents. Limited access to social relationships with friends and family and strictly following stay-at-home restrictions were cited as reasons for decreased physical activity levels. The few reporting an increase (2.6%) in physical activity had more time available to be active, including setting goals while staying home. This data provides an insight on how COVID-19 impacted activity levels for older adults. These findings can inform tailored interventions to promote physical activity during the pandemic. For example, interventions should focus on safely leveraging social relationships to increase activity levels.

POSTER NO. 29

Xenolith Structures in Welded Basalt Agglutinate Associated with Dotsero Crater, Colorado

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Senate District 7
House District 26

MAJOR
Earth and Environmental Sciences

FACULTY MENTOR
Alison Graettinger

MENTOR'S DEPARTMENT
Earth and Environmental Sciences

FUNDING SOURCE
UMKC SUROP Grant; UMKC SEARCH Grant

The focus of this study is to gain a detailed understanding of the lava and sediment interactions that occurred at the Dotsero maar volcano in Dotsero, Colorado through examination and analysis of xenoliths within the welded agglutinate. A xenolith, or foreign rock, can be described as a fractured piece of underlying sediment that has been transported to the surface by magma during an eruption and can be found within volcanic deposits like welded agglutinate, or cooled lava spatter. The Dotsero maar volcanic crater formed through phreatomagmatic, processes involving lava interacting with groundwater, and magmatic processes around 4,150 ± 300 years B.P. and erupted through sections of Pennsylvanian sediment deposits (323 - 299 Ma). Field observations of the eruptive material showed a variety of xenolith structures which were classified into four specific categories based on grain size and variations in the color of the sediments.

Detailed laboratory analyses included X-Ray powder diffraction and scanning electron microscopy of local surface sediments and xenolith samples collected from the three sites south of Dotsero Crater. These analyses will provide answers to thermal impacts and deformation on the localized sediment xenoliths from the eruption event to gain a deeper understanding of the impacts to the surface sediments and provide the groundwork for future analysis and study. The skills used to describe and reconstruct regional geology are valuable to addressing a wide range of problems, both here in Missouri and beyond.

POSTER NO. 30

Reframing the Narrative: Uncovering Kansas City Women in Jazz

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Music Theory

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MENTOR'S DEPARTMENT
Musicology

FUNDING SOURCE
UMKC SUROP Grant

The jazz canon, formed primarily by white, male scholars of the twentieth century, has neglected and trivialized the careers of women within the genre, especially instrumentalists. This research project investigates the historically underrepresented and forgotten women in Kansas City jazz. These women were highly influential to the development of the region's distinct style, which, in turn, greatly contributed to the city's growth, although history texts do not reflect this. Even in the twenty-first century, the contributions of women in jazz remain overshadowed and diluted by their male colleagues and competitors. This research diversifies the highly gendered jazz canon, as well as reframes Kansas City jazz history, and the city's history at large, which excludes Black women disproportionately. This research has been used to create a database of Kansas City women in jazz: Countess. Countess preserves the legacies of the women that helped build the vibrant Kansas City jazz scene and spotlights the women on today's scene that keep the Kansas City jazz tradition alive and thriving through a free, online, and widely accessible medium.

POSTER NO. 31

Student Life Through the Art of Luis Quintanilla: A Study of the Murals in Haag Hall

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House District 11

MAJOR
Spanish; Sociology

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Viviana Grieco

MENTOR'S DEPARTMENT
History; Latin American and Latinx Studies

FUNDING SOURCE
UMKC Emerging Research Scholars Program

In 1941, Clarence Decker, President of the University of Kansas City (UKC, today UMKC) between 1938 -1953, offered Luis Quintanilla (1893-1978), a Spanish artist who mastered the Italian fresco painting technique, a position as a resident professor. Quintanilla lived through the World Wars and the Spanish Civil War (1936-1939). He opposed the dictatorship of Francisco Franco and lived in exile in New York City until the 1950s. Then, he relocated to France and returned to Spain in 1976 (after Franco's death) where he resided until his own death in 1978. Counting on the support of the Emergency Committee in Aid of Displaced Foreign Scholars (which was established to aid scientists and academics fleeing from Nazi Germany), Dr. Decker invited Quintanilla to UKC to establish the first fresco painting school in the United States. While painting murals on the walls of the Liberal Arts Hall (present-day Haag Hall), Quintanilla was given the opportunity to train apprentices and engage with the students who served as models. My research focuses on Dr. Decker's efforts at broadening the academic scope of the university by appointing prominent international figures to the faculty. Additionally, it explores how the university engaged with students beyond the classroom. Finally, it studies the institutional and financial support UKC received from the Emergency Committee and other organizations that aided American universities interested in hiring displaced scholars. For advancing this project, I read and analyzed original primary sources housed at UMKC's archives, UMKC's LaBudde Special Collections, The Rockefeller Foundation, and the New York City Public Library. I consulted Dr. Decker's correspondence, UKC's yearbooks, the records of the Committee in Aid of Displaced Foreign Scholars, and Rockefeller Foundation's Annual Reports, Articles from the Kansas City Star covering the progress of the murals as well as New York Times articles concerning foreign scholars were accessed online. My research is relevant to Missourians as it shows how higher-education institutions promote cultural engagement through students' activities within and outside the classroom. While they were painted, Quintanilla's murals were noted by the press and the local community. However, over time, they received less attention. I hope that my work helps these murals become noted beyond the walls of Haag Hall.

POSTER NO. 32

The Importance of Yeast in Cancer Research

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Biology; Chemistry

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FUNDING SOURCE
UMKC SEARCH Grant

Cancer is the second leading cause of death in Missouri. Cancer is formed by mutations which prevent cells from behaving normally, for example normal regulation of cell division is lost in cancer cells. Cell division is regulated in part by a family of proteins called cyclins, and cyclin levels are raised to abnormally high levels in cancer cells causing unregulated cell division. A eukaryotic model organism, the yeast Saccharomyces cerevisiae, has been used to examine how cyclins regulate cell division. Yeast is a useful model for cancer cells because it has a short generation time, shares many biological properties with human cells, and is relatively simple to genetically manipulate. My research focuses on three yeast cyclins – Cln1, Cln2, Cln3. We are determining whether mutants in these cyclins affect surrounding cells as well as the cell containing the mutation. These experiments will define whether cyclins are involved in cell-cell communication. Understanding cyclin function in yeast could help elucidate the role of these cyclins in cancer.

POSTER NO. 33

Hair Cell Regeneration in Zebrafish

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House District 35

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Biology; Chemistry

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Hillary McGraw

MENTOR'S DEPARTMENT
Biology

FUNDING SOURCE
UMKC SEARCH Grant

Approximately 18% of adults in the USA and 19% of adults in Missouri report hearing loss. Understanding the biology of hearing and hearing loss is critical to finding potential clinical treatments. In the ear, specialized cells, called hair cells, sense sound. When hair cells are damaged, they fail to regrow, resulting in hearing loss. Aquatic animals have hair cells that sense water current, and in contrast to hair cells in the ear, they can regrow following damage. Currently, I am performing undergraduate research in the McGraw lab at UMKC investigating the genetic regulation of hair development and regeneration using zebrafish (*Danio rerio*) as a model organism. In my research, I am using a mutant zebrafish line in a gene called Kremen1 that shows increased development and regeneration of sensory hair cells. I am using this mutant line to understand how and why excess hair cells form in the fish sensory system. Understanding the mechanisms that allow regeneration in zebrafish hair cells could help human treatment research for hearing or balance function loss.

POSTER NO. 34

Understanding Latinx Students at an Urban Research University

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FACULTY MENTOR
Stephen Christ

MENTOR'S DEPARTMENT
Sociology

FUNDING SOURCE
UMKC Emerging Research Scholars Program

The purpose of my study is to better understand the Latinx students on UMKC's campus. UMKC plays a crucial role in its community as an urban research university. For many students, an added plus of UMKC is the small faculty-to-student ratio. This is attractive to prospective students as it often indicates more interactions with faculty to support academic success. The first mission of this study is to understand the Latinx students and how they see themselves within the larger context of UMKC's campus. Latinx students are largely underrepresented in higher education and it is important to understand the complexities this student demographic faces in their undergraduate journeys. A better comprehension of Latinx students can be seen as an asset for campuses across the United States to improve their diversity and inclusion plans. Another aspect of this study is to survey the educators on campus and how able they feel they are to understand their Latinx students. It has been seen that if a student makes just one friend in their first year of college, they are more likely to stay. The support students receive also has a correlation to the retention rates of Latinx students on their campus. By collecting responses from both Latinx students on campus as well as their faculty, we can get two perspectives on the issue of the underrepresentation of Latinx students in higher education.

POSTER NO. 35

Building a Georeferenced Database for the 1976 Guatemalan Earthquake Rupture of the Motagua Fault System along the North American-Caribbean Plate Boundary

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House District 36

MAJOR
Earth & Environmental Science

FACULTY MENTOR
Tina Niemi

MENTOR'S DEPARTMENT
Earth & Environmental Sciences

FUNDING SOURCE
UMKC SUROP Grant; UMKC SEARCH Grant

In this study, we sought to relocate sites along the 1976 Motagua fault rupture by analyzing archival material from George Plafker of the U.S. Geological Survey who was part of the team that collected data on the effects of the earthquake within days of the event. The data included 1250 original 35 mm slides, numerous annotated 1:50:000 scale topographic maps, several hundred aerial photographs, a 1978 field trip guidebook, and various other original documents that are only available in paper format.

The process of georeferencing the data proved difficult, as names and locations of many towns, roads, and geographic features have changed or no longer exist. The data were georeferenced using Google Earth and ArcMap, and when possible, correlated to field notes and map annotations. After the files were georeferenced, a geodatabase was built in ArcMap thus providing easily accessible geospatial data for photographs. The 1976 Guatemala earthquake georeferenced database can then be loaded into a mobile GIS software such as Touch GIS for use in the field. Prior to this project, locating any of these past field sites and points of interest along the 1976 Guatemalan earthquake rupture was hindered by the lack of GPS coordinates. The new database will benefit future paleoseismic and seismic hazard analyses research.

POSTER NO. 36

How Stress Level and Coping Styles Impact Eating Decisions

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MENTOR'S DEPARTMENT
Psychology

FUNDING SOURCE
UMKC SEARCH Grant

It is widely accepted that stress and emotions lead to changes in eating behavior (Greeno and Wing, 1994; Ganely, 1989). Maladaptively coping with stress and emotions has been postulated to negatively impact eating behavior (Martyn-Nemeth et. al., 2008); therefore, identifying adaptive coping strategies that would lead to positive eating behavior changes is an integral path for public health research. Past research has identified two primary coping styles an individual uses to deal with stress: Problem-Focused Coping, where one take actions to eliminate stress; and Emotion-Focused Coping, where one tries to regulate emotions to minimize impacts of stress. My research analyzed the relationship between problem and emotion-focused coping styles and eating behavior. Participants rated foods based on taste, health, preference, and consumption using a computer food rating and choice task and completed a self-report measure concerning factors associated with eating behavior. Participants then completed a self-report measure that ascertained their preferred coping style. Results showed that individuals who engage in unhealthier eating behaviors are less likely to use problem-focused coping strategies. However, emotion-focused coping was not found to be correlated with unhealthy eating decisions. These results appear to indicate that individuals who make unhealthier eating decisions do not utilize problem-focused coping strategies when it comes to dealing with stress. Future research should seek to determine if teaching problem-focused coping strategies would lead to healthier eating decisions.

POSTER NO. 1

Developing Flexible Non-enzymatic Biosensors for Continuous Health monitoring

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Chemistry

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Manashi Nath

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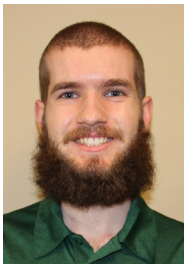
Chemistry

FUNDING SOURCE
National Science Foundation

These research products (i.e. novel biosensors) can improve health conditions in Missouri rural areas where there is limited access to testing facilities and state-of-the-art healthcare. These products can also reduce/alleviate the risk of PTSD, Alzheimer's, and other neurological disorders in susceptible patients including elderly and stressed individuals by continuous monitoring of dopamine levels (for pre-diagnosis) and integrating it with available healthcare networks for preventive care. These sensors are multifunctional leading to the detection of range of biomolecules most of which are acquired through diet and behavioral patterns and can be used to investigate the synergistic effect of such biomolecules on developing neurological (Alzheimer's, depression, Parkinson's) and metabolic disorders (such as diabetes, obesity, etc.)

POSTER NO. 2

High-fidelity Numerical Simulations of Tornadoes through Combining CM1 and CFD



CALEB FINK

Troy, MO

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House District 64

MAJOR
Mechanical Engineering

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Kakkattukuzhy Isaac; Guirong Yan

MENTOR'S DEPARTMENT
Mechanical Engineering

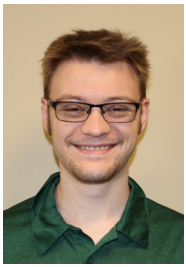
FUNDING SOURCE
NASA Missouri Space Grant Consortium, National Oceanic and Atmospheric Administration

Tornadoes result in an incredible amount of property damage and a significant number of fatalities each year. There is a need to improve the construction of civil structures to resist the wind effects of tornadoes to reduce damage. Considering that it is very challenging to obtain the *in situ* velocity and pressure measurements, in order to study wind characteristics of tornadoes and their wind effects on civil structures, CFD simulations can be used to create detailed, accurate tornadoes. To balance the simulation precision and computational cost, in this study, a new numerical simulation approach that couples CM1 with CFD is created to ensure the simulated tornadoes are as close to the real-world situation as possible. This coupling produces a simulation which has low deviation from the CM1 simulation and allows for high-resolution analysis. Using this approach, it is possible to create simulations which accurately simulate real-world tornadoes that will have the resolution necessary to observe the effect on common civil structures.

MISSOURI S&T

POSTER NO. 3

Intuitive user interface and software optimizations for cost effective and low training soil property discovery



RICHARD GORZEL

St. Peters, MO

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House District 105

MAJOR
Computer Engineering

FACULTY MENTOR
Xiong Zhang

MENTOR'S DEPARTMENT
Civil, Architectural and Environmental Engineering

FUNDING SOURCE
U.S. Dept. of Transportation through the National Center for Transportation Infrastructure Durability & Life Extension

Current methods of determining mechanical properties of soil require extensive training and expensive hardware. This project was undertaken in order to make a set of powerful photogrammetric MATLAB scripts usable by engineers in the field with little to no training. By developing a graphical user interface, it was possible to allow extremely fine granular control of what was previously a raw MATLAB script without the overwhelming prospect of manually editing configuration files directly. This allows the end-user to use cost effective sensing hardware with little training.

POSTER NO. 4

Effects of Auditory Stimuli on Attention in Visual Search

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MAJOR
Psychology & Biological Sciences

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Psychological Science

FUNDING SOURCE
N/A

While focusing on tasks, many people may choose to play music or white noise in the background to aid their focus. However, it seems odd that adding a stimulus to the environment would help one focus on other stimuli, rather than serving as a distractor. This study aims to find if music and white noise are effective focus tools, or not. Previous research shows that music may have special qualities that help with focus, though other research shows music can be distracting. In this study, different auditory stimuli such as no noise, white noise, nonlyrical music, and lyrical music, were tested to determine their effects on one's focus and attention on a "T among L's" visual search task. It was found that only white noise had a significant effect by slowing down reaction time. These findings can help everyone including teachers, students, and workers who want to create an optimal learning or working environment. This research indicates that for simple visual search tasks, white noise is a poor focusing tool, while music is an ineffective, though harmless, one.

POSTER NO. 5

Analysis of Cybersecurity and Survivability for Autonomous Vehicles

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Electrical and Computer Engineering

FUNDING SOURCE
National Science Foundation

Connected vehicle technology is already prevalent in consumer transportation, with vehicles boasting Wi-Fi capable infotainment systems, hands-free calling, and driver assistance programs such as OnStar (General Motors). Assisted driving, including self-parking and traffic sign recognition, is becoming increasingly available. Consumer use of fully autonomous vehicles is on the horizon.

Testing, standardization, and regulation of connected and autonomous vehicles has not kept pace with the rapid advances in their capabilities, manufacturing, and use. As bad actors and malicious threats increase, along with the development of more sophisticated computing techniques, unidentified vulnerabilities in autonomous vehicles can be exploited to cause serious consequences, up to and including loss of life. Furthermore, attacks on these vehicles can have ripple effects on other vehicles, as well as components connected to intelligent transportation systems, which are networks of devices used to collect and distribute data to increase transportation safety and efficiency.

Our research aims to reduce these risks by identifying, simulating, and predicting potential attacks on autonomous vehicles. The first step is to identify vulnerabilities that can be exploited in potential attack vectors. This is followed by determining the likelihood and severity of each successful attack, by using a simulation environment that models autonomous vehicles and their surroundings, including intelligent transportation systems to which they may be connected. Our ultimate goal is to evaluate and improve survivability for an autonomous vehicle under attack, i.e., determine and increase the extent of critical functionality retained under attacks of greatest concern.

POSTER NO. 6

Machine Learning Optimizes a Survey of Dark Energy

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FUNDING SOURCE
Missouri S&T National Merit Semifinalist Scholarship Package

Measuring the history of cosmic expansion via the Baryon Acoustic Oscillation (BAO) scale from a gigantic three-dimensional galaxy map is a well established technique to probe the nature of dark energy, one of the most fundamental mysteries in physics now. In fact, a forthcoming galaxy redshift survey, the Subaru Prime Focus Spectrograph, is designed mainly for this purpose. An essential optimization problem in such galaxy redshift surveys is the target selection. Namely, it is not clear how we should select our targets to maximize the number of galaxies which provide successful redshift measurement in a desired cosmic epoch, while avoiding other galaxies. Taking PFS as an example, we apply a modern machine learning algorithm to the target selection problem. In this project we analyze how well machine learning could optimize the PFS survey target selection compared to more conventional methods, and show that our new approach could play a crucial role in understanding dark energy.

MISSOURI S&T

POSTER NO. 7

Marine Corps Recruit Training: Why a Centralized System of Recruit Training was Established and How it Helped Create a Unique Enlisted Culture in the Marine Corps

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MAJOR
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MENTOR'S DEPARTMENT
History

FUNDING SOURCE
N/A

Marine Corps Recruit Training — boot camp — has become an institution in American martial lore. Although boot camp is addressed in many biographies, histories of the Marine Corps, and guidebooks for prospective recruits, few historians have devoted significant discussion to why the Marine Corps chose to develop this method of training. This paper will focus on the specific events in the early 20th Century which caused the Corps to develop depots devoted to training new recruits and transitioning them from civilian to Marine. The paper relies heavily on reports from the Commandant of the Marine Corps to the Secretary of the Navy concerning the early attempts and challenges associated with creating an effective system for training new Marines. Early training materials and recollections from recruits as well as correspondence and documentation from the early recruit depots fill in gaps the Commandant's executive summaries do not address. These documents show a combination of factors led to the creation of recruit depots. A high operational tempo, combined with lack of training facilities, especially rifle ranges, as well as inefficiencies in screening new recruits for physical and medical readiness resulted in lower effectiveness, morale, and ultimately a significant desertion rate. The development of recruit training significantly improved training, readiness, and morale and contributed directly to the successes the Marine Corps enjoyed during World War I. The recruit training methodology went through significant changes up through the mid-20th Century, but the overall strategy of recruit training remained the same and contributed significantly to the development of the unique subculture of the Marine enlisted member.

POSTER NO. 8

Phylogeography of the Bigmouth Shiner, *Notropis Dorsalis*

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Biological Sciences

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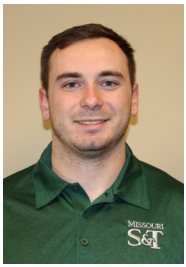
MENTOR'S DEPARTMENT
Biological Sciences

FUNDING SOURCE
COER

North American river systems exhibit diverse communities of freshwater fish, which are among the most diverse in the world. This diverse speciation is due in part to the extensive impact of Pleistocene era glaciation on river drainages. This glacial formation drove northerly distributed species to seek refuge in more southern habits during maximum glaciation. Once the glaciers retreated, the species redistributed back to more northern habitats of their drainages. Some broadly distributed northern species such as Bigmouth Shiner *Notropis dorsalis* might in fact be comprised of multiple divergent and geographically separated lineages. *Notropis dorsalis* is a species of minnow native to small streams throughout central North America, occurring throughout tributaries of the Missouri River, upper Mississippi River, and tributaries of Lake Michigan and Lake Erie. All known populations of *N. dorsalis* exhibit homogenous morphology, however we hypothesized that geographically separate populations would contain genetically distinct groups known as cryptic species. Using molecular genetics, it was possible to compare genetic variations in *N. dorsalis* samples through sequencing of the highly variable region of mitochondrial DNA known as cytochrome B. The variations in the cytochrome B gene have displayed distinct and most likely cryptic clades that align with the geographic isolation of the observed *N. dorsalis* lineages. This study has shown two distinct clades populating the Missouri and Mississippi River drainages, respectively, which are more closely related to each other than clade representatives observed in two different Great Lakes drainages. Additional sampling of populations in the eastern ranges of *N. dorsalis* is ongoing.

POSTER NO. 9

Miniature Fatigue Testing Controller Parameter Estimation Based on Frequency Response and Material Properties



NATHAN SWADLEY

Willard, MO

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House District 130

MAJOR
Mechanical Engineering

FACULTY MENTOR
Frank Liou

MENTOR'S DEPARTMENT
Mechanical and Aerospace Engineering

FUNDING SOURCE
GKN Aerospace, Product Innovation and Engineering, and the Department of Energy

Engineering design must have strong consideration when it comes to material fatigue. As additive manufacturing (AM) technologies advance and new alloys become possible to deposit, it becomes essential for engineers to understand the fatigue characteristics resulting from this process. Conventional fatigue testing specimens require large footprints for AM technologies that not only bring about size, but cost issues as well. With more exotic alloys, this problem amplifies. Using an in-house designed fatigue machine that reduces specimen size significantly, these new alloys can be tested in greater numbers with the same amount of material. Because no two materials behave exactly the same, it is important to be able to model, predict, and implement proper control parameters and frequencies to accurately examine the fatigue characteristics of any material. This project introduces the methods for doing so and provides the relevant results from such a procedure.

UMSL

POSTER NO. 10

Experiences with Community Health Work among clients at Bridge of Hope

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House District 83

MAJOR
Sociology; Psychology

FACULTY MENTOR
Larry Irons

MENTOR'S DEPARTMENT
Sociology

FUNDING SOURCE
Bridge of Hope

This study will explore how Bridge of Hope's (BoH) newly implemented BoH Program assist the unhoused and how management, staff, and clients view its effectiveness. Effectiveness will be assessed by exploring the clients' journey through BoH in relation to its newly introduced client-based on-site community health services.

The question explored is: Does the application of onsite client-based community health services and holistic care improve clients' perceived stability and quality of life?

Specifically, it aims to 1) understand the factors that block or facilitate access to Community Health work services, and 2) understand if Community Health work impacts client's stability and if so how?

The research question will be explored utilizing face-to-face in-depth interviews at a day shelter in North St. Louis' neighborhood The Ville. The population of The Ville is predominantly African American (97%), this reflects the majority of the participants who will have the opportunity to participate in this study.

UMSL

POSTER NO. 11

Comparative Performance of Food and Nutrition Security Operations

MAYA HARTER

St. Louis, MO

Senate District 5
House District 79

This research presents a systemic characterization of the different operational features of food and nutrition security supply chain operations. The results provide insight into the level of effectiveness of different approaches to mitigate food and nutrition insecurity. In-depth interviews were conducted in the St. Louis Metropolitan Area to gather data about the supply chain configurations employed by these organizations. Using a grounded theory approach, the authors extracted the common themes that characterize the organizational structures and supply chain dynamics from the organizations interviewed. The results discuss the chief conclusions and policy implications.

MAJOR
Marketing; Supply Chain Management

FACULTY MENTOR
Trilce Encarnación; Matias Enz

MENTOR'S DEPARTMENT
Supply Chain and Analytics

FUNDING SOURCE
N/A

UMSL

POSTER NO. 12

Competition between honey bees (*Apis mellifera*) and native bees: an investigation in urban community gardens

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House District 42

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Biology; Pre-Med

FACULTY MENTOR
Aimee Dunlap

MENTOR'S DEPARTMENT
Biology

FUNDING SOURCE
Whitney R. Harris World Ecology Center Research Grant

The European honey bee (*Apis mellifera*), is considered one of the world's more important pollinator species and is often the focal species for bee conservation. However, lesser known native bees are equally, if not more valuable for pollination services. Native bees are better pollinators for native crop plants, but often must compete with honeybees for floral resources. There has been an increase in support for including honeybee hives in private and public spaces, but recent studies suggest that interactions between resident native bees and introduced honeybees can have long lasting and detrimental effects on population persistence. These interactions have been well documented in natural landscapes, but competition between bee species in the context of urban agriculture remains unknown. Therefore the goal of this study was to document interactions between native bees and honeybees in urban community gardens to elucidate differences in the number of competitive interactions and the competitive behaviors used by bees in urban regions. To accomplish this, we filmed flowers in three community gardens in Saint Louis, MO, one of which has four managed honey bee colonies and two that do not. We quantified known competitive behaviors for bees including chasing, dive bombing, pollen robbing and attacks. We found significant differences in both the frequency and type of competitive interactions between bee species and across surveyed community gardens. This information is vital for understanding the effects of introduced honeybee colonies in local landscapes, particularly in urban regions with already high selection pressures.

UMSL

POSTER NO. 13

The Effects of Floral Attributes and Conspecifics on Bumble Bee Forager Memory

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FACULTY MENTOR
Aimee Dunlap

MENTOR'S DEPARTMENT
Biology

FUNDING SOURCE
Harris Center Research Grant

What do bees remember about flowers? These memories are important for both bees and flowers. The bees have better foraging success and gain more nectar and pollen from flowers when they remember the most rewarding flower types. More memorable flowers will be visited more frequently, resulting in more successful pollination for the plant. At the same time, bees can also learn about flowers from other bees and may remember this information differently. We are training and testing three floral cues and a single social cue to see how the different types of cues affect their learning and memory of rewarding flower types. Testing is being done by rewarding the bee for foraging on a specific floral or social cue while discouraging foraging of the control flower. A reward is high percentage sugar solution while discouraging is done through water. When the bee drinks the high percentage sugar solution it should observe the cue associated with the reward and use that information to forage on flowers of the same type. Once a cue has been learned the bee will be removed for a period of time and then tested again to observe memory length and foraging efficiency.

This research is significant because it will provide insights into bumble bee pollination behavior. Pollination is an essential aspect of ecosystem health ranging from wildflowers to agriculture. Observing this behavior will help us understand more efficient methods to preserve pollinator health as vital contributors to the environment.

UMSL

POSTER NO. 14

Effects of Threatening Education Environments on Minoritized Students in STEM

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O'Fallon, MO

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Clinical Psychology

FACULTY MENTOR
Bettina Casad

MENTOR'S DEPARTMENT
Psychological Sciences

FUNDING SOURCE
National Institutes of Health

The experiment was a between-subjects experimental design in which participants (all female and of various racial identities) were randomly assigned to a threatening or safety condition. The threatening intellectual environment was created in a virtual classroom hosted by Second Life with the following: (1) a White male professor who made a disparaging comment during a lecture; (2) a racially homogenous (all White) class; (3) a male-dominated classroom (95% males), and (4) a male professor's office with "geeky" and sexually themed science décor. The safe virtual academic environment included: (1) a White male professor who made a comment about gender equality; (2) a racially diverse class; (3) a gender-balanced classroom, and (4) a male professor's office with neutral décor. The cues were created using multiple avatars that vary in gender and race, and room décor on Second Life.

UMSL

POSTER NO. 15

Improving cultural competence of hospice care workers: What makes it work?

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House District 98

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FACULTY MENTOR
April Sun; Kim Werner

MENTOR'S DEPARTMENT
Nursing

FUNDING SOURCE
N/A

Some ethnic minority patients and their caregivers perceive the quality of the end-of-life care they receive from healthcare professionals in hospice as substandard. Ethnic disparities exist in patient care causing problems in areas such as satisfaction, communication, and pain management. Interventions that can reduce these disparities need to be identified.

The purpose of this study is to examine the impact of cultural diversity and sensitivity training on healthcare professionals and its importance for decreasing disparities experienced by ethnic minorities in hospice.

What are the characteristics of effective training programs for improving healthcare professionals' cultural competency, in palliative and hospice care among ethnic minorities?

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