UNDERGRADUATE RESEARCH DAY

APRIL 4, 2024

University of Missouri System

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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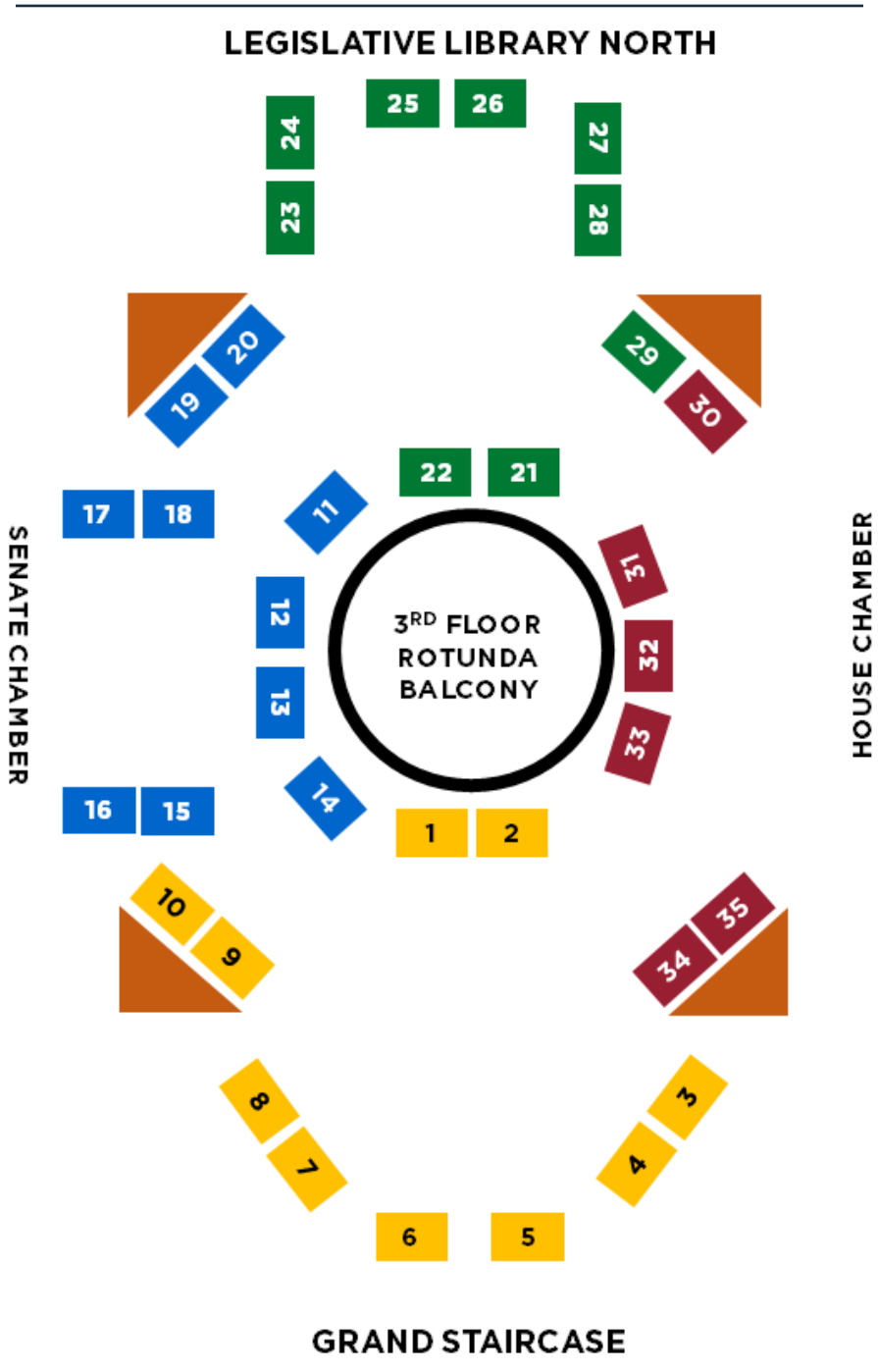
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GRAND STAIRCASE

POSTER NO. 1

Early Universe Behind a Lens: The Hidden Matter Revealed by the James Webb Space Telescope

JULIANNA BAYLESS

Gerald, MO

co-author, poster no. 1

Senate District 26
House District 118

MAJOR
Physics

FACULTY MENTOR
Yicheng Guo

MENTOR'S DEPARTMENT
Physics and Astronomy

FUNDING SOURCE
Colonel Arthur C. Allen Research Scholarship

The universe consists of three components: ordinary matter, dark matter, and dark energy. Dark matter makes up about a quarter of our universe, five times more than ordinary matter, but we know little about it. This is because dark matter does not interact with light and can only be detected through gravitational effects. One such effect is gravitational lensing, which occurs when a massive object, such as a galaxy, bends the light of objects behind it. Using public data from the new James Web Space Telescope, we studied one candidate of galaxy-galaxy lensing. In this system, the possible background galaxy is lensed and appears as an arc around a large foreground elliptical galaxy. We measured the brightness of both. From these results, we derived the galaxies' physical properties with a method called Spectral Energy Distribution Fitting, which fits model galaxies to brightness measurements. This confirmed that the arc is a gravitationally lensed galaxy. After modeling the system, we subsequently found that the foreground galaxy contains a very high amount of dark matter, inconsistent with previous predictions. This result poses a serious challenge to the current physical model of how galaxies like our own Milky Way were formed. In the future, we will conduct further research to refine our results, which will allow us to gain more insight into why this galaxy has more dark matter than expected. Since dark matter makes up such a large fraction of our universe, learning more about it and its role in galaxy formation is imperative to better understanding our universe.

POSTER NO. 1

Early Universe Behind a Lens: The Hidden Matter Revealed by the James Webb Space Telescope

ELLEN GATES

Columbia, MO

co-author, poster no. 1

Senate District 19
House District 45

MAJOR
Physics

FACULTY MENTOR
Yicheng Guo

MENTOR'S DEPARTMENT
Physics and Astronomy

FUNDING SOURCE
Colonel Arthur C. Allen Research Scholarship

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POSTER NO. 2

Are Nursing Students Immune to COVID Vaccine Hesitancy?

AMY BRANDT

Jefferson City, MO

co-author, poster no. 2

Senate District 6
House District 60

MAJOR
Health Science Leadership and Policy

FACULTY MENTOR
Kevin Everett

MENTOR'S DEPARTMENT
Family and Community Medicine

FUNDING SOURCE
PANDEMIC Project

Cultural beliefs and misunderstandings may affect attitudes toward COVID and vaccinations. Educators need to realize that nursing students may be swayed by prevalent misinformation or have misconceptions about COVID vaccines just like the public. A better understanding of nursing students' perceptions can lead to needed changes in immunization and infectious disease education.

A survey was distributed in September 2023 to senior-level BSN students. We then compared the results to 371 other Missourians. We observed several differences. Most notably, nursing students risk perceptions of COVID and Long COVID, their intent to vaccinate in the future, and their trusted source of information. While 82% of nursing students know their risk of getting COVID, 59% are not worried about long COVID. Surprisingly, more than 25% were unsure about future vaccinations. Nursing students were more likely to trust government agencies for information about vaccines, however the general population trusts healthcare professionals.

This is concerning as healthcare systems are repealing COVID vaccination mandates for workers. Nursing staff who choose not to vaccinate are putting themselves and their patients at high risk of exposure and prolonged illness. Nurses could become a source of transmission for COVID. Additionally, because the public trusts health care professionals as a source of vaccine information, it is important for nurses to fully understand the safety and efficacy of vaccinations, the protective qualities against Long COVID, the reduction of severe symptoms, and decreased chance of transmission to patients.

POSTER NO. 2

Are Nursing Students Immune to COVID Vaccine Hesitancy?

ROBIN VANDERBECK

St. Charles, MO

co-author, poster no. 2

Senate District 23
House District 106

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Public Health

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Kevin Everett

MENTOR'S DEPARTMENT
Family and Community Medicine

FUNDING SOURCE
PANDEMIC Project

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POSTER NO. 2

Are Nursing Students Immune to COVID Vaccine Hesitancy?

OLIVIA WOODY

Gallatin, MO

co-author, poster no. 2

Senate District 12
House District 2

MAJOR
Biochemistry

FACULTY MENTOR
Kevin Everett

MENTOR'S DEPARTMENT
Family and Community Medicine

FUNDING SOURCE
PANDEMIC Project

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POSTER NO. 3

Ligaments and Tendons Respond Differently to Exercise: Implications for Injury and Repair

GILLIAN HARK

Hannibal, MO

Senate District 18
House District 5

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Biological Sciences

FACULTY MENTOR
Aaron Stoker

MENTOR'S DEPARTMENT
Orthopaedic Surgery

FUNDING SOURCE
Thompson Laboratory for Regenerative Orthopaedics

Patient activity level is an important risk factor for anterior cruciate ligament (ACL) injury, but the metabolic responses of tendon grafts are poorly understood. ACL reconstruction with tendon autografts is a common treatment of ACL injuries in the knee. ACL rupture is most common in young active individuals, but a significant number occur in older adults. The study was designed to determine the metabolic responses of tissues to activity level. It was hypothesized that lower activity levels would significantly increase inflammatory and degradative responses of cells compared to higher activity level. ACL, posterior cruciate ligaments, patellar, and quadriceps tendons were recovered from dogs, and cell lines were created from each tissue. Cells were cultured for 6 days using a vacuum to stretch cells to mimic a sedentary lifestyle (5,775 steps), and active lifestyle (10,500 steps & 5k run), or no load based on the number of cycles per day. During and after culture, biological molecules released by the cells and genes being expressed by the cells were measured. There were significant differences in levels of pro-inflammatory, pro-degradative, and extracellular matrix molecules based on activity level and source of the tissue. The data from this study indicate that ligament and tendon tissues may respond differently to activity levels of patients, which could influence risk of ACL injury as well as outcomes after ACL reconstruction. By determining these differences, we can recommend lifestyle changes and work towards developing targeted treatments to reduce ACL injury rates.

POSTER NO. 4

Public Opinion and Israel's Decision to Go to War, 1967

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House District 87

MAJOR
History, Psychology

FACULTY MENTOR
Bradley Nichols

MENTOR'S DEPARTMENT
History

The Waiting Period (May 14, 1967 – June 5, 1967) is a complex three-week period in Israeli history that started when Egypt blocked trade with Israel and sent troops to the Israeli-Egyptian border, ending on June 5 with the start of the Six-Day War. The paper examines the role that public opinion had on the choices of the Israeli government. It draws a direct line between public opinion and the decision to establish an emergency government on June 1. Materials such as cabinet transcripts, radio recordings, newspaper articles, interviews collected from surviving military officials, and public opinion polls were used to examine both public opinion and governmental reaction. It also looks at the public perception of the Waiting Period through music, examining both its historical role and the content of music produced after the war. Using these new resources, the mentality of the Israeli public could be better understood. The Waiting Period shaped Israeli policy following the Six-Day War. Many notions held today by the Israeli public are connected to alleged fears of the Waiting Period. The influence of the Waiting Period on settlements in the newly occupied territories of the West Bank, Gaza Strip, Sinai peninsula, and the Golan Heights. The Israeli government paid great attention to the international attitude toward the brewing conflict, helping shape much of its initial passive policy. Examining the Waiting Period provides necessary insights into how democratic governments function, especially when international and intranational opinions are of utmost importance.

POSTER NO. 5

Artificial Intelligence (AI) for Enhancing Protein Function Prediction

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FACULTY MENTOR
Jianlin Cheng

MENTOR'S DEPARTMENT
Electrical Engineering and Computer Science

FUNDING SOURCE
National Science Foundation

Proteins are essential building blocks for all living things. They play crucial roles by providing structural support, catalyzing biochemical reactions, regulating genes, and transmitting signals within cells. Understanding protein functions is important for grasping how biological systems work, which leads to the advancement in biomedical research and biotechnologies. In addition, since many diseases are linked to specific proteins, predicting their functions enables drug development to treat those diseases.

Numerous gene-sequencing projects have generated millions of protein sequences, but determining protein functions through experiments is highly expensive and time-consuming. Less than 1% of known protein sequences have had their functions experimentally determined; therefore, it has become important to develop computational methods to predict protein functions. Despite significant advances in the development of computational methods using different approaches, achieving high accuracy remains a challenge.

My research aims to enhance the precision of protein-function prediction using artificial intelligence (AI). In the field of bioinformatics, deep learning is gaining popularity and becoming widely used because it is a powerful technique that can handle large and complex data. In this project, we use a protein language model and graph neural networks to extract information from protein sequences and structures, respectively, to predict protein function. We also combine our model with a sequence similarity-based method for further improvements in performance. Benchmarked on the test datasets, we achieved higher levels of accuracy in protein-function predictions compared to other existing methods that generally rely on protein sequences, demonstrating the promise of using AI to close the gap between protein sequences and their verified functions.

POSTER NO. 6

Minority Focused News As a Locus of Empowerment

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Kansas City, MO

Senate District 17
House District 17

MAJOR
Journalism

FACULTY MENTOR
Christopher Josey

MENTOR'S DEPARTMENT
Communications

Research demonstrates that the most common form of news consumption today is online. Scholars have well documented how mainstream news outlets (e.g., Fox News & The New York Times) perpetuate harmful stereotypes of marginalized groups. These stereotypes, in turn, can impact endorsement of policies by the electorate that disproportionately impact the marginalized (e.g., Latinx and Black Americans). Such coverage is also associated with increased intergroup conflict and lower racial esteem for persons belonging to historically subordinated groups. Despite these well documented and empirically validated associations, not much is known about narratives about these groups in spaces meant to serve the marginalized. My Arts, Social Sciences and Humanities (ASH) Scholar's Program team's research studies the portrayals of minority characters in eight well known minority-focused news outlets. Initial results indicate these sites present a more positive narrative than their traditional counterparts. Our follow-up analyses find Latinx and Black-focused news media aren't as degrading and stereotypical for all groups and not just Black and Latinx characters. This has important implications in a world where these sites are consumed by an increasingly diverse audience. These sites are making pointed choices to have truly fair and representative portrayals of all audiences. These choices, in turn, are likely to have a positive impact on the greater populace as they gain greater circulation. As a journalism major, identifying the practices that are driving these content differences will assist me in my professional career.

POSTER NO. 7

Relationship Between Amygdalar Functional Connectivity and Camouflaging in Autistic Young Adults

JANE MANSON

Barnhart, MO

Senate District 22
House District 113

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Psychology

FACULTY MENTOR
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MENTOR'S DEPARTMENT
Thompson Center for Autism and Neruodevelopment

FUNDING SOURCE
TRIUMPH (Translational Research Informing Useful and Meaningful Precision Health) - University of Missouri School of Medicine

The social deficits of autism spectrum disorder are correlated with abnormal interaction between brain regions, or functional connectivity (FC) with the amygdala, an area of the brain associated with emotional processing, and therefore, social communication. To minimize impact of social deficits, many autistic people camouflage, attempting to hide autistic traits. While camouflaging can be adaptive to secure employment and education, it is also linked to negative mental health outcomes, including higher stress, exhaustion, anxiety, and depression. Camoflauging often impedes individuals from acquiring diagnoses and consequently accessing important resources for autistic individuals because they do not appear autistic. This study aims to conduct a novel analysis of the relation between autistic camouflaging and resting-state FC of the amygdala, which we hypothesize are interrelated. The sample contained 14 autistic participants, primarily white males, aged 18-27 (M=21.8). FC was assessed with a twelve-minute fMRI scan during which participants had no tasks and their eyes closed. Camouflaging was assessed using the Camouflaging Autistic Traits Questionnaire (CAT-Q), which contains 25 questions from three subscales: compensation, masking, and assimilation. Analyses revealed higher scores on the CAT-Q, indicating greater camouflaging, was associated with reduced connectivity between the amygdala and the sensory processing and integration as well as risk-reward brain pathways. Additionally, higher CAT-Q scores were associated with greater connectivity between the amygdala and areas of the brain responsible for object recognition. These findings suggest that greater camouflaging is associated with greater interactions with the brain's stress reactivity center, a potential biomarker for greater stress reactivity.

POSTER NO. 8

Biochemical-Based Solutions to NextGen Agriculture

RANDI NOEL

Butler, MO

Senate District 31
House District 125

MAJOR
Plant Sciences

FACULTY MENTOR
Richard A. Ferrieri

MENTOR'S DEPARTMENT
Chemistry

FUNDING SOURCE
MizzouForward Undergraduate Research Training Grant

Twenty-first century agriculture faces many formidable challenges with the growing global population. Increasing demands on the planet's natural resources are already taxing existing agricultural practices. Today, many farmers use biochemical treatments to increase crop yields where commercialized biostimulants are marketed in the form of pyroligneous acid (liquid smoke) generated by burning agricultural waste. MU Research Reactor (MURR) scientists recently partnered with Corigin Solutions, a startup company in California that produces and markets Coripholas a biostimulant product. To expand its market base in the Midwest, the company seeks data on how well soybeans perform and the mechanisms driving its products' results. Outdoor studies conducted at MURR examined different Coripho treatment doses and their effect on soybean growth. Plant height, number, size, and greenness of leaves were positively impacted in a dose dependent manner with 2 gallon/acre soil treatments being optimal. At harvest, this dose increased crop yield by 40%. Laboratory-based studies using radioactive 11CO2 produced at MURR were carried out to examine the effects of treatment on important leaf pigments. Most notably, chlorophyll (a & b) gives leaves their green color and is essential to harnessing sunlight for driving photosynthesis, capturing carbon, and generating oxygen. Beta-Carotene, another important pigment, serves as an antioxidant protecting plants when too much oxygen is produced. We discovered that 2 gal/acre Coripholtreatments boosted rates of chlorophyll a, chlorophyll b and beta-carotene biosynthesis significantly, all contributing to a 13% increase in leaf capture of carbon dioxide. Coripholhas demonstrated promising results for modern agriculture's sustainability challenges.

POSTER NO. 9

Rates of Insomnia and Treatment Interest Among Veterans of Color

NIVEDITA PRABHU

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Senate District 24
House District 96

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FACULTY MENTOR
Mary Beth Miller

MENTOR'S DEPARTMENT
Psychological Sciences

The public health burden of sleep disorders is an estimated $100 billion for treatment and associated conditions (e.g., work-related injuries, motor vehicle accidents, lost productivity). Although Veterans report insomnia rates two to three times higher than civilians, and ethnic minority groups report higher rates of insomnia in comparison to non-Hispanic White Americans, racial/ethnic differences in rates of insomnia among Veterans have not been studied. This study compares insomnia severity scores between White, Black, Asian, and Hispanic Veterans. In a national survey, 325 veterans (age 18-88; 66% men, 32% women, 2% other gender; 12% Asian or Asian American, 15% Hispanic or Latinx, 28% non-Hispanic White, 36% Black or African American) reported on their insomnia, mental health, and interest in sleep treatment. Overall, 68% of participants screened positive for clinically significant insomnia: 90% of Asian, 79% of Hispanic or Latinx, 65% of Black, and 58% of White participants. Veterans of color reported higher rates of insomnia than non-Hispanic White Veterans, with 4 out of 5 Asian and Hispanic Veterans screening positive for insomnia. Of those who screened positive for insomnia, 95% also screened positive for Post-Traumatic Stress Disorder (PTSD). However, only 74% of Veterans reported interest in sleep treatment. Despite higher rates of insomnia, veterans of color were less interested in seeking treatment. Given the prevalence and societal impact of insomnia, improved access to treatment and examining the cause between disparities is needed, particularly for the diverse racial/ethnic groups of Americans.

POSTER NO. 10

Evidence of Political Conformity Among Black Adults

KYLER RICHARD

Columbia, MO

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MAJOR
Political Science

FACULTY MENTOR
Jordan A. Booker

MENTOR'S DEPARTMENT
Psychological Sciences

FUNDING SOURCE
McNair Scholars Program

Conformity involves the way people adapt their beliefs, attitudes, and behaviors with surrounding groups. Conformity can also be an important psychological process that explains how people act toward broad group goals. My study focused on evidence of political pressures and conformity among Black Americans. Since the Civil Rights Era, most Black adults have supported liberal groups because of their assumed stances that would support Black community members. I tested whether personal and environmental factors would predict Black adults' political affiliation and whether political affiliation was related to well-being. I studied two samples of Black adults: a nationwide sample of adults from 2008; and University of Missouri students studied between 2018 and 2023.

In each sample, most Black adults supported liberal groups. Nationwide, older adults were more likely to support liberal groups. Among college adults, women were more likely to endorse liberal groups than men. The few Black college adults who endorsed independent or conservative groups reported greater social support when a Republican president was in office.

My work fits within the larger focus of political decision-making for modern Black adults. My work also challenges some assumptions on political decisions that reflect mostly White adult samples in earlier studies. Work remains on the family and community messages that may motivate political decisions for Black adults. Moving forward, I intend to build on this work to understand Black people's awareness and responsiveness to political pressures.

POSTER NO. 11

The Urban Heat Island Effect: Creating An Interactive Model

SOPHIA BAUGHER

Independence, MO

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House District 32

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Earth and Environmental Science

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Fengpeng Sun

MENTOR'S DEPARTMENT
Earth and Environmental Science

FUNDING SOURCE
UMKC SEARCH Grant

The Urban Heat Island Effect is a phenomenon that affects metropolitan centers across the entire world. The metropolitan centers, typically an urban area, show a trend of being much hotter than that of their surrounding suburban or rural areas. With the recent trend of rising temperature thanks to Climate Change, the Urban Heat Island Effect has only begun to rise. With this increase in heat comes an increased risk in heat borne illnesses, and even an increased risk of heat-related death. However, when it comes to this phenomenon, a lack of knowledge was noted when presenting this phenomenon. The idea was then formed of creating an Urban Heat Island model, interactive with the user as to understand the phenomenon as it presents itself in a city but on a smaller scale. With this, a model city was crafted from 3D printed materials, real roofing and asphalt samples, and plants and trees that also show the affects that can mitigate this phenomenon. The project also utilizes a FLIR C5 thermal camera that will be used to demonstrate the temperature effects in real-time, as directed by the user.

POSTER NO. 12

Foxg1a is required for hair cell development and regeneration in the zebrafish lateral line

EMILY BLEDSOE

Overland Park, KS

Senate District 7
House District 27

MAJOR
Biology

FACULTY MENTOR
Hillary McGraw

MENTOR'S DEPARTMENT
Biological and Biomedical Systems

FUNDING SOURCE
National Institute of General Medical Sciences

In the human inner ear, hearing and balance are mediated by specialized sensory cells, called hair cells. When damaged, these hair cells cannot regrow, resulting in deafness and balance disorders. In the state of Missouri, one in ten Missourians experience hearing loss or deafness, meaning there is a large population who could benefit from research into hair cell biology. Aquatic animals, including zebrafish (Danio rerio), have specialized hair cells used in their lateral line systems to sense water current. These hair cells are very similar to the inner ear hair cells in humans, but unlike human hair cells, these lateral line hair cells can regrow throughout the lifespan of the fish. This ability to regenerate hair cells makes zebrafish an excellent model organism to determine how hair cells develop and regenerate. My project is to investigate the Foxg1a gene, which is important for mammalian inner ear development, and to determine if it also plays a role in hair cell development and regeneration in the zebrafish. We particularly look at the lateral line hair cells of young zebrafish carrying a mutation in Foxg1a. My work in the McGraw lab, with my mentor, doctoral student Jon Bell, shows that Foxg1a mutant zebrafish form fewer hair cells during development and have a reduced capacity for regeneration. This work suggests that Foxg1a is a good target for future study and may provide insights into how we could someday regrow damaged hair cells in human patients.

POSTER NO. 13

Circadian Regulation of Spt Ada Gcn5 Acetyltransferase (SAGA) in Drosophila Melanogaster

CHRIS EKENGREN

Raytown, MO

co-author, poster no. 13

Senate District 9
House District 28

MAJOR
Biology

FACULTY MENTOR
Ryan D. Mohan

MENTOR'S DEPARTMENT
Biological and Biomedical Systems

The entrainment model of Drosophila Melanogaster has demonstrated that it is an ideal method for studying circadian rhythm and the impact mis-regulation can cause. Spinocerebellar ataxia type 7 (SCA7) is a disease which leads to the degeneration of the retina and cerebellum, causing neurodegeneration, blindness, and loss of motor skills. Following the ATXN7 gene, to the Ataxin7 protein, to the transcriptional cofactor called SAGA which is critical for gene expression, Atxn7 polyQ may disrupt the balance bound and free non-stop causing dysregulation. Our lab aims to investigate the dynamics of circadian regulation of SAGA and non-stop in the brain and how their dysfunction may lead to disease. The research being performed is critical to the citizens of Missouri due to the impact on their health. Missouri has roughly 38,000 new cancer diagnoses per year, 34% of adults reporting they have a form of depression, and roughly 15% reported to be obese. This research is paramount because it has the potential to shed light on such a wide range of debilitating diseases and disorders that no one should have to suffer through.

POSTER NO. 13

Circadian Regulation Of Spt Ada Gcn5 Acetyltransferase (SAGA) In Drosophila melanogaster

AUSTIN EVANS

Neosho, MO

co-author, poster no. 13

Senate District 32
House District 160

MAJOR
Biology

FACULTY MENTOR
Ryan D. Mohan

MENTOR'S DEPARTMENT
Biological and Biomedical Systems

The entrainment model of Drosophila Melanogaster has demonstrated that it is an ideal method for studying circadian rhythm and the impact misregulation can cause. Spinocerebellar ataxia type 7 (SCA7) is a disease which leads to the degeneration of the retina and cerebellum, causing neurodegeneration, blindness, and loss of motor skills. Following the ATXN7 gene, to the Ataxin7 protein, to the transcriptional cofactor called SAGA which is critical for gene expression, Atxn7 polyQ may disrupt the balance bound and free non-stop causing dysregulation. Our lab aims to investigate the dynamics of circadian regulation of SAGA and non-stop in the brain and how their dysfunction may lead to disease. The research being performed is critical to the citizens of Missouri due to the impact on their health. Missouri has roughly 38,000 new cancer diagnoses per year, with 34% of adults reporting they have a form of depression, and roughly 15% reported to be obese. This research is paramount because it has the potential to shed light on such a wide range of debilitating diseases and disorders that no one should have to suffer through.

POSTER NO. 14

Unveiling Urban Trauma: The Impact of Design on Community Well-being

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Urban Planning and Design

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MENTOR'S DEPARTMENT
Architecture and Urban Planning

Design is a powerful force that shapes the physical and social fabric of our communities. When wielded responsibly, it has the potential to uplift and enrich the lives of individuals, fostering a sense of belonging and well-being. However, as we explore the transformative capabilities of design, it becomes imperative to acknowledge the darker implications of its misuse. Design negligence, a term gaining prominence in contemporary discourse, encapsulates the unintended consequences of ill-informed, or negligent design decisions. In the context of community development, design negligence not only fails to address the unique needs and aspirations of diverse populations but can also actively enforce trauma, perpetuating cycles of inequality and marginalization.

POSTER NO. 15

Exploring the Molecular Links Between Circadian Rhythm and Neurodegeneration

SYDNEY ROGERS

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Health Sciences

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Biological and Biomedical Systems

Sleep quality is important for every dimension of mental and physical health, and numerous analyses show a correlation with sleep loss and disease. Our research focuses on the irregularities of an organism's circadian rhythm and how they affect brain function. The circadian rhythm is a 24-hour internal biological clock that bodily proteins rely on to determine their level of activity throughout the day. It is responsible for your sleep-wake cycle, regulating alertness during the day and rest during the night. It also greatly influences other biological functions including hormone and immune control, eating habits, and body temperature. Disruption of this internal cycle causes circadian dysfunction which can be correlated with the onset of a wide spectrum of neurodegenerative diseases such as Alzheimer's and Parkinson's.

At a molecular level, the circadian rhythm impacts ubiquitination, which determines the rate of protein degradation by tagging proteins to be broken down. Our research identifies sleep patterns using behavioral analysis of Drosophila melanogaster to investigate how loss of sleep disrupts these ubiquitination patterns. SAGA is a protein complex that harbors the deubiquitinating enzyme Non-stop. Non-stop is shown to participate in the regulation of the circadian rhythm and could be a key factor in understanding the effects of sleep disruption. Researching these effects can help us understand why loss of sleep may cause reduced health and disease.

POSTER NO. 15

Exploring the Molecular Links Between Circadian Rhythm and Neurodegeneration

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Biological and Biomedical Systems

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POSTER NO. 16

Physical Activity, Sleep, and Demographic Patterns in Urban Missouri Youth: A Quasi-Experimental Study

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FUNDING SOURCE
Health Forward Foundation and Public Health Americorps

Connections between sleep and physical activity (PA) are vital components of growth and development, especially in adolescence. Lack of adequate sleep and sleep quality has been known to affect mood, school performance, as well as health in general. Middle school students in urban areas also face complexities that may cause increased complications in sleep and PA, calling for a comprehensive intervention approach that allows students to engage in physical activity safely and learn about how to take care of themselves with productive strategies.

As accelerometry grows in popularity for consumers, public health researchers can utilize its tracking abilities to record accurate physical health markers and refine public health interventions. In our research, we utilize Garmin VivoFit4 health tracking wrist-worn devices to monitor sleep time and daily step counts in our primary focus group of adolescents in Kansas City Public School systems. Along with these devices, regular after-school intervention sessions focused on increasing PA and physical literacy are provided to students. This study aims to expose the correlation between PA and sleep in middle school students in urban areas of Missouri.

POSTER NO. 17

The Humorous Disability Rhetoric of Jess Thom

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Jane Greer

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FUNDING SOURCE
UMKC SUROP Grant

Jess Thom is a theatrical performer, activist, comedian, and part-time "superhero." She was diagnosed with Tourette's Syndrome in her early 20s, and now in her 40's, is working through her website Touretteshero, theatrical performances such as her show "Backstage in Biscuit land," interviews, TedxTalks and more to break down barriers for people with disabilities. Tourette's Syndrome is a neurological condition that causes tics, which are sudden movements or sounds a person makes and cannot control. Tourette's is extremely common, yet still a highly stigmatized condition.

My project focuses on her use of humor to educate her audiences on her disability and promote understanding. Although humor is often used to demean individuals with disabilities, Thom views it as a power, and uses it as such.

I began my research with looking into Thom's past interviews and reviews of her performances, as well as exploring the website Touretteshero.com. I familiarized myself with her sense of humor, and the specific and intentional ways she uses humor as a part of her rhetoric. Thom's work is vital to the disability community in the ways that she works towards a more inclusive world, making people laugh one tic at a time.

POSTER NO. 18

Characterizing Lava Flow Behavior Using Digital Models of Small Tubes from Flows at Askja, Iceland

MYA THOMAS

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Earth and Environmental Science

FUNDING SOURCE
UMKC SEARCH Grant; UMKC SUROP Grant; Newcomb Student Research Fund; Tyler Center for Global Studies Grant

A 1961 eruption at Askja Volcano in Iceland produced a series of lava flows over seven weeks.

Lava tube formation is common in viscous basaltic flows such as this eruption. Tube networks influence flow extent by insulating lava which enables it to travel farther and faster. During a field campaign to Askja, eight small (2 meter diameter) lava tubes and five lava ponds were located in the 1961 flow. Length of the tubes varied between approximately 2.5 to 10 meters.

Three of these encountered tubes were digitized using a low-cost photogrammetry technique that relies on a local coordinate system to compensate for the challenge of collecting accurate GPS coordinates in underground environments. To validate the accuracy of this method, field measurements of the height, length, and crust thickness of each lava tube were taken to compare against measurements derived from the digital models. The crust thickness of lava tube MT009 was 27 centimeters with a width of >200 centimeters and a height of 100 centimeters in the field which were reflected in the digital model with an average percent error of <11%. Models like this are used to study the influence of various transport mechanisms, like tube systems, on flow dynamics. This technology can also be leveraged for exploration, and is transferable to cave environments in Missouri. Caves are a large part of Missouri's natural heritage and the state's tourism. Creating digital models of geologic features using this photogrammetry technique increases accessibility and enables detailed study of their characteristics.

POSTER NO. 19

A Perfect Tuning System?

BRADY WOLFF

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Music Composition, Music Theory

FACULTY MENTOR
David Thurmaier

MENTOR'S DEPARTMENT
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FUNDING SOURCE
UMKC SEARCH Grant

Musical tuning systems have undergone constant evolution throughout recorded history, culminating in the modern-standard tuning of 12-tone equal temperament. This tuning method divides the octave into 12 equal parts. The composer Ben Johnston regarded this system as imperfect and inherently "gray," inspiring him to explore an alternative tuning system which he called "extended just intonation." This system favors pure interval ratios while making sacrifices to playability and simplicity. This pursuit of purity results in sonorities which resonate with natural acoustics, evoking clarity and consonance. Johnston implements these concepts in a set of variations on the renowned hymn tune "Amazing Grace," which intensifies in harmonic complexity as the piece progresses.

Research on just intonation explores the practical applications of pure harmonic ratios in composed music, fostering innovative harmonic possibilities. Current research delves into the tuning systems utilized by specific composers, but lacks a comprehensive overview for individual compositions.

To address this gap, I have developed a visual aid capable of displaying the tuning center, harmonic reach, and harmonic complexity of numerous compositions composed with just intonation. Inspired by the lattice structures employed by Ben Johnston, my visual aid provides insight to other notable composers, including the sacred realist music of Catherine Lamb, and the microtonal electronic dance music of Sean Archibald (Sevish).

POSTER NO. 20

The Growth Plate and Its Role in Youth ACL Injuries

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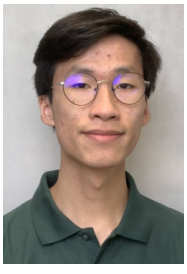
FUNDING SOURCE
UMKC SUROP Grant

The anterior cruciate ligament, or ACL, is a ligament in the knee joint that is commonly injured during athletic activities. ACL injuries often have long recovery times and can cause lifelong knee problems. Interestingly, recent research has shown that, from the ages of 14-18 in particular, female athletes are much more likely to suffer an ACL injury than male athletes. One possible cause of this trend is the adolescent growth plate: a soft, cartilage-like segment in an adolescent's leg bones that allows the adolescent leg to grow until it reaches maturity, at which point the growth plate hardens into bone. Due to the softer, springier properties of the growth plate, some have hypothesized that the growth plate may act as a shock absorber for the knee. Since the female growth plate hardens into bone several years earlier than in males, such a shock absorbing effect of the growth plate may explain this strange spike in teenage female ACL injuries. To investigate the role of the growth plate in ACL injury, this study used computer modeling software to create two software models of the same knee joint: one with a growth plate and one without. Tests were then run on these two models to investigate the impact of the growth plate on ACL stress. Interestingly, the test results indicate that the growth plate does have a shock absorbing effect on the ACL in certain modes of knee loading, thus offering a potential explanation for this strange trend in adolescent ACL injuries.

MISSOURI S&T

POSTER NO. 21

Spectroscopic and Interferographic Methods Deployed in Tandem for Detecting Volatile Organic Compounds Used to Diagnose Diseases and Identify Explosive Materials



EZEKIEL ALLEN

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Rex Gerald

MENTOR'S DEPARTMENT
Electrical and Computer Engineering

FUNDING SOURCE
Lightwave Technology Research Laboratory

This study explores the detection and identification of volatile organic compounds (VOCs) in human breath for disease diagnosis and emanating from explosives for military applications. Several VOCs found in human breath, like acetone and acetaldehyde, are associated with diseases such as diabetes, lung cancer, and acute respiratory distress syndrome (ARDS). For explosives detection, specific nitrogen-containing analogues like pyridine are used. An Owlstone-FTIR system, in tandem with an optical sensor interrogator, is used to establish a benchmark calibration system of VOCs for novel sensors such as Metal-Organic Framework (MOF) single crystals and porous glass microspheres. The results of this study have important implications for disease diagnosis and military applications. This study aims to provide concise and informative insights into the application of VOC detection systems for a multitude of uses.

POSTER NO. 21

Spectroscopic and Interferographic Methods Deployed in Tandem for Detecting Volatile Organic Compounds Used to Diagnose Diseases and Identify Explosive Materials

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MENTOR'S DEPARTMENT
Electrical and Computer Engineering

FUNDING SOURCE
Lightwave Technology Research Laboratory

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POSTER NO. 22

Emotional Impact of Music Memories

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Amy Belfi

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Psychological Sciences

FUNDING SOURCE
National Institute on Aging of the National Institutes of Health Award

Music evokes strong and persistent emotional responses. However, the mechanisms underlying the emotional effects of music, particularly in older adults, are largely unknown. One purported mechanism by which music evokes emotions is through memory – that is, music evokes personal, autobiographical memories that then lead to emotional responses. Here, we investigated whether memory-evoking music induces stronger and longer-lasting emotional responses than non-memory-evoking music, and whether these emotional responses differ between younger and older adults. Older (N=30) and younger adults (N=30) listened to two blocks of self-selected music (one block of memory-evoking music and one block of familiar but non-memory-evoking music). Participants reported their emotions prior to and at three timepoints post-listening. Older adults reported higher levels of positive affect than younger adults. For both groups, positive affect increased after listening to both memory-evoking and non-memory-evoking music. However, negative affect only increased after listening to memory-evoking music. These results suggest that both memory-evoking and non-memory-evoking music generate strong emotions in younger and older adults, but music that conjures personal memories is more likely to elicit mixed emotions. Our results have important clinical implications when designing music-based interventions for mood and affect, particularly in older adult populations.

POSTER NO. 23

Tomographic PIV System for Supersonic Wind Tunnel Application

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MAJOR
Aerospace Engineering

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Davide Viganò

MENTOR'S DEPARTMENT
Mechanical and Aerospace Engineering

I began my work in the Aerodynamics Research Laboratory at Missouri S&T in the Fall of 2022. I was the first student to conduct research under Dr. Davide Viganò, my advisor, and I plan to pursue a PhD in Aerospace Engineering upon my graduation this Spring. Thus far, my research has revolved around the redesign and improvement of the MST Supersonic Wind Tunnel. The goal of a wind tunnel is to provide a controlled environment in which airflow properties may be studied. This is important because observing actual airflow can aid the understanding and prediction of aerodynamic phenomena in real applications. For example, compressible turbulence is a subgroup of supersonic aerodynamics where much is still unknown, despite many years of research. Fortunately, with time comes more advanced methods to study airflow. The particular method that I work with is called Tomographic Particle Image Velocimetry (TPIV), which allows us to easily measure the flow velocity distribution over a 3-dimensional volume. When I started research, the MST Supersonic Wind Tunnel was not capable of supporting TPIV. So, over the past 3 semesters, I have designed and built a new test section to accommodate TPIV. This upgrade greatly improves Missouri S&T's relevancy when it comes to experimental supersonic aerodynamics, and I cannot wait to continue working and presenting my findings over the coming years. Some interesting applications of my work include hypersonic propulsion, spaceplanes, and planetary entry.

POSTER NO. 24

Competition or Prey: C. elegans populations in the presence of P. pacificus

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co-author, poster no. 24

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House District 13

MAJOR
Biological Sciences

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Andrea Scharf

MENTOR'S DEPARTMENT
Biological Sciences

The predatory and territorial behaviors of the model organism P. pacificus provide a useful opportunity to study territorial defensive behaviors and optional predatory behaviors in relation to the availability of preferred food sources. P. pacificus will be grown with C. elegans in shared cultures, in which E. coli will be placed and used to feed both species of worm. The number of predation events and territory defense events by P. pacificus against C. elegans will be recorded and tracked at differing levels of food concentrations. One potential issue is the different mouth morphs found in P. pacificus, with the stenostomatous (in contrast to the Eurystomatous morph) not being able to attack or feed on C. elegans. This will be investigated by controlling a number of environmental factors, such as growth medium type, temperature, and culture movement. Understanding of these topics can be applied to further understanding of inter-species ecological pressures and preferences, as well as, having the potential to provide insight on inter-species resource partitioning.

POSTER NO. 24

Competition or Prey: C. elegans populations in the presence of P. pacificus

ELENA ZOBEL

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POSTER NO. 25

TNT Equivalence: Measuring, Validating, and Appending Binary Energetics to the Literature

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FUNDING SOURCE
Missouri S&T Energetics Research Team

TNT equivalency is a standard used to measure and quantify the effects of energetic materials. Using these equivalencies, the safety factors for minimum distances and storage of explosives are determined. Having a known TNT equivalence of energetic materials also helps estimate potential blast damage and risks for individuals. The TNT equivalencies for numerous energetic materials, such as binaries, have no published values, but are regularly used in industry, military, and research testing. To determine TNT equivalence, three tests were performed: 1) a plate dent test for direct dent comparison, 2) air blast tests to measure air overpressure and calculate impulse, and 3) velocity of detonation test using a fiber optic system of measurement. This research produced TNT equivalency values for commonly used explosives and provided recommendations for an inexpensive and repeatable method of determining TNT equivalence. Standardizing these TNT equivalency values for energetic materials will ensure safe procedures that mitigate the potential risks and blast damage for the military and law enforcement when handling, storing, or detonating explosives. Results showed that variations in equivalence values were present depending on the test performed, but the values measured for reference material Composition B were all within, or very close to, the range of values cited in literature. This suggests that the other values found through this work are also relevant, provided caution is taken with their use, safety factors are applied as applicable, and the best value is selected for the application at hand.

POSTER NO. 26

Microbe Emulation: Cell-Cell Communication in Bacterial Strain Competition

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David J. Westenberg

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FUNDING SOURCE
Missouri S&T
Biological Sciences
Department

This research project focuses on looking at different quorum-sensing positive strains in bradyrhizobium japonicum, a species of legume-root bacteria found in soybean plants across the Midwest. Our objective is to use different chemical testing methods to distinguish genetic differences between negative strains. This can be done through polymerase chain reaction, gel electrophoresis, and gene editing. Our goal has been to polymerase chain reaction (PCR) amplify a fine-tuned promoter then clone it into the gene. In previous studies, drought has been shown to reduce nitrogen fixation in plants. When bacteria infect these plants, they leave behind nodules containing different chemical compounds, and so by studying these strains grown in Missouri and learning what we can about the existing bacteria, we could potentially create a drought-resistant bacteria strain and focus on the genetics and competition that go into each compound makeup.

POSTER NO. 27

Role of Native Mycorrhizal Fungi to Facilitate Establishment of Compatible Prairie Plants on Mine Waste

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House District 88

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Computer Engineering

FACULTY MENTOR
Sahra Sedigh

MENTOR'S DEPARTMENT
Psychological Sciences, University of Missouri-St. Louis

As technology advances, chips in embedded systems, personal computers, supercomputers, etc. run at higher clock speeds and with smaller and smaller form factors, which makes them more susceptible to electromagnetic interference. Cybersecurity breaches of embedded systems often utilize intentional electromagnetic interference. The proposed research aims to detect such interference, provide an understanding of its impact on the system, and create interventions that prevent or mitigate these impacts. In the short term, associated research tasks are to 1) create lightweight software-based instrumentation that monitors the registers of an embedded system, 2) to identify indicators of electromagnetic interference, and 3) to use this information to determine the root cause of system-level failures. I will be working with Dr. Sahra Sedigh Sarvestani, Dr. Chulsoon Hwang, and Joel Schott. We will be building on an earlier project on software-based analysis of the immunity of embedded systems, which originated with funding from Samsung and Intellispeak, and continued in collaboration with Ford. It was interrupted when Ford suspended their University Research Program early in the pandemic. My role will be to restart the work in preparation for collaboration with industry. I will be troubleshooting and refining the code base, carrying out fault injection experiments using hardware, and refining the machine learning algorithms used for detection and classification of interference.

POSTER NO. 28

Poly-ε-caprolactone Nanoparticles to Remove Endotoxins

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MENTOR'S DEPARTMENT
Chemical Engineering

Lipopolysaccharides (LPS), also known as endotoxins, are toxins released from the cell walls of gram-negative bacteria upon their death. Ingestion of LPS by humans or animals can initiate inflammatory immune responses, resulting in blood vessels dilation, organ dysfunction and potential death. These toxins contaminate a variety of manufacturing processes from the pharmaceutical industry to animal feed production, posing a risk to humans and animals alike. Poly-ε-caprolactone (PCL) nanoparticles have shown potential for efficient and cost effective removal of LPS, however limited research has been performed on this matter. This study investigates a novel production method for PCL nanoparticles and their ability to remove LPS from water. The outcomes of this research hold significant implications for industries reliant on bacterial cultures and biological material, offering an inexpensive potential solution to mitigate LPS contamination.

POSTER NO. 29

Modeling Climate Resilience of Rural Phelps County, Missouri

GUY TIMBROOK

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FACULTY MENTOR
Daniel Oerther

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Environmental Engineering

Previously, Dr. Zach Miller (et. al) accessed decision-makers perspectives on the programs and policies aiding rural Missouri in climate resilience. Currently, I propose to verify if the prior results for the state-level leaders are consistent with the results collected from local leaders. Using the same interview guide, I propose to meet with a sample of local leaders located in or around Phelps County, Missouri.

UMSL

POSTER NO. 30

Healthy Eating at Project Compassion

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Nursing

Project Compassion is a NFP organization that provides resources for single mothers. Through our interaction with them, we learned that the majority of meals they eat come from fast food restaurants. Our project was designed to encourage the preparation of home cooked meals. Our goal was to minimize the risk factors associated with hypertension (HTN), coronary artery disease (CAD), and diabetes mellitus (DM), by incorporating healthy substitutions that are sustainable.

UMSL

POSTER NO. 31

Jefferson Barracks Post Theater: A Place for People to Gather

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FACULTY MENTOR
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MENTOR'S DEPARTMENT
Pierre Laclede Honors College

The Jefferson Barracks Military Post had a rich and extensive history during its 120 years as an active military installation. The Post Theater was just one aspect of everyday life at Jefferson Barracks. This project is part of a collection of historic research blogs about Jefferson Barracks done in collaboration with St. Louis County Parks. The blogs will soon be available to view on the Jefferson Barracks County Park website.

The story of the Jefferson Barracks Post Theater begins with the Old Post Theater, which was built during World War I. From 1933 to 1944, four more post theaters were built at Jefferson Barracks. They showed the latest Hollywood movies in addition to instructional military films. Soldiers and their families living at Jefferson Barracks often invited guests over for dinner and a show at the Post Theater. Numerous events and celebrations were held at the Post Theater over the years. The Post Theater ceased operations after Jefferson Barracks was decommissioned in 1946. A few years later, the Archdiocese of St. Louis purchased the Post Theater and converted it into a church for the parish of St. Bernadette. The Post Theater building remained in continual use for over 70 years, until St. Mark Catholic Church absorbed St. Bernadette in August of 2023. Currently the former Post Theater building is used once a week for mass, but its future remains uncertain.

UMSL

POSTER NO. 32

Harmony in the Glades: Analysis of a Small Predator Location Survey

JESSE LASETER

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co-author, poster no. 32

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House District 71

MAJOR
Biology

FACULTY MENTOR
Aimee Dunlap

MENTOR'S DEPARTMENT
Biology

Small predators, despite their size, play pivotal roles in ecosystem balance. Primarily, through their predation of herbivores, they indirectly benefit native plant communities. By reducing the damage from herbivory, herbaceous plants have a higher likelihood to thrive and proliferate. This is crucial in the restoration of Missouri glades. However, for small predators to achieve this, they rely heavily on their ability to navigate through their environment. One factor that may influence their ability to traverse their environment is recreational trails. Trails can cause habitat fragmentation by disconnecting one larger area into two. Trails also have significantly different microclimate than the surrounding glade, and little ground cover to protect from aerial predators, possibly deterring small animals from crossing. Our hypothesis posits that by looking at the locations of the herpetofauna and tarantulas found in Missouri glades, in comparison to nearby walking trails, we will see evidence that they may be avoiding such areas.

UMSL

POSTER NO. 32

Harmony in the Glades: Analysis of a Small Predator Location Survey

ZACHARY PFEIFFER

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co-author, poster no. 32

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House District 72

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FACULTY MENTOR
Aimee Dunlap

MENTOR'S DEPARTMENT
Blology

Small predators, despite their size, play pivotal roles in ecosystem balance. Primarily, through their predation of herbivores, they indirectly benefit native plant communities. By reducing the damage from herbivory, herbaceous plants have a higher likelihood to thrive and proliferate. This is crucial in the restoration of Missouri glades. However, for small predators to achieve this, they rely heavily on their ability to navigate through their environment. One factor that may influence their ability to traverse their environment is recreational trails. Trails can cause habitat fragmentation by disconnecting one larger area into two. Trails also have significantly different microclimate than the surrounding glade, and little ground cover to protect from aerial predators, possibly deterring small animals from crossing. Our hypothesis posits that by looking at the locations of the herpetofauna and tarantulas found in Missouri glades, in comparison to nearby walking trails, we will see evidence that they may be avoiding such areas.

UMSL

POSTER NO. 33

Deconstructing Diagnostic Criteria for ADHD

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Electrical and Computer Engineering

Attention deficit hyperactivity disorder (ADHD) is a highly prevalent disorder across development. Early detection is a critical first step to early intervention but the average age of diagnosis is 7. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, (DSM-5) includes 18 symptoms for ADHD. The purpose of this project is to determine how these 18 symptoms individually map onto effortful control, surgency, and negative affect (measured via the Child Behavior Questionnaire) in 3-6 year olds. A better understanding of how ADHD symptoms manifest in this age range has the potential to move the average age of diagnosis and help connect children with resources earlier.

UMSL

POSTER NO. 34

Investigating the Impact of Edaphobacter aggregans (WBG-1) on Arabidopsis thaliana Development

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Acidobacteria is a phylum of bacteria that make up 50% of soil microbes. While making up a large proportion of bacteria found in soil, this phylum is largely unexplored with limited information about the bacteria and their impact on plant growth. The selected target of this study is Edaphobacter aggregans, WBG-1, which is a part of a subdivision of acidobacteria. Examining the bacteria's effects on the development of the model plant Arabidopsis thaliana will provide insight into understanding this unknown phylum of soil-dwelling bacteria. Acidobacteria are an important realm to investigate as they affect agriculture practices. With Missouri being such a hotspot of farming, it is important to know the function of what is in our soil.

UMSL

POSTER NO. 35

Effects of Written and Screen-Based Media on Infant Attentional Control

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The present study investigated how exposure to both television and book media impact infant executive function, as assessed through attentional control. Specifically, eye-tracking was used to examine infants' average fixation duration as an index of how efficiently they divide their attention in a visual scene. A sample of 3.5-month-old infants (N = 44) participated in a social cognition eye-tracking study, where they viewed static images of human bodies. Results indicated the more hours per week parents reported reading to their infants, the stronger attentional control infants demonstrated (lower fixation durations). The number of hours infants were reported to watch television per week, however, did not predict attentional control. The current study suggests being read to may promote executive function in infants as young as 3.5 months, providing further evidence parents should read to their infants early and often, and suggesting reading time may be a useful target for intervention and prevention studies aimed to promote robust cognitive development. Additional implications and future directions are discussed.

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