



University of Missouri System

Undergraduate Research Day

Virtual Event
Week of April 12, 2021



Dear Legislators,

At the University of Missouri System, we understand that an important part of our role as Missouri's only public research university is to help our students develop key life skills, such as critical thinking, logical problem-solving and tenacity. Undergraduate research allows students to build these skills as they work alongside our talented faculty and graduate students to conduct cutting-edge research at our four universities. These experiences, ranging from laboratory science to medicine to the humanities, help prepare our students for bright futures as thought leaders in the workforce. Setting our students up for success is central to our commitment to serving the interests of our state and the nation.

Undergraduate Research Day at our state's Capitol celebrates these student accomplishments and gives elected officials an opportunity to hear first-hand about the innovation and transformation taking place at the University of Missouri-Columbia, University of Missouri-Kansas City, Missouri University for Science and Technology and the University of Missouri-St. Louis. To access the event, please visit:

https://www.umsystem.edu/ums/red/undergraduate_research_day

Thank you for joining us this year for our virtual event to learn more about our undergraduate researchers who will build Missouri's future, and we look forward to the next opportunity to introduce these ambitious students to our state leaders.

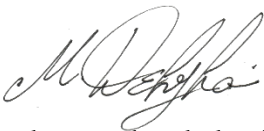
Sincerely,



Mun Y. Choi, Ph.D.
President
University of Missouri



C. Mauli Agrawal, Ph.D.
Chancellor
University of Missouri-Kansas City



Mohammad Dehghani, Ph.D.
Chancellor
Missouri University of Science & Technology



Kristin Sobolik, Ph.D.
Chancellor
University of Missouri-St. Louis



Hannibal, Missouri

Senate District 18
House District 5

Major
Biological Sciences

Faculty Mentor
Aaron Stoker

Mentor's Department
Orthopaedic Surgery

Funding Source
Thompson Laboratory
for Regenerative
Orthopaedics

Poster Number 1

Modeling Orthopedic Disease in a Test Tube

Orthopedic conditions such as osteoarthritis, intervertebral disc disease, and ACL tears, affect over 100 million adults nationwide, according to some estimates. They are common causes of disability and drastically decrease quality of life for patients. There is a need to better understand the causes and effects of these conditions in order to develop prevention and treatment strategies. In the Thompson Laboratory for Regenerative Orthopaedics, we begin by evaluating orthopedic disease at the level of individual cells before exploring how tissues react to different proteins involved in inflammation and tissue breakdown. By mimicking the body in a test tube, we can study the minute details involving progression and development of orthopedic conditions. Subsequent animal model studies allow us to visualize what may occur in the human body during disease progression or treatment due to the similarities in orthopedic conditions between species. Finally, we can translate what we learned at basic levels to studies involving human patients. After receiving tissue sample donations from recent orthopedic surgery patients, we can directly determine the effects of proteins on the structure and functions of these human tissues. We also evaluate outcomes of different surgical procedures and their effect on patient health. Using different methods of research such as cell and tissue culture for both animal and clinical models, we can—as undergraduate students—actively model orthopedic disease in a test tube, enabling breakthroughs that help us to have a direct impact on patients' lives.



All Mixed Up: Multiracial Identity and Existential Isolation

The population of multiracials in the United States is projected to triple within the next 40 years. In 2016, it was estimated that 2.6% of the population identified as multiracial by 2060, that number is expected to be 6.2%. Missouri's population is expected to mirror these projections. Research has already shown multiracial individuals can experience adverse psychological consequences related to their racial identity. It can be difficult for their monoracial counterparts to categorize and accept them as one of their own races, contributing to feelings of "otherness" and perceptions of racial ambiguity. We hypothesized this process may lead to feelings of existential isolation (EI), the subjective feeling that other people do not understand your experience or perspective. EI has been found to predict worse mental health and lower well-being. Two studies assess this general prediction. Study 1 found that multiracial students at the University of Missouri do report higher levels of EI than monoracial individuals. Study 2 further investigated if experiences of being miscategorized would explain this relationship. Results support this hypothesis. Racial identity indirectly predicted EI via the experience of being miscategorized. Specifically, multiracial identity predicted greater experience of being miscategorized, which then predicted higher EI. With a growing population of this marginalized group, it is crucial for research to foster understanding of the challenges multiracials may face as a result of their unique experiences by understanding the mechanisms underlying "otherness" can we create tools to navigate obstacles and improve their well-being.



Columbia, Missouri

**Senate District 19
House District 46**

Major
Psychology

Faculty Mentor
Jamie Arndt

Mentor's Department
Psychological Sciences

Funding Source
Psychology Department

Poster Number 5



University City, Missouri

**Senate District 14
House District 86**

Major
Sociology and Statistics

Faculty Mentor
Andrea Figueroa-
Caballero and
Christopher Josey

Mentor's Department
Communication

Funding Source
ASH Scholars Program

Poster Number 9

Minority Focused News Outlets as Potential Means of Empowerment

News reporting often depicts Black and Latinx individuals in negative ways, associating them with criminal behavior and other negative stereotypes. Consumers of mainstream news may then inaccurately blame minority groups for societal problems. Research has focused on the cognitive, affective, and behavioral effects of this biased news on White audiences; however, little is known about how people of color are affected by non-traditional media outlets which primarily produce news about minorities. These social-identity focused news (SIFN) outlets could empower people of color. My research team conducted a content analysis to investigate SIFN portrayal of Black and Latinx individuals. We examined a year of archived news content from four Latinx online media outlets and four Black news media outlets. After examining 1,200 news stories, we found that portrayals of Black and Latinx individuals in Black-oriented and Latinx-oriented SIFN, respectively, were more diverse than in traditional news outlets. Black and Latinx individuals were overrepresented in Black-oriented and Latinx-oriented SIFN, respectively, compared to their overall proportion of the US population. In addition to including more Black and Latinx individuals overall in their news coverage, SIFN portrayed Black and Latinx individuals more positively and less stereotypically. These findings suggest that minority-oriented SIFN offers an alternative and counter-influence to degrading representations of Black and Latinx individuals in traditional news.



Maddy Creach

Using Automated Robots to Perform Image Analysis to Study Plant Development

To understand the complex immune system present in plants we focus on the model plant *Arabidopsis Thaliana*. We work on this plant rather than corn or soybean because it is one of the most highly researched plants and therefore easy for scientists to work with. One focus of our research lab in the Bond Life Sciences Center is understanding the role of the protein called *SRFR1*. To understand the role of *SRFR* we have a genetically mutated plant where the *SRFR* protein doesn't work. In this plant where *SRFR* is non-functional the plant is stunted. This physical appearance that is caused by genetics is called the phenotype of the plant. We study phenotypes of plants to better understand which traits are critical for growth and immunity. Specifically I am looking at the length of the roots and the size of the rosettes, the arrangement of leaves looking down at the plant, to better characterize the variations in phenotypes. We use robots to measure these traits because prior to this method people would measure phenotypes one by one by hand which is inefficient and subject to bias. A collaborative lab in the Bond Life Sciences Center has developed a robot that has a camera attached to a computer which takes photos periodically across a pot of plants. This is more efficient, unbiased, and captures lots of data. This is also beneficial because it allows us to capture a snapshot in time that we can compare at later dates. With this new method using two robots, I have discovered the point in the life cycle of the plant when root length and rosette size diverge. I will be taking what I've learned working on this project with me to graduate school where I hope to pursue a PhD in Bioinformatics.



Holts Summit, Missouri

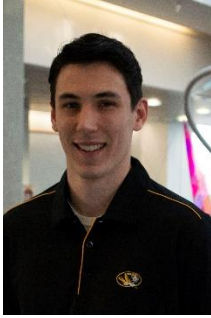
**Senate District 10
House District 49**

Major
Biological Sciences and
Mathematics

Faculty Mentor
Walter Gassmann

Mentor's Department
Life Sciences

Poster Number 13



St. Charles, Missouri

**Senate District 23
House District 103**

Major
Environmental Science
Water Quality Emphasis

Faculty Mentor
Rebecca North

Mentor's Department
School of Natural
Resources

Funding Source
Prairie Fork Charitable
Endowment Trust

Poster Number 17

The Effects of Nutrient Runoff on Harmful Algal Blooms in Four Lakes

Toxin-free water is important for the health of aquatic life, human health, and recreation. One challenge in maintaining healthy water is when excess nutrients (nitrogen, phosphorus) runoff into the water body causing the rapid growth of phytoplankton. This process is called eutrophication. Nutrients can enter the water body in two ways: via a spike of nutrients surging into the water body quickly such as a flooding event (i.e., episodic), or slowly over time through water runoff and erosion (i.e., chronic). One type of phytoplankton that responds quickly to eutrophication is cyanobacteria. Some cyanobacteria can produce cyanotoxins. Cyanotoxins have many negative impacts on both aquatic ecosystems and human health. We conducted an experiment on 4 separate freshwater bodies (2 in Missouri, 2 in Canada) measuring two cyanotoxins, with the objective of determining the effects different nutrient entries have on cyanobacteria populations and resultant cyanotoxin concentrations. We simulated chronic entry by adding small amounts of nutrients over a six-day period in a nutrient simulation experiment. Episodic entry was simulated by adding a large spike of nutrients to lake water on the first day of the nine-day experiment. After nine days, we analyzed sample water for the concentrations of two types of toxins: microcystin and cylindrospermopsin. We also measured chlorophyll-a and phycocyanin concentrations to represent phytoplankton and cyanobacteria concentrations. The resulting concentrations of microcystin, chlorophyll-a, and phycocyanin in the four lakes indicate that each lake ecosystem responds differently to variations in how nitrogen and phosphorous are added to the water, and because of that, different treatments may not be significant. Data is being calculated for cylindrospermopsin. This research is important to better understand how cyanobacteria respond to different types of external nutrient inputs, and to better understand how freshwater bodies might be impacted in the future as seasonal flooding becomes more severe.



Effect of State Medicaid Expansion on Social Security Disability Insurance Enrollment

Since the mid-1980's, enrollment by non-elderly in Social Security Disability Insurance (SSDI) has increased substantially, although there has been a sudden and steady decrease in the annual number of people enrolling into the program throughout the mid- to late-2010's. I investigated the question as to why SSDI enrollment began to decrease at the same time as the passage of the Affordable Care Act (ACA). I hypothesize that enrollment rates for SSDI dropped steadily throughout the 2010's because of changes in economic incentives and health insurance availability due to state-by-state Medicaid expansion that was outlined in the ACA. Since beneficiaries of SSDI are eligible for Medicare after a two year wait period, limited access to health insurance may have incentivized enrollment in SSDI; however, Medicaid expansion allowed for states to offer their most in-need residents access to health insurance, thereby decreasing that potential incentive. To better understand this policy event, I constructed a statistical model using data from the 32 states in which Medicaid expansion was enacted to observe if any relationship exists between ACA-related Medicaid expansion and SSDI and Medicare enrollment. While there is statistical evidence to partially support our original hypothesis, analysis of data from all 50 states lead us to conclude that other legal and economic factors also contribute to SSDI enrollment.



Harviell, Missouri

**Senate District 25
House District 152**

Major

Economic and
Mathematics

Faculty Mentor

Saku Aura

Mentor's Department

Economics

Funding Source

UM Honors College
Cherng Summer Scholars
Program

Poster Number 21



Kirkwood, Missouri

**Senate District 15
House District 90**

Major
Chemical Engineering

Faculty Mentor
Bret Ulery

Mentor's Department
Biomedical, Biological,
and Chemical
Engineering

Funding Source
MU College of
Engineering Incentive
Fund, MU Research
Council

Poster Number 25

Developing Artificial Implants for Better Bone Tissue Regeneration

Five to ten percent of bone fractures fail to grow back together on their own. Traditional solutions, such as grafts, have significant side effects disease transmission and loss of tissue. My lab is working to develop a more cost effective and widely applicable treatment for large bone fracture repair which addresses the full complexity of bone tissue. The research group's ultimate goal is to create an implantable synthetic scaffold which will facilitate bone fracture healing better than traditional grafts and eliminate side effects. The scaffold must be able to regenerate all three types of cells found in bone tissue: blood vessels, nerves, and bone cells. My project focuses on the regeneration of blood vessels, exploring the use of hydrogen peroxide to facilitate growth of blood vessels from bone marrow-derived stem cells.

Although hydrogen peroxide is generally used to kill cells like bacteria, our results suggest small concentrations can cause growth of new blood vessels. I conducted cell studies, in which bone marrow-derived stem cells from mice were exposed to concentrations of hydrogen peroxide for varying lengths of time. Afterwards, the cell health and blood vessel formation were measured. This work has determined the lower limit at which hydrogen peroxide induces blood vessel proliferation as well as the upper limit at which the hydrogen peroxide causes cell death. To further develop hydrogen peroxide as a possible treatment option, we have now begun working to create a hydrogen peroxide-releasing molecule, which will be incorporated into the synthetic scaffolds for full bone regeneration.



Evaluating a new method for doctors to measure lung function

In Missouri, 7.6 % of citizens have been diagnosed with Emphysema or Chronic Obstructive Pulmonary Disease (COPD), a prevalence higher than other states. Annual costs for treatment of this disease in our state total \$666 million. The current method doctors use to visualize these lung diseases is nuclear medicine (NM) imaging using an inhaled, radioactive tracer gas. A different approach to imaging lungs is to use an inert tracer (Xenon) and an MRI procedure. This method uses no radiation and provides higher resolution images. To push Xenon MRI method towards regulatory approval by the FDA, we have used computerized methods to compare Xenon MRI and NM lung imaging of the same patients.

59 Subjects (14 healthy, 23 with Asthma, and 22 with COPD) underwent both traditional NM imaging and new Xenon MRI. NM and Xenon MRI images were spatially matched and compared based on lung ventilation. We found a correlation in overall lung ventilation shown in the two scans. In addition, Xenon MRI was able to differentiate between healthy, COPD, and Asthmatic lung images. These results indicated that Xenon MRI provides at least equivalent information to NM imaging. Since it can do this (1) without exposing the patient to radiation, (2) has a shorter scan time, and (3) produces higher resolution images, we believe Xenon MRI will be a valuable tool in lung imaging. The University of Missouri is one of a handful of locations worldwide with the equipment required for Xenon MRI, positioning Missouri to be a leader in lung imaging research and pulmonary medicine.



Ballwin, Missouri

**Senate District 15
House District 98**

Major

Biomedical Engineering

Faculty Mentor

Robert Thomen

Mentor's Department

Biomedical, Biological,
and Chemical
Engineering

Funding Source

Discovery Fellows,
Cherng Summer Scholars

Poster Number 29



Columbia, Missouri

**Senate District 19
House District 46**

Major
Computer Science

Faculty Mentor
Mirna Becevic

Mentor's Department
Dermatology

Poster Number 32

Improving Rural Health Outcomes through Telemedicine – A Patient Travel Time Study

In Missouri, a predominantly rural state with 37% of the population living in rural areas, patients face very unique challenges, with one being a lack of timely and quality access to healthcare services. The University of Missouri's Telehealth Network's Show-Me ECHO (Extension for Community Healthcare Outcomes) Project uses video-conferencing between experts and primary care providers (PCPs) to provide telementoring and case-based education across Missouri to help physicians efficiently diagnose and treat patients with chronic conditions. My research project aims to estimate the time saved by patients when they are able to receive health care close to home from their trusted providers, who have sufficient knowledge on chronic conditions due to Show-Me ECHO training. Receiving care close to home should save patients' travel time and avoid problems associated with unstable internet access in rural parts of the state.

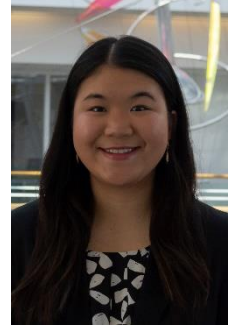
Using Show-Me ECHO's data, we selected 507 unique locations of providers who participated in educational categories related to chronic conditions, such as asthma, dermatology, and diabetes. We then created a road network dataset of Missouri's roads and added the selected locations to display an overall map. We set the University of Missouri Health Care (UMHC) location in Columbia as the assumed facility for specialty care due to its central location. Then, we mapped incremental service areas (minutes) and calculated the most efficient routes from all organizations (physician locations) to UMHC. The results found that on average, it takes almost two hours to travel to UMHC, while the maximum time is over 4.5 hours. Our project through geospatial methods provides a more holistic context for analyzing health care accessibility. The ECHO program may eliminate the need for rural patients to travel up to five hours and improve access to quality care and life-saving early diagnoses.



Alisa Sivapiromrat

Modeling Orthopedic Disease in a Test Tube

Orthopedic conditions such as osteoarthritis, intervertebral disc disease, and ACL tears, affect over 100 million adults nationwide, according to some estimates. They are common causes of disability and drastically decrease quality of life for patients. There is a need to better understand the causes and effects of these conditions in order to develop prevention and treatment strategies. In the Thompson Laboratory for Regenerative Orthopaedics, we begin by evaluating orthopedic disease at the level of individual cells before exploring how tissues react to different proteins involved in inflammation and tissue breakdown. By mimicking the body in a test tube, we can study the minute details involving progression and development of orthopedic conditions. Subsequent animal model studies allow us to visualize what may occur in the human body during disease progression or treatment due to the similarities in orthopedic conditions between species. Finally, we can translate what we learned at basic levels to studies involving human patients. After receiving tissue sample donations from recent orthopedic surgery patients, we can directly determine the effects of proteins on the structure and functions of these human tissues. We also evaluate outcomes of different surgical procedures and their effect on patient health. Using different methods of research such as cell and tissue culture for both animal and clinical models, we can—as undergraduate students—actively model orthopedic disease in a test tube, enabling breakthroughs that help us to have a direct impact on patients’ lives.



O’Fallon, Missouri

**Senate District 2
House District 102**

Major

Biology and Economics

Faculty Mentor

Aaron Stoker

Mentor’s Department

Orthopaedic Surgery

Funding Source

Thompson Laboratory
for Regenerative
Orthopaedics

Poster Number 1



Jefferson City, Missouri

Senate District 6
House District 49

Major
Special Education

Faculty Mentor
Chad Rose

Mentor's Department
Special Education

Poster Number 35

Improving Social Skills and Communication to Reduce Bullying among Youth

Missouri House Bill 1583, requires schools and districts to implement bully prevention programming making this research relevant and highly important considering the current mental health of students in the United States school system. Bullying is a pervasive problem facing the nation's youth, one in five kids experience bullying. Some subgroups of students are disproportionately involved (i.e. victimizing and perpetrating) in bullying, including those with disabilities. However, two of the most notable predictors of bullying involvement are social and communication skill deficits. Therefore, it is critical for schools to implement programs and practices for social and communication acquisition to both improve the life-long outcomes of ALL youth as well as reduce the likelihood of bullying involvement. The current study, which was part of a larger, on-going study, was designed to reduce and/or prevent bullying involvement by conducting a behavioral risk screener (i.e., SAEBRS; Kilgus et al., 2012), and delivering a 10-week, web-based social and communication skill intervention (i.e., *Cool School*) for youth in grades K-5, identified as having low social and communication skills. Data was collected before and after from all participants and participants' teachers. Initial analyses of pre/post data through repeated measures revealed that students reported increased prosocial behaviors, academic self-efficacy, and decreased victimization. Teachers reported increased prosocial behaviors, emotion regulation, and academic competence. For the past three years Cool School skill based intervention has been implemented in many schools and outcomes are consistently positive. This study suggests a social and communication skill approach could both decrease bullying involvement and improve critical social skills.



Anna Sullentrup

Modeling Orthopedic Disease in a Test Tube

Orthopedic conditions such as osteoarthritis, intervertebral disc disease, and ACL tears, affect over 100 million adults nationwide, according to some estimates. They are common causes of disability and drastically decrease quality of life for patients. There is a need to better understand the causes and effects of these conditions in order to develop prevention and treatment strategies. In the Thompson Laboratory for Regenerative Orthopaedics, we begin by evaluating orthopedic disease at the level of individual cells before exploring how tissues react to different proteins involved in inflammation and tissue breakdown. By mimicking the body in a test tube, we can study the minute details involving progression and development of orthopedic conditions. Subsequent animal model studies allow us to visualize what may occur in the human body during disease progression or treatment due to the similarities in orthopedic conditions between species. Finally, we can translate what we learned at basic levels to studies involving human patients. After receiving tissue sample donations from recent orthopedic surgery patients, we can directly determine the effects of proteins on the structure and functions of these human tissues. We also evaluate outcomes of different surgical procedures and their effect on patient health. Using different methods of research such as cell and tissue culture for both animal and clinical models, we can—as undergraduate students—actively model orthopedic disease in a test tube, enabling breakthroughs that help us to have a direct impact on patients’ lives.



Washington, Missouri

**Senate District 26
House District 109**

Major
Biology and Economics

Faculty Mentor
Aaron Stoker

Mentor’s Department
Orthopaedic Surgery

Funding Source
Thompson Laboratory
for Regenerative
Orthopaedics

Poster Number 1



Springfield, Missouri

**Senate District 30
House District 133**

Major
Computer Engineering

Faculty Mentor
David Mendoza

Mentor's Department
Plant Sciences

Funding Source
NSF, The Foundry

Poster Number 38

Rapid Plant Characteristic Detection for Crop Improvement

Missouri is home to over 95,000 farms covering two-thirds of the state's total land, with nearly all of them being family owned and operated. Missouri ranks consistently in the top ten for corn, soybean, cattle, and many other essential crops; however, current crop production is projected to be outpaced by human population growth by the year 2050. As part of the global effort to improve crops to be more resilient, nutritious, and higher yielding, I work with a research group that studies how plants sense and accumulate micronutrients. Plants are the only dietary source of many micronutrients, like zinc and iron, which are vital in the human body for energy production, immune function, and blood clotting. Currently, there is not enough understanding of which plant genes are responsible for collecting and regulating micronutrients. Moreover, current methods of detection are labor-intensive, subjective, and slow. I construct devices to automate the process of collecting data from a plant over its lifetime at high resolution to better predict what genes are responsible for micronutrient control. The Single Row Phenotyper (SRP) can capture over 1000 high-resolution images from each of eight plants grown hydroponically over the course of several weeks. Using open-source components, I was able assemble and program this device for less than \$1000, making it accessible to research labs around the world. The SRP has been able to document many known characteristics of plants with micronutrient deficiencies, as well observe previously unknown characteristics. This device is the first design in a series of automated image-collecting platforms for plant biology.



Brooke Weiler

Combination Treatment for Stronger Muscles in a Mouse Model of Brittle Bone Disease

Healthy bones allow us to run, walk, and even type on a computer. When the integrity of the structure of bone is interrupted, these simple tasks can cause bones to break. Our lab studies *osteogenesis imperfecta* (OI), better known as brittle bone disease, a heritable disease characterized by fragile bones and weak muscles. We study this in a genetically modified mouse model, which exhibits one of over 20 genetic mutations that causes mild to moderate OI.

Bone is a mechanosensing organ, meaning it responds to stress applied to it, typically by the pull of muscles, by building more bone. Myostatin, a protein which controls muscle growth, increases muscle size when inhibited. Activin-A is a protein which regulates bone size and is in the same family of proteins as myostatin. Previous studies have shown that stopping the function of this family of proteins builds stronger muscle and bone, but resulted in unrelated negative side effects, such as chronic nosebleeds, in humans when moved to clinical trials. We hope by using a more specified treatment and turning off only myostatin and activin-A, we will circumvent these negative side effects while obtaining the same positive effects on muscle and bone.

We injected 40-60 mice with either a control antibody, which does not turn off a protein, or a combination of myostatin and activin-A antibodies, which bind to those specific proteins and turn off their function. Mice treated with the combination treatment showed an increase in lean muscle mass and body weights, as well as a decrease in body fat. The decrease in fat is a typical correlation with an increase in muscle, indicating the success of additional muscle growth. Further testing will need to be completed to determine the effect on bones, but it is expected that this increase in muscle as well as the lack of function in the activin-A protein will lead to stronger bones.



Ste. Genevieve, Missouri

**Senate District 3
House District 115**

Major

Biochemistry, Psychology

Faculty Mentor

Charlotte Phillips

Mentor's Department

Biochemistry

Funding Source

NIH NCATS Grant
#UL1 TR002345, Leda J.
Sears Trust

Poster Number 41



Kansas City, Missouri

**Senate District 17
House District 16**

Major
Biology

Faculty Mentor
Shin Moteki

Mentor's Department
Chemistry

Funding Source
NSF

Poster Number 2

Increasing STEM Engagement in Underrepresented Minority Groups

The purpose of this research project is to acknowledge and encourage greater equity within the STEM fields of science, technology, engineering, and mathematics in a way that is aimed to reinforce and support minority students in the Midwestern United States in order to encourage economic growth. The number of African American PhD holders has remained unchanged in the last 26 years and has even decreased (~ 1-2%) among the Latino community. The US Department of Education declares that people of color continue to fall behind other groups. In 2017, although students of color made up 20% of the college population, barriers confirmed that only 9% secured degrees in STEM. These barriers range from a general lack of representation and mentorship, unequal opportunity, limited perception of potential career paths, disproportionate access to materials, all the way to the perpetual biases and stereotyping that begins early and continues on throughout a minority student's career. All of which has proven to contribute to this increasing gap in education and marginal minority success in STEM professions. These facts prompted our research to emphasize the steps that can be taken to mitigate these barriers and encourage Missouri students from a variety of backgrounds to engage in STEM higher education. According to Missouri's 2019 Equity Report, economists believe that higher levels of education contribute to overall employment opportunities which will promote economic growth and decrease dependency on state welfare programs by 91% if all high school graduates were able to obtain a bachelor's degree. Most importantly, black and Latino students will be able to receive the support they deserve in order to excel and contribute to their communities in a major way.

Move More, Get More: A Physical Activity and Nutrition Intervention for Middle School Youth

One chronic health issue adolescents may experience is obesity. According to the Center for Disease Control and Prevention, in 2019 there was a 20.6% prevalence for obesity in individuals aged 12-19 in the United States. One possible solution for reducing the occurrence of chronic health issues like obesity is physical activity. Kansas City, Missouri (KCMO) was selected by the US Department of Health and Human Services as one of eighteen sites to deliver a physical activity and nutrition intervention to adolescents. Move More, Get More (formally known as Youth Engagement in Sports) is an initiative that targets students in grades 6-8 who attend select KCMO public middle schools. Within the first couple months of data collection, the COVID-19 pandemic occurred. Physical activity levels (in minutes) of the students enrolled decreased dramatically with the schools' transition to online learning. The program has since been adopted to fit an online format where students meet multiple times a week for one hour live coaching sessions on Microsoft TEAMS with Kansas City Parks and Recreation and other fitness instructors. Approximately 100 students from Kansas City Public Schools have been served by this program since its implementation in spring 2020. Once a week, participants in the study have the opportunity to receive fresh produce from Truman Medical Center's Mobile Market. This study aims to improve physical activity and nutrition in middle school students in order to improve overall health for marginalized youth with a particular focus on female youth.



Independence, Missouri

**Senate District 11
House District 21**

Major
Health Sciences

Faculty Mentor
Amanda Grimes and
Joseph Lightner

Mentor's Department
Nursing and Health
Studies

Funding Source
Department of Health
and Human Services

Poster Number 6



Lee's Summit, Missouri

**Senate District 8
House District 30**

Major
Chemistry

Faculty Mentor
Shin Moteki

Mentor's Department
Chemistry

Funding Source
UMKC Students
Engaged in the Arts and
Research Grant /NSF

Poster Number 10

Smart Catalysts – Green and Sustainable Synthetic Approach Mimicking Living Cells

Chemical manufacturing is one of the largest and diverse pattern industries in Missouri. Chemical manufacturing industries employ nearly 17,000 and are clustered in St. Louis and Kansas City, Missouri. Chemicals represent Missouri's second largest foreign export (>\$2.5 Billion) and are a major domestic export to other states. Over 375 establishments are developing chemicals for agriculture, pharmaceutical, industrial, and cleaning applications, among others. Catalysis is a process that accelerates chemical reactions which would otherwise be extremely slow. Enzymes are biological catalysts which transform many materials (food) into essential products critical for sustaining life. Outside of biological systems, catalytic processes are involved in the industrial chemical processing of over 80% of all manufactured products. The purpose of this research is to design and prepare artificial enzymes or "smart catalysts," which are applicable toward one-pot multi-step reactions that mimic biological systems. As many chemical reactions occur efficiently within a living cell (one-pot) without isolation and purification processes, our one-pot process is an artificial version of chemical processing where multi-step chemical processes occur in a single reaction flask (artificial cell). In other words, our approach will drastically reduce harmful waste associated with chemical productions and reduce CO₂ emissions by minimizing isolation/purification processes at manufacturing plants. Therefore, a significant contribution to green/sustainable production will be made through our research, and our product will be highly competitive in price through a reduction in manufacturing costs.

Predator Avoidance Behavior of Dubia Cockroaches

This study focuses on observing and analyzing the different behavioral patterns Dubia cockroaches use to avoid potential predation. *Blaptica dubia* (Dubia cockroaches) are natively found in South America in tropical locations. There is considerable variation in terms of habitats occupied by insect groups and how they avoid detection by predators in those locations including camouflage or taking cover. Documented strategies include burying themselves in the substrate and otherwise hiding in tight spaces. This species has been shown to favor hiding in crevices and hollow spaces to avoid being detected. Additionally, Dubia cockroaches discriminated between colored-shelter options. Dubia cockroaches are economically beneficial because of their recently gained importance to the reptile food industry due to their high protein and Calcium content. Because of the close phylogenetic relationship between the Dubia cockroach (one of the most preferred feeder insect options available in Missouri) and the German cockroach (which is the most abundant domestic pest cockroach in Missouri) it may be possible to extend the reach of this study to find ways to dissuade domestic infestations of this widespread household pest. Using the German roach as a model in the experimental design poses limitations. Thus, this study aims to understand how avoidance observed in Dubia roaches can be a model for the common household roach.



Bronx, New York
residing in Lees Summit, MO

Senate District 17
House District 16

Major
Biology

Faculty Mentor
Rachel Allen

Mentor's Department
Genetics, Developmental
and Evolutionary Biology

Funding Source
UMKC Students
Engaged in the Arts and
Research Grant

Poster Number 14



Independence, Missouri

**Senate District 11
House District 21**

Major
Biology

Faculty Mentor
Jeffrey Price

Mentor's Department
Genetics, Developmental
and Evolutionary Biology

Funding Source
UMKC Students
Engaged in the Arts and
Research Grant

Poster Number 18

Promoting Better Sleep: Studying Eye Physiology at the Cellular Level in Fruit Flies

This research on mechanisms affecting circadian rhythms will assist in the understanding of sleep-related disorders including Insomnia, Narcolepsy, and Alzheimer's disease. Understanding the circadian rhythm can lead to the development of treatments for these disorders, as well as mechanisms for changes in eye physiology. The circadian rhythm, which is produced by an internal biological clock and drives the sleep/wake cycle as well as changes in eye physiology, is driven by a nuclear accumulation of several proteins in the eyes. For this project, we are looking specifically at two proteins called Bride of Doubletime (BDBT) and Doubletime (DBT), as well as the Nuclear Localization Sequence (NLS) which controls the movement of DBT to the nucleus. We observe this by comparing overexpression of wild type DBT in eyes of *Drosophila melanogaster* (fruit flies) to overexpression of DBT with a mutated NLS. Prior work showed that mutated DBT NLS eliminates its interaction with BDBT. During our research, we showed that the NLS mutant does not downregulate or reduce BDBT foci, formed by aggregation of BDBT, at ZT19 (middle of the night). However, overexpression of wild type DBT does reduce these foci. Reductions of BDBT in the eye led to reduced movement of DBT to the nucleus during the day. Therefore, the DBT-BDBT binding event involving the DBT NLS is needed for movement of DBT to the nucleus and the daily reductions in BDBT.

Comparisons of Support Among K-12 Music Teachers in Missouri and Kansas

The purpose of this study is to examine correlations between various personal/situational factors and music teachers' perceptions of support received from administration, colleagues, and students' parents. This descriptive study will help us better understand teachers' perceptions of the music education environment in rural, urban, and suburban school locations as well as perceptions held by participants located across the Missouri/Kansas state line. We developed a survey for music teachers in the states of Missouri and Kansas, inquiring about participants' demographic information, educational experiences, teaching history, future teaching plans, and perceptions of support. Results of the study suggest that state location alone does not seem to correlate with differences in perceived administrative, colleague, or parent support. Music teachers in rural, urban, and suburban school locations report similar levels of perceived administrative support, while urban teachers report lower levels of perceived parent support and rural teachers report lower levels of perceived colleague support. Additionally, nearly half of all participants reported that they considered their classrooms to be fully financially supported by their administration; those who indicated otherwise tended to report lower levels of administrative, colleague, and parent support. We asked these participants how much additional funding they would need to consider their classrooms fully financially supported, and teachers in urban school districts reported needing the least amount of additional funding. Overall results support the notion that unique factors determined by school location might play an important role in music teachers' perceptions of support.



Monett, Missouri

**Senate District 29
House District 158**

Major
Music Education

Faculty Mentor
Lani Hamilton

Mentor's Department
Music Education

Poster Number 22



Kansas City, Kansas
residing in Kansas City, MO

Senate District 17
House District 16

Major
Sociology and History

Faculty Mentor
Shannon Jackson

Mentor's Department
Sociology

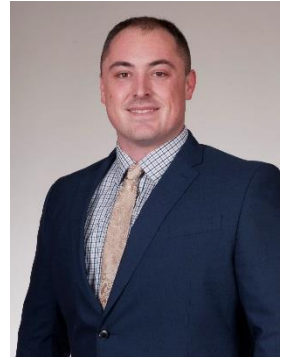
Poster Number 26

Internet of Things (IoT) and Public Space: The Case of ShotSpotter

Devices, such as Fitbit, smart watches, etc., have become an indistinguishable part of our daily lives. The digital platforms, algorithms, and networks that support direct connections among such devices, known as the Internet of Things (IoT), is also being integrated with urban infrastructure leading to development trends such the Smart City. The purpose of the Smart City is to help public officials and innovators respond to the needs of residents more efficiently and effectively by using IoT to gather data about user behavior and the urban environment. The belief is that devices and more automatic data collection will create a safer and more efficient city. My research focuses on ShotSpotter (SST), an IoT gunshot detection system that uses acoustic sensors to locate and determine gun fire. ShotSpotter is one of many publicly deployed systems that is privately owned. Its integration with public infrastructure further blurs the boundaries separating public and private decision-making. I examine SST as part of a larger trend that shifts control of public space away from citizens, city residents, and publicly accountable officials. Through scholarly literary review and interviews with community stakeholders in Kansas City, Missouri, I examine the relationship between IoT devices and public space to consider the larger impact of this trend on the rights of citizens. This case study will demonstrate that while IoT technologies are believed to solve urban problems, they change the ways problems are defined while removing accountability from the use of public information.

Promoting Better Sleep: Studying Eye Physiology at the Cellular Level in Fruit Flies

This research on mechanisms affecting circadian rhythms will assist in the understanding of sleep-related disorders including Insomnia, Narcolepsy, and Alzheimer’s disease. Understanding the circadian rhythm can lead to the development of treatments for these disorders, as well as mechanisms for changes in eye physiology. The circadian rhythm, which is produced by an internal biological clock and drives the sleep/wake cycle as well as changes in eye physiology, is driven by a nuclear accumulation of several proteins in the eyes. For this project, we are looking specifically at two proteins called Bride of Doubletime (BDBT) and Doubletime (DBT), as well as the Nuclear Localization Sequence (NLS) which controls the movement of DBT to the nucleus. We observe this by comparing overexpression of wild type DBT in eyes of *Drosophila melanogaster* (fruit flies) to overexpression of DBT with a mutated NLS. Prior work showed that mutated DBT NLS eliminates its interaction with BDBT. During our research, we showed that the NLS mutant does not downregulate or reduce BDBT foci, formed by aggregation of BDBT, at ZT19 (middle of the night). However, overexpression of wild type DBT does reduce these foci. Reductions of BDBT in the eye led to reduced movement of DBT to the nucleus during the day. Therefore, the DBT-BDBT binding event involving the DBT NLS is needed for movement of DBT to the nucleus and the daily reductions in BDBT.



Hallsville, Missouri

**Senate District 19
House District 44**

Major
Chemistry

Faculty Mentor
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Mentor’s Department
Genetics, Developmental
and Evolutionary Biology

Funding Source
UMKC Students
Engaged in the Arts and
Research Grant

Poster Number 18



Kansas City, Kansas
residing in Kansas City, MO

Senate District 17
House District 16

Major
History and Spanish

Faculty Mentor
Viviana Grieco

Mentor's Department
History

Poster Number 30

A Knowledge Graph for Managing and Analyzing Spanish American Notary Records

Spanish American notary records were written in script that was intentionally cryptic and it takes years of paleography training to become proficient in reading and analyzing their contents. Since we are fluent in Spanish and trained in paleography, we were able to use notary records as sources for our studies. Our research follows the changes in modern Spanish spelling and phonetics to show that modifications pioneered by prominent Spanish writers and poets transferred to the notarial scripts and focuses on how public notaries and the deeds they drafted promoted the expansion of trade and credit in seventeenth century Buenos Aires beyond the boundaries of family networks.

Projects were developed under an intercampus and interdisciplinary (History/Computer Science) collaboration led by Dr. Viviana Grieco (UMKC) and Dr. Praveen Rao (MU). They are developing a software system that will enable scholars to efficiently read, analyze, and find content in the seventeenth-century notary records housed at the National Archives in Argentina. This corpus has been digitized and its digital information can be modeled as a knowledge graph by applying deep learning and scalable knowledge management techniques. A knowledge graph models each page in this collection, their attributes, and the relationships between.

This tool will transform future historical and linguistic scholarship as it will make these documents accessible to broader audiences. Since advances in deep learning are transferrable to other fields, this software could be used in the management of documentary collections available in Missouri.

The Intercalation of Cancer Drug Doxorubicin in Various DNA Sequences

Doxorubicin is a cancer drug that treats a wide range of cancers namely leukemia, lymphoma, and cancers in internal organs, tissues, and skins. This drug damages the cancerous cells and prevents them from growing and reproducing. Previous studies found that when the doxorubicin is intercalated, the DNA of the cancer cell forms a complex preventing the enzyme topoisomerase-II from performing its function of replicating the DNA, in this instance the cancerous DNA. However, blocking the topoisomerase-II enzyme results in the cancer cell to kill itself. It is important to note where this drug is added into the DNA. DNA has four base pairs that create an abundant number of sequences. Finding the most effective base pair, for the cancer drug to be inserted, can efficiently block the DNA replication and translation of the cancer cell. Consequently, this can guide in finding the strongest topoisomerase inhibitors to force the cancer cell to its end. Finding the best insertion site can more effectively prevent the spread of the cancer while also decreasing the side effects of the drug. This research project focuses on studying different DNA sequences that would generate the highest yield for the insertion of doxorubicin. This is determined by analyzing chemical and physical properties of the cancer drug incorporated into the various studied base pairs in the DNA. This understanding can guide the advancement and modification of drug designs intercalating into DNA sequences.



Kansas City, Missouri

**Senate District 19
House District 18**

Major

Biology, Chemistry, and
Psychology

Faculty Mentor

Wai-Yim Ching

Mentor's Department

Physics and Astronomy

Funding Source

NSF

Poster Number 33



Farmington, Missouri

**Senate District 3
House District 117**

Major
Psychology and
Sociology

Faculty Mentor
Erin Hambrick

Mentor's Department
Psychology

Funding Source
UMKC Students
Engaged in the Arts and
Research Grant

Protective Factors and Their Relationship with Attachment in Preschoolers

Attachment in the context of child development is defined as the emotional bond between a child and their parent or caregiving figure. Adverse experiences, such as a lack of consistency in parenting, can affect attachment because they may influence the child's perception that caregivers are consistently available to provide a safe base from which they can explore their world. This can negatively affect regulation, adaptability, and resilience. This project will investigate factors that may have protected children who experienced adversity from experiencing low attachment. For example, 78.9% of our sample came from households with a yearly income at or above \$50,000. Thus, we will examine the role of protective factors such as household income, the child's relationships, and parent report of their confidence in their caregiving skills in promoting attachment. To do this, we will utilize data from a study of typically- developing (not currently receiving any mental health or developmental services and not having an intellectual disability) preschoolers. The subset of our sample used for this project will be only children whose parents reported at least one adverse experience that was relational in nature. We hypothesize that protective factors may have buffered children's response to adversity. This would support the idea that though childhood adverse experiences are common, resilience is possible. It may also indicate ways to promote resilience in Missouri youth.

A Knowledge Graph for Managing and Analyzing Spanish American Notary Records

Spanish American notary records were written in script that was intentionally cryptic and it takes years of paleography training to become proficient in reading and analyzing their contents. Since we are fluent in Spanish and trained in paleography, we were able to use notary records as sources for our studies. Our research follows the changes in modern Spanish spelling and phonetics to show that modifications pioneered by prominent Spanish writers and poets transferred to the notarial scripts and focuses on how public notaries and the deeds they drafted promoted the expansion of trade and credit in seventeenth century Buenos Aires beyond the boundaries of family networks.

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This tool will transform future historical and linguistic scholarship as it will make these documents accessible to broader audiences. Since advances in deep learning are transferrable to other fields, this software could be used in the management of documentary collections available in Missouri.



Nixa, Missouri

**Senate District 20
House District 139**

Major
Spanish

Faculty Mentor
Viviana Grieco

Mentor's Department
History

Poster Number 30



Joplin, Missouri

**Senate District 32
House District 161**

Major
Biology and
Environmental Science

Faculty Mentor
Fengpeng Sun

Mentor's Department
Earth and Environmental
Sciences

Funding Source
UMKC Students
Engaged in the Arts and
Research Grant

Cool Roofs' Potential to Mitigate Heat-Induced Health Risks in the Kansas City Metro Area

An urban heat island (UHI) refers to an urban area that is significantly warmer than surrounding rural and suburban regions due to human activity, sparse vegetation, and the use of heat-retaining materials in infrastructure. This increase in temperature is associated with an increased risk of heat stress and heat-related illness, such as heat stroke. A potential solution to mitigate the UHI effect in urban areas is the implementation of cool roofs, which absorb less heat and reflect a greater percentage of solar radiation compared to traditional roofs due to their reflective color and/or material (e.g. solar reflective shingles or tiles). In addition to reducing local air temperatures, cool roofs can improve indoor comfort, reduce energy costs associated with air conditioning, and extend roof life due to decreased heat absorption. In this study, three common heat stress indices were used to evaluate the effectiveness of cool roofs in mitigating UHI-induced heat stress in the Kansas City metropolitan area. Output data from a series of high-resolution regional climate model simulations were used to generate spatial maps and highlight differences in the indices after the implementation of cool roofs in the area. According to all three indices, a substantial reduction of heat stress after cool roof implementation was found in the core of the downtown metropolitan area. These modeling and analysis results suggest that the implementation of cool roofs will efficiently reduce UHI-induced heat stress in Kansas City.

Real-time Prediction of Water Quality in Kansas City Urban Lakes

The expense of traditional water quality monitoring systems has limited community accessibility, giving rise to public health concerns of harmful algal blooms. Availability of reliable, affordable, and real-time water quality data is not an option for most communities due to technical and financial limitation. The purpose of this project is to develop a cost-effective approach to monitoring the water quality of lakes in real-time. I developed an IoT-based (internet of things) water quality sensor system and deployed on Smithville Lake in Missouri. This device provides the water quality information based on specific parameters known to be linked to increased health risk, enabling local governments to act accordingly. The device was deployed alongside a United States Environmental Protection Agency water quality probe for verification of data accuracy. Further research is needed to improve the device, but the results of this study show potential for the development of an affordable and accurate water quality monitoring system.



Kansas City, Missouri

**Senate District 12
House District 17**

Major

Environmental Science

Faculty Mentor

Jejung Lee

Mentor's Department

Earth and Environmental
Sciences

Funding Source

UMKC Students
Engaged in the Arts and
Research Grant

Poster Number 42



Elkhart, Kansas
residing in Kansas City, MO

Senate District 17
House District 16

Major
Biology

Faculty Mentor
Scott Hawley and Katie
Billmyre

Mentor's Department
Stowers Institute

Funding Source
Stowers Institute

Poster Number 44

Keeping it Together: Unlocking the Causes of Infertility and Genetic Disorders

Meiosis is a complex process that most organisms use to generate germ cells (eggs and sperm) for sexual reproduction. Successful meiosis requires the correct amount of genetic material (i.e. chromosomes) to be packaged in each egg or sperm. A failure in this process results in aneuploidy (the incorrect number of chromosomes), which can cause genetic disorders such as Down syndrome, Klinefelter syndrome, infertility, or miscarriage. There are many steps during meiosis that ensure that the proper number of chromosomes are inherited. One key step is the establishment and maintenance of a multi-protein complex known as the synaptonemal complex (SC) between chromosomes. This structure allows chromosomes to be paired together and moved to the correct germ cell. We use the fruit fly to study multiple aspects of the synaptonemal complex. Currently, not much is known about how SC formation is regulated in flies. Previous work in yeast and mice suggest that SC formation is impacted by the modifications made by cyclin-dependent kinases (CDKs). CDKs are well-known for their role in the generation of new cells, but they are also known to regulate meiosis. Here we removed three predicted CDK binding sites in an SC protein to observe if SC formation was impacted by the loss of CDK regulation. Interestingly, we found that deleting these sites prohibited the SC from fully forming. This suggests that CDK binding sites are important for building and maintaining the SC. Additional work is needed to see if other aspects of meiosis are affected. These results further our understanding of how the SC is assembled and maintained. Understanding how chromosomes are separated into germ cells is critical to furthering our ability to treat infertility and chromosomal disorders.

The Shaping of the Mind – Symbols of Hate and the Resistance They Created

This research is about remembrance and not letting the world forget that humanity is always at peril to lose its significance. I want to bring a conscience to the events that happened eighty years ago and are still happening today, although in some cases in a different form. Civilizations sometimes tend to forget those events that span more than a couple of generations away, yet they have a deep footprint of who we are today, and where we may head up next into the future. My hope is that with this project we learn of the failures of a totalitarian regime that was voted into power not by force but following the legal due procedure. Also, to learn of the resilience of a group of people who against all odds decided to resist and survive under the deadliest of conditions. With some hope, this project will still keep shedding light on the hardships of the Jewish community during World War Two and still carry on the promise of "Never Again". As an added goal, my work is intended to bring awareness of the potential political impacts taking place at this very moment around the world which could lead to a repetition of these events. As a historian, we understand that history sometimes repeats itself, but we also know that proper education and awareness can stop the cycle. That is the purpose of this project, to understand that the future and its consequences belong to us.



Manati, Puerto Rico
residing in Waynesville, MO

**Senate District 3
House District 117**

Major
History

Faculty Mentor
Shannon Fogg

Mentor's Department
History and Political
Science

Poster Number 3

Quantitation of Pteridines in an Isogenic Cellular Breast Cancer Model



Imperial, Missouri

**Senate District 22
House District 112**

Major
Chemistry and Biological
Sciences

Faculty Mentor
Honglan Shi

Mentor's Department
Chemistry

Funding Source
National Institutes of
Health

Poster Number 7

Pteridines are a class of compounds which participate in several metabolic pathways and are specifically utilized to create important vitamins and cofactors. Due to the elevated quantities of some of these pteridine derivatives in the urine of women with breast cancer in a stage-dependent amount, these compounds have the potential to play a significant role in the diagnosis of breast cancer and potentially other cancers. In order to improve our understanding of pteridine metabolism, our team is utilizing newly developed analytical techniques to investigate the metabolism of pteridine and determine its specific metabolic role in an isogenic progressive cellular breast cancer model consisting of a non-tumorigenic, semi-tumorigenic, and completely tumorigenic human breast cells. We have so far developed a sampling method which is able to consistently and efficiently extract and quantify the pteridine concentrations in each of these cell lines. We have also begun to expose chemicals known to be metabolic precursors of pteridines (guanine and folic acid) to these cells to track their evolution through the pteridine biosynthetic pathway and thus determine how these compounds actually interact on a cellular level. We then plan to expose the cells to isotopically-labelled versions of the precursors (that can be quantified separately from the natural chemicals) and calculate the exact rate of each of the reactions involved in this pathway, which we can then compare between cell lines to identify differences in how these compounds are produced at the cellular level and identify more specific urinary biomarkers for breast cancer diagnoses.

Recovery of Degraded Ni-Rich NMC811 Cathode Particles for Lithium-Ion Batteries

This project focuses on recovering the cathode materials of lithium ion batteries through atomic layer deposition (ALD) thin film coating. In industry, when a cathode material for a lithium ion battery are stored, it reacts with CO₂ and moisture in the air creating Li₂CO₃ and LiOH on the particle surface. The harmful substances on the surfaces have a negative impact on battery performance and battery life. In this study, we found that when Li₂Ni_{0.8}Mn_{0.1}Co_{0.1} (Ni-Rich NMC) is exposed to a high amount of moisture it degrades and the performance is reduced. For example, the discharge capacity of Degraded Ni-Rich NMC (DNMC) was much lower than the discharge capacity of pristine Ni-Rich NMC. When applying Al₂O₃ ALD thin film coating on the surface of DNMC particles, the discharge capacity was able to be restored. According to the electrochemical performance, the 2Al-DNMC (2 cycles of Al₂O₃ ALD) was able to perform at a similar level as the non-degraded NMC. The increase in performance is likely due to the surface of the DNMC being corroded when exposed to moisture and Al₂O₃ ALD thin film coating can fix the corroded part, leading to the recovery of discharge capacity. With an Al₂O₃ ALD film thicker than 2 cycles of ALD, the performance of DNMC was further improved. We will study the coating to figure out the best ratio of coating and then study the mechanism that is driving the increase in performance.



Wildwood, Missouri

Senate District 26
House District 110

Major

Chemical Engineering

Faculty Mentor

Xinhua Liang

Mentor's Department

Chemical Engineering

Funding Source

NSF

Poster Number 11



Wildwood, Missouri

**Senate District 15
House District 110**

Major
Chemistry

Faculty Mentor
Rainer Glaser

Mentor's Department
Chemistry

Funding Source
S&T Office of Academic
Support (OURE), NSF

Poster Number 15

Your Brain on Lockdown: The Stress-Cortisol Connection and How to Remedy with Mindful Nutrition

Following the onset of the COVID-19 pandemic, people all around the world have been plagued by chronic traumatic stress. Prolonged levels of stress result in immunosuppression and indirectly cause a number of severe diseases (hypertension, strokes, mental health disorders). Stress management and preventative healthcare can alleviate some of the effects of exposure to traumatic and prolonged stressors. On a chemical level, the response to any kind of stress involves the hydroxylation of 11-deoxycorticosterone to corticosterone. The inhibition of this hydroxylation is the key target for stress management techniques. Our research aims to establish and understand the mechanism of the enzymatic hydroxylation as a prerequisite to designing new inhibition strategies. Specifically, we have performed a computational investigation of the hydroxylation of 11-deoxycorticosterone to corticosterone by cytochrome P450 enzyme CYP11B2.

Development of High-Performance Electrode Materials for Supercapacitor Application through Combinatorial Electrodeposition

Electrochemical capacitors (ECs) are promising energy storage devices that have received great attention because of their excellent electrochemical performance with high output power, short discharging time, and long-term cycle stability. Metal chalcogenides (especially selenides and tellurides) are considered to be a new class of battery-like electrode materials and have contributed to ameliorate the electrochemical performance with better electronic conductivity and chemical stability. In the current investigation, a series of mixed transition, metal-based chalcogenides have been grown directly on nickel foam by the process of electrodeposition without the addition of a binder to the catalyst. The supercapacitor activity is dependent on the quantity of Cu and Co in the Cu-Co-Se ternary selenide electrocatalysts. Surprisingly, Cu-Co ternary selenides exhibit superior specific capacitance in comparison to their pure parent compounds, CoSe and Cu₃Se₂. Among the series of Cu-Co ternary selenides, the specific capacitance achieved for Cu_{0.6}Co_{0.4}Se₂ showed the best specific capacitance value of 2063 F/g at a current density of 1 A/g and also maintained a cyclic stability of more than 90 % at a higher current density of 10 A/g after 1000 charge-discharge cycles. Moreover, doping effects at the transition metal site are also illustrated in this work and had a positive influence on the supercapacitor activity because, it led to lattice distortion, electronic structure modification, as well as helping to tune the surface redox behavior. The observed results clearly demonstrate that the binder free metal chalcogenide-based catalysts may be used as a potential electrode material for future energy storage devices.



Kansas City, Missouri

**Senate District 17
House District 16**

Major
Chemical Engineering

Faculty Mentor
Manashi Nath

Mentor's Department
Chemistry

Funding Source
S&T Innovation Fund

Poster Number 19



Wildwood, Missouri

**Senate District 26
House District 110**

Major
Chemistry

Faculty Mentor
Rainer Glaser

Mentor's Department
Chemistry

Funding Source
FYRE, S&T Office of
Academic Support
(OURE), NSF

Poster Number 23

Improving Access to Chemistry Education: Using Colorimetry to Teach Titration in a High School Chemistry Lab

Educational inequality is a large problem in the United States, and the gap between high and low achieving students has grown over the past years. Students from schools with higher poverty rates and fewer financial resources consistently score lower than their more wealthy counterparts on assessments of scientific achievement. Chemistry education can be very costly for schools that are already struggling since it requires specialized equipment, chemicals, and facilities. For this reason, many schools are unable to do hands-on chemistry experiments that would benefit their students. We have developed a more cost-effective method that would allow chemistry teachers to teach titration, a staple of the high school chemistry curriculum, while requiring only easily-obtained chemicals, and access to a camera and a computer. This method would also make titration more accessible to visually-impaired or colorblind students.

From Bricks to Canvas: An Analysis of Berlin Wall Graffiti

For this research I am analyzing the graffiti on the Berlin Wall. My interest in the project was inspired, in part, by the National Churchill Museum and the "Breakout" sculpture in Fulton. Fulton is where Winston Churchill gave his famous "Iron Curtain" speech, but it is also where his granddaughter Edwina Sandys decided to place her "Breakout" sculpture 44 years later. This sculpture is made out of actual sections of the Berlin wall that were chosen for their close proximity to the Brandenburg Gate, for their very colorful and abundant graffiti, and for the appearance of the German word Unwahr (meaning "lies" or "untruth"), which Sandys felt resonated with both the object and the circumstances of its creation. These sections helped to magnify the meaning of the sculpture through the graffiti on it and the messages that it gave. I am looking at the graffiti to better understand what the wall meant to the people living with it as a part of everyday life in divided Germany. It is with this research that I hope to better understand the Berlin Wall, including the parts of it that are now in Fulton, Missouri..



Mexico, Missouri

**Senate District 10
House District 43**

Major
History

Faculty Mentor
Andrew Behrendt

Mentor's Department
History and Political
Science

Funding Source
S&T Office of Academic
Support (OURE)

Poster Number 27



St. Charles, Missouri

**Senate District 23
House District 106**

Major
Nursing

Faculty Mentor
Alicia Hutchings

Mentor's Department
Nursing

Poster Number 4

Chlorhexidine Gluconate Bathing & Its Effect on Central Line-Associated Bloodstream Infection (CLABSIs)

Central Line-Associated Bloodstream Infections (CLABSIs) are one of four healthcare-associated infections (HAIs) commonly seen in healthcare. CLABSI is defined as an infection of the bloodstream that occurs within two days of a central line being inserted. This infection increases the mortality rate and price for hospitals to care for patients who are affected. Though the standard of care for CLABSIs has kept these numbers from increasing drastically, this problem continues to occur indicating that the interventions used to solve this problem are ineffective. Research has shown, however, that Chlorhexidine gluconate (CHG) an exceptional antimicrobial agent against gram-positive organisms is effective in reducing CLABSI infection rates when used during bathing. This information led to the comparison of CHG bathing to the standard of care for central lines on infection rates. Patients in long-term acute care hospitals, noncritical care units and burn units were a few of whom benefited from this intervention. The majority of data that enhanced the utilization of CHG baths for patients with central lines came from intensive care units (ICUs) given that they are more susceptible to infections. This data proved that CHG baths reduced the infection rate of CLABSIs more than the standard of care protocol. Additionally, it confirmed that CHG bathing helped reduce the colonization of other bacteria including Vancomycin-resistant Enterococcus (VRE) and Methicillin-Staphylococcus aureus (MRSA). Incorporating CHG bathing as an intervention for patients with central lines along with proper patient education is imperative to decreasing the infection and mortality rates of CLABSIs seen in healthcare.

A Velvet Rope of Exclusion: The Delmar Divide

Many reports have been published about the complex topic of segregation in the Greater St. Louis area. However, the effect of years of systemic segregation on education has not been adequately discussed in a modern context. This report studies the root causes of the Delmar Divide in an attempt to understand the impact it produced in the educational community. St. Louis is a classically divided city and the public-school system has suffered as a result of educational inequities. This work focuses on how the Delmar Divide created pockets that continue to marginalize residents, particularly students. The effect that purposeful segregation had on this area and how it places students of color at a disadvantage to their white counterparts in other city neighborhoods is certainly visible through research. St. Louis is considered a historically segregated city. Location seems to be one of the most important factors in determining quality of education, health, housing, and access to jobs. Where people live has been molded by a long history of intentional systemic practices at both the governmental and societal levels. Black residents bear the brunt of this history and have been excluded from locations that could provide better opportunities. This report delves into the history that led to the division of the schools on both sides of the Delmar Divide, comparing their educational realities while attempting to understand why this happened and what can be done to directionally move forward as a community.

**St. Louis, Missouri****Senate District 4
House District 83****Major**Elementary Education
with TESOL
Certification**Faculty Mentor**

Gerianne Friedline

Mentor's Department

Honors College

Poster Number 8



St. Louis Missouri

**Senate District 4
House District 83**

Major
Psychology and
Anthropology

Faculty Mentor
Bettina Casad

Mentor's Department
Psychological Sciences

Positive Campus Climate Buffers the Effects of Classroom Gender Salience on Science Devaluing

This research examines threatening educational environments for women STEM (Science, Technology, Engineering, and Math) majors. Previous research found that threatening experiences may result in psychological disengagement, or the psychological separation of the self from the threatening environment (e.g., math and/or science domains; Major & Schmader, 1998). This study used survey data from students ($N = 66$) who attended a Midwestern University. The results indicate a 2-way interaction between perceptions of campus climate (e.g., harassment, intimidation, or support) and classroom gender salience (or how aware women are of their gender in STEM classrooms) on science devaluing among women STEM majors. Results showed that while greater classroom gender salience predicted more science devaluing, participants who reported a highly positive campus climate showed a weaker, or buffered, relationship between gender salience and science devaluing. This result can better help us understand why women are underrepresented in STEM fields, and provide insight into possible interventions, such as improving campus climate and reducing gender salience in STEM classrooms.

Poster Number 12

Curcumin: A Key to Fight Sepsis

Previously, in our lab we demonstrated the efficacy of ferrocenium salts in etherification of propargylic alcohols. Replacement of hydroxyl group by nucleophile was done with the help of a ferrocenium cation. We are currently working on new methods to synthesize carbohydrates. Carbohydrates play key roles in a number of biological processes such as in cellular communication or disease progression. Carbohydrates are also used as vaccines and pharmaceuticals. The most common way to assemble oligosaccharides is glycosylation. Currently we are investing novel catalysts for glycosylation reactions, which would make these reactions easier and faster to perform. We will apply this methodology for the synthesis of curcumin which has the ability to fight sepsis.



St. Louis, Missouri

**Senate District 4
House District 83**

Major
Chemistry

Faculty Mentor
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Mentor's Department
Chemistry

Funding Source
NSF

Poster Number 16



St. Louis, Missouri

Senate District 4
House District 83

Major
Nursing

Faculty Mentor
April Sun

Mentor's Department
Nursing

Poster Number 20

The Interprofessional Management of Concussions in the School Setting

Concussions are the leading cause of death in children and young adults. Failure to manage concussions in young adults can lead to severe long-term complications. Yet, it is unclear what could be an effective model of concussion management for nurse to employ in the school setting. This evidence-based project aimed to evaluate and identify the existing research on databases including CINAHL, Science Direct, JSTOR, Ebscohost, and Wiley Online Library.

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Therefore, there's an imperative need to educate students, coaches, and athletic trainers on preventative measures, signs and symptoms and care of concussion. An interprofessional concussion management model is necessary to successfully manage concussion including prevention and follow-up care.

Chlorhexidine Gluconate Bathing & Its Effect on Central Line-Associated Bloodstream Infection (CLABSI)

Central Line-Associated Bloodstream Infections (CLABSIs) are one of four healthcare-associated infections (HAIs) commonly seen in healthcare. CLABSI is defined as an infection of the bloodstream that occurs within two days of a central line being inserted. This infection increases the mortality rate and price for hospitals to care for patients who are affected. Though the standard of care for CLABSIs has kept these numbers from increasing drastically, this problem continues to occur indicating that the interventions used to solve this problem are ineffective. Research has shown, however, that Chlorhexidine gluconate (CHG) an exceptional antimicrobial agent against gram-positive organisms is effective in reducing CLABSI infection rates when used during bathing. This information led to the comparison of CHG bathing to the standard of care for central lines on infection rates. Patients in long-term acute care hospitals, noncritical care units and burn units were a few of whom benefited from this intervention. The majority of data that enhanced the utilization of CHG baths for patients with central lines came from intensive care units (ICUs) given that they are more susceptible to infections. This data proved that CHG baths reduced the infection rate of CLABSIs more than the standard of care protocol. Additionally, it confirmed that CHG bathing helped reduce the colonization of other bacteria including Vancomycin-resistant Enterococcus (VRE) and Methicillin-Staphylococcus aureus (MRSA). Incorporating CHG bathing as an intervention for patients with central lines along with proper patient education is imperative to decreasing the infection and mortality rates of CLABSIs seen in healthcare.



Wentzville, Missouri

**Senate District 2
House District 83**

Major
Nursing

Faculty Mentor
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Nursing

Poster Number 4



St. Louis, Missouri

**Senate District 14
House District 85**

Major
Nursing

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Nursing

Poster Number 20

The Interprofessional Management of Concussions in the School Setting

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Computer Aided Development of Fluorescent Dyes

Using newly synthesized fluorescent dyes from the Braddock-Wilking group, the Dupureur research group aims to understand and develop relationships between the structure of these dyes and their fluorescent properties. These dyes, called metallafluorenes, are composed of a bi-symmetrical structure containing either a silicon or germanium atom in its fluorene core. These structures can be modified at the left and right sides of the core, allowing for tunability in the function and performance of the compound. These "add-ons" allow us to change or even tune important characteristics like fluorescence wavelength, fluorescence efficiency, and reactivity. The most recent compounds show solvatochromic characteristics, meaning the dyes respond to their environment by shifting the color of fluorescence. These environmentally sensitive dyes have broad and important applications in biomedical and cell research by being able to visualize changes to the micro-environment of a cell. To aid in the development of these compounds a state-of-the-art chemical simulation software, called Spartan '18, is used to predict attributes of compounds before they are physically made. This in return allows us to narrow a broad library of potential compounds, which decreases time spent determining if a proposed compound is a viable dye and additionally saves money and other important resources. Through analysis of these predicted attributes and those measured physically in the lab, trends between structure and fluorescence can be determined that can lead to new discoveries and breakthroughs in fluorescent dyes for biological applications.



St. Louis, Missouri

**Senate District 26
House District 101**

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Biochemistry and
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Faculty Mentor

Cynthia Dupureur

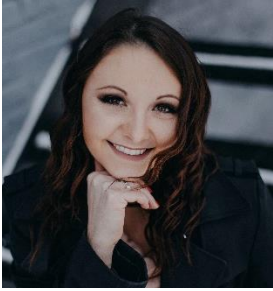
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Funding Source

UMSL

Poster Number 28



Carlyle, IL

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**Senate District 14
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**Funding Source
NASA Missouri Space
Grant Consortium,
UMSL**

Poster Number 31

AI Gravity Project

High-resolution gravity maps are needed across many geoscience applications, including inertial navigation systems, early detection of earthquake activity, natural disaster response, and a variety of geophysical modeling applications. The Office of Geomatics at the National Geospatial-Intelligence Agency (NGA) maintains such models, including Earth's Gravitational Model (EGM). In the most basic sense, EGM utilizes measured gravity values collected over several decades to map Earth's shape. However due to difficult to reach terrain or geopolitical constraints, measured gravity data are difficult to obtain throughout the entire Globe. A series of forward modeling techniques are currently used to "predict" gravity in these areas with little to no measured values. The end result is a lower resolution model, with the current EGM iteration at a 5-minute resolution. With funding from the NASA Missouri Space Grant Consortium, this research collaboration between the University of Missouri-St. Louis and NGA involves developing a higher-resolution gravity map utilizing Amazon Web Services (AWS) high-performance computing power to build an AI-gravity prediction tool. The aim is to replace the current forward modeling process within EGM. The AI-prediction tool uses both supervised and unsupervised machine learning techniques such as clustering and a convolution neural network (CNN). Initial results show a root mean square error on par with current forwarding modeling processes utilizing only a simple, shallow CNN without optimization. This suggests as the AI-optimized model is refined the end goal of reaching a 1-minute from a 5-minute resolution model is within reach. Approved for public release #21-222.

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St. Louis, Missouri

**Senate District 5
House District 80**

Major

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St. Louis, Missouri

**Senate District 14
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Major
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The Interprofessional Management of Concussions in the School Setting

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**Grit & Resilience: Foundations for Mindset
Differences Between Adult Children of
Alcoholics and Adult Children of Non-
Alcoholics**

Alcoholism is a destructive consequence of a combination of environmental, genetic, and social influences. While it is the choice of an individual to consume alcohol, their family is facing the consequences as well. Children of alcoholics (CoAs) face a unique set of challenges growing up with one (or two) alcoholic parents. This study seeks to investigate the presence of a difference in grit and resilience in adult children of alcoholics (ACoAs). Furthermore, the study aims to uncover the influence grit and resilience have on an individual's mindset; whether they maintain a growth or fixed mindset. A survey containing four different aspects of measure was distributed. The first section collected demographic data. The participants were then to complete the Children of Alcoholics Screening Test (CAST) to determine which population they belonged to. The third section measured resilience using a 37-question questionnaire. Lastly, grit was measured using the Short Grit Scale. The study found that Non-ACoAs ($M=3.24$, $SD=0.72$) had significantly higher levels of grit than ACoA ($M=2.97$, $SD=0.60$) ($t_{(165)}=2.56$, $p<.011$). Aspects of resilience, such as family coherence, were also higher in Non-ACoAs ($M=56.48$, $SD=24.85$) than in ACoA ($M=38.75$, $SD=22.45$), ($t_{(165)}=4.67$, $p>.001$). This study brings forth data to support the idea that those who live with a parent with alcoholism have lower levels of grit and resilience, leading to a fixed mindset. Future investigation is needed to better grasp the influence that interactions with alcoholic parents have on the development of children in many aspects, including grit and resilience.

**St. Louis, Missouri****Senate District 14
House District 66****Major**
Psychology**Faculty Mentor**
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St. Louis, Missouri

**Senate District 4
House District 83**

**Major
Chemistry**

Faculty Mentor
Jim O'Brien and
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Mentor's Department
Chemistry

Funding Source
NSF

Poster Number 43

Spectral Analysis of Platinum Fluoride

A new electronic transition of PtF has been recorded at high resolution using Intracavity Laser Spectroscopy (ILS). The PtF molecules were produced in a current regulated RF discharge operating at 0.20-0.80 A applied to a Pt-lined Cu hollow cathode in 0.50 to 1.25 Torr total pressure comprised of 1-5% SF₆ in an Ar/He sputter gas mixture. This hollow cathode was located within the resonator cavity of a tunable DCM dye laser operating over the 14,500-16,500 cm⁻¹ range, and effective pathlengths of 0.4-2.0 km were utilized with the ILS method. The band system observed corresponds to the (0,0) band of the [15.3] $\Omega=3/2 - X^2\Pi_{3/2}$ electronic transition. Rotational assignments for the transitions have been confirmed through combinational difference analysis using known ground state constants. The data were fit using PGOPHER with a standard Hund's case (*c*) energy level expression. Spectra and results of the analysis will be presented.



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