



University of Missouri System

# Undergraduate Research Day

Jefferson City, Missouri  
April 5, 2018







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.

Undergraduate Research Day at our state's 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 for 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  
President

MISSOURI



**St. Peters, Missouri**

**Senate District 23  
House District 104**

**Major**  
Mathematics & Physics

**Faculty Mentor**  
Kattesh Katti

**Mentor's Department**  
Special Education

**Funding Source**  
NSF Research  
Experience for  
Undergraduates

*Poster Number 39*

## **The Development of Berry Extract Gold Nanoparticles towards Treating Cancer**

Prostate and breast cancer are the most diagnosed forms of cancer, making up approximately 20% of cancers for men, and 30% of cancers for women, annually. Pancreatic cancer, one of the most aggressive cancers, kills approximately 80% of those diagnosed. Available treatments present toxicity issues due to use of hazardous substituents in drug development; it is paramount to develop cost-effective treatment modalities with minimal side-effects to patients. Nanotechnology provides a new platform for cancer treatment.

This study investigated the utilization of green-nanotechnology as a means to treat prostate, breast, and pancreatic cancer cells. Three species of gold nanoparticles (AuNPs) were synthesized using gum arabic as a stabilizing agent (FDA approved), and acai-berry (AB), cranberry (CB), and elderberry (EB) extracts, facilitated by the berries' chemical compounds (phytochemicals). The nanoparticles were characterized by their sizes and charges to ensure successful synthesis. Utilizing both single and triple phytochemical concentrations, cellular *in vitro* studies were carried against the cancer cells to examine the nanoparticles' cytotoxic efficacy.

The average size for the all species of nanoparticles were below 200 nm, while the charges were negative, indicating desirable size and stability. After immersion in various biological fluids for one week, the nanoparticles demonstrated stability. Toxicity analyses show favorable effects on the prostate, breast, and pancreatic cancer cells, reducing proliferation after two days of treatment by approximately 30%, 40%, and 50%, respectively. These nanoparticles provide new opportunities for cancer treatment, as they are both cost-effective and environmentally friendly, and exhibit *in vitro* toxicity towards cancer cells.



# Carson Broecker

## **Determining the Genetic Mechanism Responsible for Specific Amino Acid Levels in Seeds**

Staple crop species such as maize, rice, and wheat account for over half of the total calorie intake of the world's population, with many areas relying solely on one crop for nutrition. As the global climate continues to warm, the climate community warns of increased drought, heat waves, and extreme local weather phenomena, especially as it pertains to food security. Areas that are already arid and hot will become more so, while areas prone to flooding will see more intense and frequent rainfall; both scenarios are devastating when it comes to crop production. The largest effects of climate change will be seen in areas close to the equator, where lack of food is already rife in society. Concurrent widespread crop failure in the two largest agricultural producers in the world, the United States and China, would result in hundreds of billions of dollars' worth in economic loss, widespread global famine, possible government destabilization, and violent uprisings in vulnerable areas along the equator.

Therefore, it is prescient that we work towards developing crop species that can withstand detrimental environmental effects such as drought and flooding. Previous scientific research has found that the free amino acid proline, when applied exogenously in moderate amounts, has increased the resilience of crops to environmental stressors such as heat, drought, and excess water. To this end, my project focuses on how to make plant seeds contain higher levels of the free amino acid proline endogenously by perturbing the plant's genome. My project methods include knocking out the gene known as MAM1 in the model plant system of *Arabidopsis thaliana* to see the resulting impact on free amino acid content in seeds.



**Portage des Sioux,  
Missouri**

**Senate District 23  
House District 65**

**Major**  
Biochemistry

**Faculty Mentor**  
Ruthie Angelovici

**Mentor's Department**  
Biological Sciences

**Funding Source**  
Missouri EPSCoR

*Poster Number 14*



**Kansas City, Missouri**

**Senate District 34  
House District 14**

**Major**  
Biological Sciences

**Faculty Mentor**  
Aaron Stoker

**Mentor's Department**  
Orthopaedic Surgery

## **Evaluation of a Natural Alternative to Alleviate Symptoms of Osteoarthritis**

Osteoarthritis is a painful and debilitating disease that many people across the globe suffer from, with currently no known cure. Cosamin® ASU is an over the counter drug commonly used by patients to alleviate of symptoms of osteoarthritis. The purpose of this study was to determine the underlying biological mechanisms of how this drug works to decrease pain experienced by patients. Discovering a drug that can ease the pain and other symptoms that these patients experience would greatly improve their quality of life.

In this study, we used tissue normally discarded after total knee replacement surgery that was obtained from 6 different patients. Cartilage explants were harvested from the tissue, and each explant was cut in half. One half was cultured with either a higher dose ( $0.1\mu\text{g/ml}$ ) or a lower dose ( $0.01\mu\text{g/ml}$ ) of Cosamin® ASU, while the other was used as the untreated control. Twenty-four plugs per patient were cultured for 21 days, and on day 21 tissues were assessed for biological indicators of degradation and inflammation. We found that Cosamin® ASU treated cartilage had significantly lower amounts of degradation and inflammation compared to untreated cartilage. Therefore, Cosamin® ASU can counteract known inflammatory and degradative changes associated with osteoarthritis at clinically relevant concentrations in an in vitro model. Delineation of these mechanisms of action provide evidence to explain the symptomatic benefits reported for Cosamin® ASU as a nutraceutical therapy in patients with osteoarthritis.



## Does Learning a Second Language Change Your First Language?

The native language (L1), is susceptible to change in early stages of second language (L2) learning. Across language domains (Chang, 2012; 2013; Marian et al., 2003; Nosarti et al., 2010), changes to L1 performance are characterized by decreases in L1 performance and reduced sensitivity to certain L1 features. L1 instability is evident in the retrieval of L1 phonology (Chang, 2012; 2013; Levy et al., 2007). Previously, we found that people with poorer cognitive resources (i.e. poor working memory) demonstrate decreases in their ability to name things in English because of its similarity in spelling of the L2 word (i.e. they pronounce piano (a cognate) according to Spanish phonology when they're supposed to be using English phonology). On the other hand, people with better cognitive resources do not show this effect until later in the L2 learning process. Through Event Related Potentials (ERPs), which are the measured brain responses that are the direct result of a specific event in the brain, we evaluate when in the course of L1 word recognition does this occur as a function of L2 proficiency. ERPs can detect differences in language processing that are not visible in behavioral performance (Bice & Kroll, 2015; Tanner et al., 2013). We tested a group of Spanish classroom learners who varied on L2 proficiency. Participants completed a word naming task with L1-English words that varied in spelling-sound regularity/consistency (how a word is produced according to the English spelling and sound system) and lexical frequency (how often a certain word is used). Preliminary behavioral results show that if the word is used frequently and its spelling is consistent with how it is pronounced, then the word will be produced correctly.



**Flossmoor, Missouri**

**Senate District 19  
House District 47**

### **Major**

Communication Sciences  
and Disorders & Spanish

### **Faculty Mentor**

Roxana Botezatu

### **Mentor's Department**

Communication Sciences  
and Disorders

### **Funding Source**

Catalyst

*Poster Number 18*



**St. Charles, Missouri**

**Senate District 23  
House District 105**

**Major**  
Biological Sciences

**Faculty Mentor**  
Stefan Sarafianos

**Mentor's Department**  
Biochemistry

**Funding Source**  
MU Honors College—  
Discovery Fellows

*Poster Number 43*

## **Discovery and Optimization of Hepatitis B Virus Antivirals that Target Virus Assembly**

More than 250 million people worldwide are chronically infected with hepatitis B virus (HBV) which leads to around 800,000 annual deaths from resulting liver-related illness. There is a vaccine available for HBV, but it has varying protection against different forms of the virus, and it does not protect those who are already infected. For infected individuals, there is only one class of virus-targeting drugs, but these drugs do not fully eliminate the virus from the body; therefore, lifelong treatment is necessary. Drugs that boost the immune system are also used for treatment, but they are less effective than optimal and cause severe side effects. Thus, treatments with new mechanisms of action are desired for HBV therapies.

We as well as others have predicted that compounds targeting assembly of the virus will lead to viral eradication in infected individuals in a number of different ways. Using multiple tests, the Sarafianos laboratory at University of Missouri- Columbia identified novel HBV antivirals that act by preventing proper virus formation. Optimization of these compounds through multiple rounds of medicinal chemistry has led to highly potent inhibitors of HBV replication. We have found that although the compounds have the same viral target, they inhibit replication in different ways, suggesting they could be used in combination therapy to reduce virus-acquired drug resistance. Our studies have led to the discovery of potent antivirals and provide insights into new strategies for HBV eradication





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**Liberty, Missouri**

**Senate District 29  
House District 159**

### **Major**

Communication Sciences  
and Disorders & Spanish

### **Faculty Mentor**

Roxana Botezatu

### **Mentor's Department**

Communication Sciences  
and Disorders

### **Funding Source**

Catalyst

*Poster Number 18*



## Using Hormones to Control Invasive Species of Crayfish

Freshwater Crayfish are crustaceans that live in waterways. They serve as a major food source to many native wildlife and keep our waterways clear by foraging for dead organisms. They are also popular bait for use in sport fishing (over \$2 billion generated annually in Missouri). Missouri is home to 35 species of crayfish, and 8 of these species are found only within Missouri borders. Unfortunately, over 30 crayfish invasions of Missouri rivers have been documented during the years 1998-2014, and this is likely a conservative number (DiStefano 2015). This occurs when a non-native species is introduced into a native population resulting in the disruption of river beds, displacement of native species, and resulting in even fewer game fish. To better control invasive species, and increase the numbers of native species, it is crucial to understand the basic behaviors of crayfish to determine how to help these populations thrive.

Crayfish form social groups (hierarchies), and dominant crayfish in these groups have greater access to resources. Competitions to prove dominance produce both a dominant (winner) and subordinate (loser) crayfish. Chemicals (pheromones) produced by crayfish affect the stability of a hierarchy. We hypothesized that exposure to dominant male pheromones would decrease the sexual responsiveness of nearby crayfish, preventing them from mating. We allowed red swamp crayfish, *Procambarus clarkii*, to establish social hierarchies while manipulating pheromones in their containers to observe changes in behavior.

Our data show that crayfish exposed to pheromones from dominant males decreases overall mating behavior, sexual responsiveness, and reproduction. The study of these pheromones will lead to a greater understanding of mating behaviors in crayfish and help Missouri Conservationists to control invasive crayfish populations, to promote native populations, and ultimately work to preserve Missouri's vast river ecosystems.

**Herculaneum, Missouri**

**Senate District 22  
House District 114**

**Major**  
Biological Sciences

**Faculty Mentor**  
Mark Kirk

**Mentor's Department**  
Biological Sciences

**Funding Source**  
Life Sciences  
Undergraduate Research  
Opportunity (LS UROP)

*Poster Number 42*



# Kania Johnson

## **Black Mothers' Affection: Effects on Relationship Quality, Mental Health, and Academic Achievement in Black Fifth Graders in Missouri**

There are many societal concerns surrounding how to improve the outcomes of poor children, especially poor black children. There are questions about whether or not the money being spent on resources are actually improving these children's lives. Such concerns led to inquiring about what role black mothers as parents play in rearing their children toward success. As well as how such parenting styles, can be transferred to inform future educators, lawmakers, and community organizations.

Research shows that authoritative parenting (medium control, high warmth) is better than authoritarian parenting (high control, low warmth) in White families (e.g., Steinberg et al., 1991). However this not consistently true in Black families. (e.g., Dornbusch et al., 1987; Steinberg et al, 1994). High control along with high warmth has been linked to good outcomes, including academic achievement, in Black families (e.g., Dornbusch et al., 1987; Steinberg, 1994). There is literature also showing that most Black mothers value their children's education and encourage them to do well in school (Robinson & Werblow 2012).

This leads to questions about how Black mothers convey affection when they talk to their children about education, how this parenting strategy may affect the child behaviorally and psychologically, and whether affection has links to children's academic achievement. The results of this question could lead to improved parenting strategies, and stronger parents' leads to more successful children.



**Minneapolis, Minnesota**  
*residing in Columbia, Missouri*

**Senate District 19**  
**House District 47**

**Major**  
Educational Studies

**Faculty Mentor**  
Jean Ispa

**Mentor's Department**  
Human Development  
and Family Science

*Poster Number 6*



**St. Louis, Missouri**

**Senate District 1  
House District 91**

**Major**  
Biological Engineering

**Faculty Mentor**  
Gang Yao

**Mentor's Department**  
Bioengineering

*Poster Number 22*

## **Pupillary Light Reflex in Infants: A potential earlier objective screening for Autism?**

Autism spectrum disorders (ASDs) are neurodevelopmental disorders that affect 1 in 45 children (National Health Statistics Reports 2015). Currently, the only way to diagnose a child with ASD is to evaluate their behavior by specially trained doctors. Although ASD can be diagnosed at age 2, most children receive diagnosis at 4 years or older (autismspeaks.org). There is a need for a better test to screen and diagnose children at a younger age so that they could be treated earlier.

Pupillary light reflexes (PLR) describes the involuntary and nearly instantaneous pupil size change as a response to the intensity of light that falls on the retina in the back of the eye. Atypical PLR was previously observed in children 2 years and older who have been diagnosed with an ASD. We are currently testing PLR in two groups of infants of 6-24 months. The 'high risk' (HR) group includes infants with one or more siblings diagnosed with autism; whereas the 'low risk' (LR) group includes infants not associated with autism in the family history. The participants' PLR is tested every 6 months until the age of 24 months. A remote PLR measuring device is used to capture images of the participant's pupil while they are attracted by a video shown on a screen. The resulting images of the PLR are converted using imaging processing software which extracts the pupil size over the time. Then the measurements are quantified by using several parameters to describe the amount and timing of the pupil size change and the baseline pupil size. While we are currently still gathering subjects and data, we hypothesize that the data will provide further evidence that PLR can be used as an earlier objective screening for risk of autism in infants.



## The Impact of Social and Communication Skill Instruction on Bullying Involvement

Bullying has become a pervasive problem among school aged-youth. According to recent data from the United States Department of Education, approximately 1 in 5 students report being victimized within American schools. Two of the most common predictors among youth that experience prolonged victimization are social and communication skills deficits. Therefore, it's critical to examine the relationship between social skills instruction and youth who have been identified with low social skills.

The current study highlights data and outcomes from a larger project that is a collaboration from the Mizzou Ed Bully Prevention Lab, Boone County Mental Health Coalition, and 9 partner elementary schools. Schools used a teacher-reported behavior checklist to identify students who may be at-risk for bullying involvement due to low social or communication skills. Additionally, teachers and students completed a pre/post survey related to skill development and bullying involvement. Overall, 439 students in grades K-5 were involved in the study, where they received eight weeks of targeted, small group instruction in response skills related to bullying scenarios presented through an interactive curriculum called *Cool School*. Based on pre/post analyses, teachers reported significant increases in prosocial behaviors, emotion regulation, and academic competence; where students reported significant increases in prosocial behaviors, academic self-efficacy, and decreases in victimization. This study demonstrates that targeted, skill-based instruction can increase prosocial behaviors and academic outcomes, while decreasing victimization. Therefore, educational stakeholders should begin to emphasize the importance of social and emotional learning as a critical component of students' daily curriculum.



**Adrian, Missouri**

**Senate District 31  
House District 56**

**Major**  
Special Education

**Faculty Mentor**  
Chad Rose

**Mentor's Department**  
Education

*Poster Number 45*

## A Test for Elemental Impurities in Pharmaceuticals



**St. Louis, Missouri**

**Senate District 15  
House District 100**

**Major**  
Biochemistry

**Faculty Mentor**  
Christopher Lee

**Mentor's Department**  
Biochemistry

**Funding Source**  
EAG Laboratories, MU  
Department of  
Biochemistry

*Poster Number 2*

Last summer, I participated in an internship program through MU Department of Biochemistry and EAG laboratories. I worked on a project developing a method to detect Elemental Impurities—trace metals (like Lead, Arsenic, and Cadmium) in pharmaceuticals. Believe it or not, Elemental Impurities are a common problem in the drug development process; excessive levels of heavy metals can pose threats to the drug's safety and efficacy. In recent years, regulatory bodies like the FDA and USP have strengthened their testing requirements. Through my work at EAG, I had the chance to participate in the drug development pipeline, working to make safer, purer pharmaceuticals.

Elemental Impurities testing is performed using an Instrument called a Mass Spectrometer, which is used to detect trace amounts of periodic table elements. To establish the method used was appropriate, we performed a method validation, demonstrating method Specificity, Detectability, and Precision.



## **Improving the Safety of Supplemental Oxygen for Premature Infants Using Automatic Control**

Infants born prior to 32 weeks' gestation and/or weighing less than 1500 grams at birth often require supplemental oxygen after birth. The ideal arterial oxygen saturation level (SpO<sub>2</sub>) of the infant lies between 87 and 93 percent saturation for the population of infants which are the focus of this research.

In a neonatal intensive care unit (NICU) setting, an infant receives supplemental oxygen (FiO<sub>2</sub>) via a nasal cannula device attached to an oxygen blender. The blender dispenses air with supplemental oxygen ranging from 21 percent of air to 100 percent oxygen. Nurses manually adjust the oxygen blender to keep the infant's SpO<sub>2</sub> level within the desired range.

Despite efforts to improve the effectiveness of manual FiO<sub>2</sub> adjustment, infants' SpO<sub>2</sub> levels may exist in the safe range for only 35 percent of the time with manual care. This issue has spurred efforts toward the use of automatic control in oxygen regulation of neonates.

The automatic oxygen control system receives information from a pulse oximeter and will adjust the FiO<sub>2</sub> levels based on the SpO<sub>2</sub> data. The automatic controller has been tested in several laboratory and clinical trials. Data from the trials, conducted in both automatic and manual modes, have been analyzed to compare the efficacy of automatic mode to manual mode.

In a recent clinical trial, the automatic controller performed similarly to manual control, except when conditions outside of normal operation were experienced. This is a preliminary result and the first trial in a study of 30 infants.



**Jefferson City, Missouri**

**Senate District 6  
House District 59**

**Major**  
Mechanical Engineering

**Faculty Mentor**  
Roger Fales

**Mentor's Department**  
Mechanical and  
Aerospace Engineering

**Funding Source**  
Coulter Foundation

*Poster Number 30*





**Aurora, Illinois**

*residing in Columbia, Missouri*

**Senate District 19  
House District 47**

**Major**  
Special Education

**Faculty Mentor**  
Chad Rose

**Mentor's Department**  
Special Education

*Poster Number 45*

## **The Impact of Social and Communication Skill Instruction on Bullying Involvement**

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# Muhammad Salim

## Computational Modeling of Articular Cartilage

Osteoarthritis, which causes severe pain and can decrease quality of life, is one of the most common forms of arthritis. It cannot be reversed, however, understanding how cartilage slowly degrades over time could lead to earlier diagnosis and treatment before joint replacement is necessary.

The goal of this project is to evaluate the mechanical and biological response of articular cartilage to variations in loading by performing a computational analysis using the FEBio software package.

Diarthrodial joint health is affected by the mechanical loading it must transmit, including sub- and super-physiologic loading. Initially, biomechanical testing of cadaver cartilage explants was performed and eventually compared to the computational analysis values. FEBio can accurately model required materials for articular cartilage. Specifically, a biphasic material is used to model the porous medium of the cartilage that consists of a mixture of a solid matrix and an interstitial fluid.

FEBio can be used to predict various parameters of cartilage tested under indenting stress. Using our model generated in the FEBio Suite, the characteristics of several samples were calculated, including the permeability and stiffness. Based on our results, we found that using our model generated a curve fit closer in correlation to the actual test data than if we had predicted the parameters manually.



**Columbia, Missouri**

**Senate District 19  
House District 50**

**Major**  
Biomedical Engineering

**Faculty Mentor**  
Ferris Pfeiffer

**Mentor's Department**  
Bioengineering

**Funding Source**  
Discovery Fellows

*Poster Number 10*



**Appleton City, Missouri**

**Senate District 28  
House District 125**

**Major**  
Special Education

**Faculty Mentor**  
Chad Rose

**Mentor's Department**  
Education

*Poster Number 45*

## **The Impact of Social and Communication Skills Instruction on Bullying Involvement**

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# Tessa Valleroy

## The Transformation of La Guignolée in Ste. Genevieve

When French settlers came to North America in the seventeenth century, they brought with them a rich collection of French traditions. Among these traditions is *La Guignolée*, a song originally performed on New Year's Eve as part of a begging quest where young men in a community would go house-to-house collecting donations of food and drink for the poor or a town-wide celebration. Although La Guignolée was a well-known and widely-practiced tradition in North America's French creole settlements, today it survives in a dwindling number of towns across the United States and Canada. The purpose of this research was to show how La Guignolée has persisted and changed in Ste. Genevieve, Missouri, and to provide that community with a record of its increasingly rare tradition.

To do this, I compared ethnographic data on current Ste. Genevieve residents' experiences with La Guignolée to archival data on La Guignolée practices between the eighteenth and mid-twentieth centuries. Through research on newspapers, journals, historical accounts, and works concerning Ste. Genevieve and La Guignolée, I created a timeline of changes in La Guignolée practices and French creole culture in Ste. Genevieve between the town's establishment and the mid-twentieth century. Data collected from semi-structured interviews with members of the Ste. Genevieve community on their experiences with La Guignolée then provided a model for how La Guignolée has changed in the last half century. Comparing this data through qualitative analysis provided a model that showed how changes in kin-related performance positions, female involvement, performer demographic, performance ritual, and community support allowed this tradition to survive for over 250 years.



**Cape Girardeau, Missouri**

**Senate District 27  
House District 147**

### **Major**

Anthropology, Biological  
Sciences

### **Faculty Mentor**

Karthik Panchanathan

### **Mentor's Department**

Anthropology

### **Funding Source**

MU Honors College—  
Cherng Summer Scholars

*Poster Number 50*



**St. Louis, Missouri**

**Senate District 5  
House District 93**

**Major**  
Elementary Education

**Faculty Mentor**  
Charles Bourduin

**Mentor's Department**  
Psychological Sciences

*Poster Number 37*

## **Social-Ecological Characteristics of Juvenile Sex Offenders from Diverse Backgrounds: A mediation analysis**

Twenty percent of all sexual crimes are committed by youths (Pastore & Maguire, 2007). These crimes have multiple correlates and causes (i.e., individual, peer, family, academic) in the youth's social-ecological environment (Ronis & Borduin, 2007). Little attention had been given to whether the correlates and causes differ by youths' racial and ethnic backgrounds, and the mechanisms underlying such differences have not been examined. The present study evaluated (a) differences between African American, Hispanic/Latino, and White juvenile sexual offenders on key individual and social-ecological characteristics and (b) mediators of these variables.

Males aged 11-17 years ( $N = 124$ ) with adjudicated sexual offenses and their caregivers completed measures that assessed (a) deviant sexual interests, (b) family functioning (c) parenting practices (d) school performance and (e) deviant peer associations. Between-groups differences were evaluated using ANOVA and then pairwise comparisons. Then, bootstrapping with confidence intervals was used to detect mediators for differences.

Youths did not differ for family warmth, parenting practices, or deviant peer associations. However, Latino youths reported fewer deviant sexual interests than African American or White youths. African American youths had significantly higher grades than Latino youths, and White youths had significantly higher levels of adaptability than did Latino youths. These between-groups difference were mediated by deviant peer associations, parental communication, and parental discipline.

The present study indicates that there were several differences between youths on key social-ecological variables (i.e., deviant sexual interests, family adaptability, and academic performance). There were several variables (i.e., parental communication, parental discipline, association with deviant peers) that mediated differences between all youths on these social-ecological characteristics. These results suggest that racial and ethnic background may play a key role for tailoring ecological interventions for juvenile sex offenders.



## **The Impact of Social and Communication Skill Instruction on Bullying Involvement**

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**Washington, Missouri**

**Senate District 26  
House District 61**

**Major**  
Special Education

**Faculty Mentor**  
Chad Rose

**Mentor's Department**  
Education

*Poster Number 45*



**Columbia, Missouri**

**Senate District 19  
House District 47**

**Major**  
Chemistry

**Faculty Mentor**  
David Mendoza-Cozatl

**Mentor's Department**  
Plant Sciences

**Funding Source**  
NIH IMSD

*Poster Number 34*

## **Finding Regulators of OPT3 via High Throughput Screening of the OPT3 Promoter Against Transcription Factors in *Arabidopsis* *Thaliana***

One of the most common causes of malnutrition worldwide are micronutrient deficiencies, affecting roughly 1.6 billion people worldwide (WHO). One strategy to combat this is by engineering plants capable of storing more essential micronutrients in their edible tissues. In order to store more iron (Fe) in the plant tissue safely, we need to understand the process of how the plant senses, transports, and stores its Fe. One of the main regulators in the Fe uptake system in *Arabidopsis* is Oligo Peptide Transporter 3 (OPT3). In *opt3-2* the plant is unable to sense its Fe status. This impairs root to shoot signaling, resulting in roots which show a constitutive Fe deficient phenotype, while leaves show a constitutive Fe excess phenotype. By utilizing a Y1H transcription factory library on a high throughput platform we were able to screen the OPT3 promoter against 1,956 *Arabidopsis* transcription factors. We were able to identify several transcription factors of interest including MYB32 and MYB85. These genes were then found to respond faster than OPT3 and serve as the preliminary results for the screen.

## Genomic Engineering for the Analysis of Multiprotein Complexes Regulating Neural Stability

Nine neurodegenerative diseases are caused by expansion of cytosine-adenine-guanine (CAG) trinucleotide repeats in a group of seemingly unrelated genes. In the subsequent proteins, these expansions mediate disruption of protein function result in progressive degeneration of the central nervous system and, in Spinocerebellar Ataxia 7 (SCA7), the retina and macula. With no current treatments available, these diseases lead to critical loss of motor control, blindness, and death. Myself, and the rest of the team at the Mohan Laboratory (<http://info.umkc.edu/mohanlab/>) are focused on advancing our knowledge of the Ataxin-7 protein, and understanding the factors that lead to the development of SCA7. These insights are applicable to the development of potential treatments, pathogenesis (the biological mechanisms behind disease), as well as oncology (cancer). To facilitate our research endeavors, we use the CRISPR/Cas9 and CRISPRi/dCas9 technology to study Non-stop, Ataxin-7, and the greater SAGA complex. Over the course of the year, we designed and prepared specific components of the CRISPR/Cas9 and CRISPRi/dCas9 systems. Subsequently, we injected wild-type fly embryos (in vivo), as well as transfected Bg3 and S2 fly brain cells (in vitro) with our CRISPR/Cas9 system in order to insert GFP tags in several relevant genes. Our analysis verified through epi-fluorescence imaging that we successfully inserted the GFP tags. These experiments have proven that we can use the CRISPR/Cas9 system to create in vivo and in vitro models for studying neural stability and potentially discovering novel neuroprotective mechanisms.



**Albuquerque,  
New Mexico**

*residing in Kansas City, Missouri*

**Senate District 31  
House District 55**

**Major**  
Biology

**Faculty Mentor**  
Ryan Mohan

**Mentor's Department**  
Biological Sciences

**Funding Source**  
University of Missouri  
Research Board &  
SUROP

*Poster Number 23*





**Kansas City, Missouri**

**Senate District 31  
House District 55**

**Major**  
Geology

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Tina Niemi

**Mentor's Department**  
Geosciences

**Funding Source**  
SUROP & SEARCH

## **Using Drone Technology and Imaging Software to Track the Locations of Boulders on the Island of San Salvador, The Bahamas and Concrete Slabs in Brush Creek, Kansas City**

Wave generated energy of tropical storms is capable of moving boulders of various sizes across shorelines and into the mainland, which shapes the development of the shore platforms in coastal regions. Relatively little is currently known about the magnitude of the waves on shorelines during tropical storms but by utilizing long-term monitoring of boulders throughout storm surge cycles we can collect valuable information which can be used to protect infrastructure and save lives. In urban areas, where above-ground water sources are kept in place by man-made means, we see a lot of similarities to the boulders being moved along shorelines. In the same way that boulders are ripped up during tropical storms, concrete slabs can be ripped up during floods and transported downstream which degrades stream stability over time. By comparing the boulder movement patterns on San Salvador due to tropical storms to the concrete slab movement of Brush Creek in Kansas City due to floods, we can create a fuller understanding of the energies in affect during these events which will help to establish more appropriate engineering practices for these environments in the future.



## Attack of bone infections: An alternative to commercial bone cements

The number of knee and hip replacement cases are growing exponentially and are projected to increase by around 170% and 670%, respectively.<sup>1</sup> Not only are the number of replacement surgeries rising, but the number of infection related complications are also expected to rise. With the number of antibiotic resistant, pathogenic microbes increasing, it is pertinent that surgeons have a large arsenal of antibiotics at their disposal. Currently, an antibiotic incorporated bone cement, known as poly(methyl methacrylate) or PMMA, is used to treat infection directly at the implant site, as systemic antibiotics have a difficult time reaching the site of infection without reaching toxic levels. However, PMMA is known to have adverse side effects such as high curing temperatures and monomer toxicity. Due to the chemical composition, only heat and chemically stable antibiotics and antifungals are able to be included into commercial bone cements, drastically reducing surgeons' options.

In order to address the many problems presented by PMMA, we have developed an alternative, silorane-based bone cement. Preliminary studies show that our bone cement cures well below body temperature and is non-toxic, while maintaining comparable mechanical strength. As a result, we expect to be able to incorporate and elute a wide variety of antibiotics and antifungals. Currently, our research is focused on optimizing the synthesis of the two components of our cement and quality control tests were performed on the products.



**Leawood, Kansas**  
*residing in Kansas City, Missouri*

**Senate District 11**  
**House District 55**

**Major**  
Biology & Chemistry

**Faculty Mentor**  
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**Mentor's Department**  
Chemistry

**Funding Source**  
SEARCH Grant

*Poster Number 3*



**Blue Springs, Missouri**

**Senate District 8**

**House District 32**

**Major**  
English

**Faculty Mentor**  
Jane Greer

**Mentor's Department**  
Women's and Gender  
Studies

**Funding Source**  
Naylor Workshop for  
Undergraduate Research  
in Writing Studies

*Poster Number 19*

## **Exploring Women's Communication with Public Figures: A Study of Angelica Schuyler Church's Letters to Founding Fathers**

America's founding fathers are remembered in large part for their written works. However, they were surrounded by intelligent, insightful women whose writing is often forgotten. One such woman was Angelica Schuyler Church, a woman of the eighteenth and early nineteenth centuries who wrote letters to Alexander Hamilton and Thomas Jefferson. This study examines some of Schuyler Church's letters and identifies three writing styles: political, flirtatious, and petitionary. She used these writing styles to navigate the social and political restrictions society imposed on women during her lifetime so that she could express her opinions without fear of backlash. While recovering women writers like Schuyler Church is critical to understanding our past, the current figuration of women in sites of public memory raises questions about how their past contributions to civic life are analyzed and interpreted in the present. To this day, Schuyler Church's letters and those of other women in the early American republic are overshadowed by the work of their male addressees. The website Founders Online (where transcribed versions of many of her letters are stored) and the musical Hamilton were analyzed as factors that contribute to public memory of Schuyler Church. This study aims to promote further research on women's letter writing in the early American republic as well as additional research on how women use the written word to interact with public figures. Moreover, it is a resource for future studies of women whose writing is overshadowed by the written works of prominent men.

## **In-Home Technology for Longitudinal Health Monitoring**

There is a recent movement to increase the use of technology in the lives of older adults with the aim of helping them age in place. Tech-enabled living could provide an attractive alternative to more costly and dependent care, as well as serve as a tool to detect early cognitive and physical impairment. The long-term goal of this project is to assess the feasibility of using in-home technology for longitudinal health monitoring.



**Kansas City, Missouri**

**Senate District 31  
House District 55**

**Major**  
Psychology

**Faculty Mentor**  
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**Mentor's Department**  
Psychology

**Funding Source**  
SUROP

*Poster Number 31*



**Independence, Missouri**

**Senate District 11  
House District 29**

**Major**  
Chemistry

**Faculty Mentor**  
Xiaolan Yao

**Mentor's Department**  
Biological Sciences

**Funding Source**  
SEARCH Grant

*Poster Number 35*

## **Investigating the Role of Jaspine B on the Function of Ceramide Transfer Protein**

In the United States, more people are diagnosed with skin cancer (melanoma) each year than all other cancers combined. Previous studies have shown that human melanoma cells with low levels of ceramide are more resistant to induced cell death. Ceramide is a waxy molecule that is important in maintaining the cell membrane and regulating important cellular processes. Ceramide is trafficked from one part of the cell to another with a protein called CERT, or ceramide transfer protein. Understanding how CERT functions could not only apply to melanoma cells but could also potentially help combat several pathogens such as the Hepatitis C virus and Chlamydia that have been shown to hijack CERT to use the lipids for their own replication.

In this study, we are currently working to characterize a compound isolated from marine sponge, Jaspine B, that could potentially inhibit CERT. Inhibition of CERT function could lead to elevations in ceramide levels that could promote death in cancer cell lines, and possibly be used as chemotherapeutic agents for cutaneous melanoma, one of the most aggressive forms of skin cancer. Biochemical transfer assays and crystal structures will allow us to further understand how Jaspine B inhibits CERT. Through this research, we can gain a better understanding of the structure and functions of CERT and could perhaps lead to applications for medical treatment in the future.

## Effect of Water to Cement Ratio on Pervious Concrete Performance

Pervious concrete is a type of hardened concrete designed with about 20 percent to 30 percent void space to allow water to soak through and infiltrate the ground. While pervious concrete is not uncommon, some of the basic relationships needed for proper design are still unknown. Ideally, the cementitious paste fully coats the coarse aggregate without draining off. Using a high water to cement ratio reduces the viscosity of the paste and causes the paste to flow down and fill the voids at the bottom of the concrete with an impermeable layer. A balance must be achieved between having enough water to allow good mixing and prevent balling in the mixer while not draining down. There is currently no literature that discusses the different water to cement effects on pervious concrete. My hypothesis is that if void content and workability are controlled, then an optimum water to cement ratio could be developed.

The void content and permeability of all samples was within the precision and bias of the selected test methods, meaning that all measured changes were a factor of the mixture proportions. The relationship between water to cement ratio and strength for pervious concrete is not linear as typical for conventional concrete.

This project consisted of mixing five batches of concrete mixes, each with different amounts of high range water reducer. There were nine cylinders made for each batch of concrete. Each mix was tested for strength, amount of void space and how much water was allowed to pass through it.



**Kansas City, Missouri**

**Senate District 9  
House District 23**

**Major**  
Civil Engineering

**Faculty Mentor**  
John Kevern

**Mentor's Department**  
Computing Engineering

**Funding Source**  
SUROP

*Poster Number 11*



**Kansas City, Missouri**

**Senate District 31  
House District 55**

**Major**  
Art History

**Faculty Mentor**  
Robert Cohon

**Mentor's Department**  
Ancient Art

**Funding Source**  
UMKC Summer  
Undergraduate Research  
Opportunity

*Poster Number 27*

## **I Mean to Do That: The Intentionality of Tool Marks on Ancient Greek Tombstones**

In in the fifth and fourth centuries BCE, Athenians erected marble stelai, slab-shaped tombstones, over their interred dead. These tombstones, typically between three and six feet high, were carved with images in relief. The depth of these reliefs ranged from a few inches to a foot or more. These images, often figural, were associated farewells between the living and the dead.

This project examines the tool marks left behind in the ancient sculpting process. While sculptors would often use a rasp, a tool covered with a series of metal teeth, and abrasive powder to smooth out tool marks, in the case of stelai, tool marks can still be seen on the surface of the stone. Stelai were left unpolished which means that many tool marks left behind by the sculptor are still visible, provided the stone is in good condition.

The author set out to determine why ancient sculptors removed some tool marks and not others. During six days of research at the Metropolitan Museum of Art, New York City, the author examined eight stelai using a combination of visual and photographic examination. This examination occurred under both the natural lighting conditions of the galleries and with a flashlight. The author also adjusted the contrast on photos taken in order to ease the identification of tool marks.

The author concluded that as the size of the stelai and intended quality of their carving increased, sculptors removed more tool marks from the stone.

## Discovery of Novel Therapeutic Targets for Disease Treatment

Cancer and neurodegenerative diseases impact millions of Americans and are only expected to rise in prevalence with an aging population. These debilitating diseases are causes of vast economic, personal, and medical burdens. In effort to eradicate these effects, we are researching a key player in cellular processes associated with these diseases, the SAGA complex.

Several subunits of this multi-protein complex are involved in processes such as DNA damage repair, cell cycle control and regulation of proteins associated with cancer including tumor suppressors and oncoproteins. Abnormalities of SAGA subunits have been observed to cause progressive loss of vision and muscle coordination. As a result, the SAGA complex is linked directly to these debilitating disease and understanding its function within the cell is imperative.

Using a model organism, we are able to investigate molecular and cellular mechanisms underlying the diseases associated with the SAGA complex. We approach the research with the knowledge that if the complex malfunctions, its interactors are impacted and their function is altered. Thus, the discovery of these interacting proteins lead to the understanding of how disruptions of parts of the complex lead to disease. Knowing the associated proteins allow us target them and restore their function in the case that the SAGA complex fails. With a better understanding of the proteins it interacts with we progress towards an ultimate goal of new therapeutic treatments and improvement of human health.



**Chillicothe, Missouri**

**Senate District 21  
House District 7**

**Major**  
Biotechnology

**Faculty Mentor**  
Ryan Mohan

**Mentor's Department**  
Biological Sciences

*Poster Number 7*



**Kansas City, Missouri**

**Senate District 17  
House District 18**

**Major**  
Biology & Chemistry

**Faculty Mentor**  
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**Mentor's Department**  
Biological Sciences

**Funding Source**  
SUROP Grant

*Poster Number 15*

## **Expanding Applications of Green Fluorescent Protein Expression to Include Criminal Justice Reform**

Green fluorescence protein (GFP) is expressed in *Aequorea victoria*, a jellyfish species found off the Washington coast. GFP interacts with aequorin to give off light and fluoresce when exposed to ultraviolet light. GFP's non-toxicity makes it ideal for research in living cells, and the protein has been adapted for a wide variety of biological sciences applications. Here we aim to expand these applications to include GFP's use as a marker in blood samples collected for DNA testing or CODIS profile formation from incarcerated persons. In the past, EDTA, a preservative added to collected blood samples, has been used in this capacity during criminal trial proceedings in regards to the origin of blood evidence. However, EDTA is a commonly used preservative found at detectable concentrations in many household items, such as cleaners, cosmetics, and even food products. This makes its usefulness as an identifiable blood marker fairly limited, as its presence cannot offer a determination on the origin of a blood sample. GFP does not naturally occur in vertebrates, is not used as additive of any kind, and is easily detected, making it an ideal candidate for a blood marker. *E. coli* bacterial cells were engineered to express GFP, which was then purified and introduced into bovine serum at different concentration levels. The serum samples were run on an ELISA and GFP was successfully detected at all concentrations, even those at half the lower detection limit. These results are encouraging and demonstrate GFP's potential as an identifiable blood marker.



## **Interchangeable Pollutant Detection in Arabidopsis**

Harmful contaminants can accumulate in soil and groundwater and may accrue in plants that are exposed to the contaminated media. In many cases, testing plants or media for specific contaminants may require specialized lab equipment. Further, significant experience and knowledge are likely required to operate lab equipment and carry out the needed tests. These tests can be time consuming and are only immediately useful to a small, specialized group of people. Contaminants may instead be detected by observable changes that occur in organisms when a specific substance is present. Biosensing techniques can be developed into viable methods of detection that are more expedient than running a battery of tests on samples, and may be quite applicable across many disciplines. This pathway is conserved in plants, hence the project's focus on biosensing in *Arabidopsis thaliana*. In the presence of the common groundwater pollutant trichloroethylene, the *Arabidopsis* produces degreening proteins which degrade and prevent production of chlorophyll. The result is an obvious color change. This biosensing technique is expedient for a number of reasons. It can be applied in many circumstances, and can be easily adapted to fit a variety of needs. Any site that monitors water, soil, and/or effluent waste may make use of such methods. Additionally, it does not require an extensive background in life sciences to understand the meaning of color changes, and does not rely on specialized personnel to run time-consuming tests.



**St. Louis, Missouri**

**Senate District 4  
House District 80**

**Major**  
Biological Sciences

**Faculty Mentor**  
David Westenberg

**Mentor's Department**  
Biological Sciences

**Funding Source**  
Student activity Finance  
Board

*Poster Number 1*



**Festus, Missouri**

**Senate District 3  
House District 115**

**Major**

Information Science and  
Technology

**Faculty Mentor**

Fiona Nah

**Mentor's Department**

Business and  
Information Technology

## **The Impact of Monetary Gains and Losses on Cybersecurity Behavior**

This research examines users' computer security risk-taking behavior when presented with the possibility of monetary value gains and losses for their action. Since personal finance is easy to identify with, we believe that this research will help to increase our understanding on the risk-taking behavior of users in an information security context. While technology may provide protection from harmful programs or viruses on a device, how a user interacts with the system, such as disabling a firewall, may open holes in the system that could ultimately cause harm to the device or risk the privacy of the user. The specific research question is: "Are users more willing to take greater risks in a cybersecurity context when gains and losses of monetary value for their risky behavior are involved?" Based on Prospect Theory, we hypothesize that users are more willing to engage in risky computer security actions when presented with the possibility of receiving a monetary value gain or avoiding a monetary value loss, but they are more likely to engage in risky computer security actions to avoid losing monetary value as compared to gaining monetary value. An experimental study was carried out and the preliminary results will be presented.

## **Simultaneous Determination of Amino Acid derivatives in Urine by Capillary Electrophoresis for Breast Cancer Risk Screening**

Metabolomics studies have revealed aberrant amino acid metabolism in breast cancer cell models that have been supported by recent findings of altered levels of amino acid derivatives in the urine of women diagnosed with breast cancer. A method for separating and quantifying the proposed amino acid panel by the use of capillary electrophoresis has been validated using spiked recovery analyses to determine method accuracy and reproducibility, and linear regression analyses to determine method detection limits, linearity, and linear range. Finally, the validated method was applied to the characterization of 150 urine samples collected from women with newly diagnosed breast cancer and healthy controls. In summary, this method has the potential to be used to support targeted studies of amino acid derivatives in epidemiological populations to better understand the significance of amino acid metabolism in cancer and its application to early breast cancer detection.



**St. Charles, Missouri**

**Senate District 2  
House District 108**

**Major**  
Biochemistry

**Faculty Mentor**  
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**Mentor's Department**  
Chemistry

**Funding Source**  
OURE Program

*Poster Number 47*



**Wentzville, Missouri**

**Senate District 23  
House District 105**

**Major**  
Ceramic Engineering

**Faculty Mentor**  
Richard Brow

**Mentor's Department**  
Materials Science and  
Engineering

**Funding Source**  
US DOE, SBIR/STTR

## **Dissolution Behavior of Na-Mo-Fe-P Glasses**

Missouri's only nuclear power plant, Callaway Energy Center, has been operating since 1984, and since that time has produced about 1,800 used fuel assemblies that are stored in a pool inside the plant. The capacity of the pool is 2,300 assemblies, so a new storage solution is necessary to contain the spent fuel. In 2015, Ameren began transferring the rods into dry casks for a more permanent storage solution. However, it still requires the use of the pool to allow the rods to cool for a few years before being transferred out to the dry casks.

Alternative storage solutions to the dry cask method in the United States use a borosilicate glass (similar to Pyrex) to contain liquid high-level waste, but not all waste can be stored with this composition. This project focuses on finding a new glass to store the waste unsuitable for the borosilicate glass. This method would decrease the nuclear waste volume while meeting DOE's chemical durability requirements.

## Interchangeable Pollutant Detection in Arabidopsis

Harmful contaminants can accumulate in soil and groundwater and may accrue in plants that are exposed to the contaminated media. In many cases, testing plants or media for specific contaminants may require specialized lab equipment. Further, significant experience and knowledge are likely required to operate lab equipment and carry out the needed tests. These tests can be time consuming and are only immediately useful to a small, specialized group of people. Contaminants may instead be detected by observable changes that occur in organisms when a specific substance is present. Biosensing techniques can be developed into viable methods of detection that are more expedient than running a battery of tests on samples, and may be quite applicable across many disciplines. This pathway is conserved in plants, hence the project's focus on biosensing in *Arabidopsis thaliana*. In the presence of the common groundwater pollutant trichloroethylene, the *Arabidopsis* produces degreening proteins which degrade and prevent production of chlorophyll. The result is an obvious color change. This biosensing technique is expedient for a number of reasons. It can be applied in many circumstances, and can be easily adapted to fit a variety of needs. Any site that monitors water, soil, and/or effluent waste may make use of such methods. Additionally, it does not require an extensive background in life sciences to understand the meaning of color changes, and does not rely on specialized personnel to run time-consuming tests.



**Jefferson City, Missouri**

**Senate District 6  
House District 59**

**Major**  
Chemistry

**Faculty Mentor**  
David Westenberg

**Mentor's Department**  
Biological Sciences

**Funding Source**  
Student Activities  
Finance Board

*Poster Number 1*



**Weston, Missouri**

**Senate District 34  
House District 11**

**Major**

Petroleum Engineering,  
Economics

**Faculty Mentor**

Rickey Hendrix

**Mentor's Department**

Geosciences &  
Petroleum Engineering

## **Application of Safety Systems Management in Rigsite Operations**

This research project documents the current state of formal safety systems management applied to the drilling industry, and its application to common personnel safety issues. A literature review shows many case studies of common workplace hazards and solutions, as well as a rich body of knowledge that has been developed, however much of this research has not been applied to the workplace. Partnering with the International Association of Drilling Contractors (IADC), we have selected some industry leaders to partner with in order to help solve some of their pervasive safety problems. Applying these solutions will improve the overall safety of the drilling industry, and have a direct impact on the wellbeing of workers in industry.

*Poster Number 9*

## Role of a Laboratory Tornado Simulator in Achieving Tornado-ready Communities

To design tornado-resistant structures and achieve tornado-ready communities, it is important to properly determine the design tornadic wind loads, which in turn requires the determination of wind effects of tornadoes. Considering that in-situ measurements of wind velocity and wind effects are very challenging, if not undoable, due to the violent nature of tornadoes, a small-scale tornado simulator has been constructed in the Wind Hazard and Mitigation (WHAM) Laboratory of the Missouri University of Science and Technology (MST) to study the wind pressure on civil structures induced by tornadoes. This simulator includes a central fan that drives the air to flow upward and turning vanes that exert angular momentum on the air flow to generate a vortex. A large-scale simulator is currently in the process of being finalized for construction, allowing for a large-scale structural model to be tested in the future. By finding the pressure induced by tornadoes with different intensities, the current design standards can be improved and used to make Missouri homes and businesses safer and more resistant to the forces of nature. This research provides the unique opportunity of educating communities and engineers in the action of tornadoes on civil structures and preparing communities for future tornadoes in order to prevent property damage and life loss.



**Farmington, Missouri**

**Senate District 3  
House District 117**

**Major**  
Civil Engineering

**Faculty Mentor**  
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**Mentor's Department**  
Structural Engineering

**Funding Source**  
NSF, Structural and  
Architectural  
Engineering and  
Materials

*Poster Number 46*



**Nixa, Missouri**

**Senate District 20  
House District 139**

**Major**

Civil and Architectural  
Engineering

**Faculty Mentor**

Lesley Sneed

**Mentor's Department**

Structural Engineering

**Funding Source**

Karakoll

*Poster Number 13*

## **Compressive Behavior of Masonry Columns Confined with Fiber Reinforced Cementitious Matrix (FRCM) Composites**

Unreinforced masonry (URM) is a common type of construction in Missouri. URM buildings are vulnerable to damage from earthquakes. This study explores the effectiveness of a new type of composite material to strengthen URM columns. The composite is wrapped around the column to enhance its strength and ductility and therefore improve the safety of the building. In this study, the behavior of clay masonry columns confined by steel reinforced grout (SRG) composite with a natural hydraulic lime mortar is investigated. An experimental study was performed to understand the behavior of masonry prisms confined with varying layers of SRG jackets subjected to a monotonic concentric compressive load. The effectiveness of the confinement is studied in terms of load-bearing capacity, ultimate strain, and energy absorption with respect to unconfined, square cross-sectioned columns. The knowledge gained from this research will be disseminated in a peer reviewed journal article that provides engineers guidance for the design of these strengthening systems for the purpose of increasing a column's load-bearing capacity and ductility under certain loading conditions.



## Predictors of Freshmen Engineering Students' Report of Cheating

Unethical behavior among students is a concern within all academic disciplines, including the STEM fields. The literature describes demographic variables (e.g., gender, academic major) of students who exhibit academically dishonest behaviors (Whitley, 1998); however, studies that have investigated predictors of dishonest behavior are limited by specific samples (for example, Taiwanese graduate students; Yang, 2012). We aimed to investigate the probability of freshmen engineering students' report of cheating based upon individual predictor variables including self-perceived ethicalness (E), cheating prevalence (CP), plagiarism prevalence (PP), knowledge of consequences (KC), and how much they cared about academic integrity (C), as well as whether the participant had previous training or education about academic integrity (no training; NT).

Our goal was to procure a fitted binary logistic regression model containing significant predictors of whether a student had previously cheated. Eighty percent of students reported that they had never cheated, and 93 percent reported that they had completed previous academic integrity training. Freshmen engineering students were more likely to report not cheating with increased self-perceived ethicalness and increased perceived prevalence of plagiarism. These results could inform academic dishonesty prevention efforts aimed at challenging students' perceptions and behaviors.



**St. Louis, Missouri**

**Senate District 1  
House District 95**

**Major**  
Psychology

**Faculty Mentor**  
Amber Henslee

**Mentor's Department**  
Psychological Sciences

*Poster Number 36*



**Rolla, Missouri**

**Senate District 16**  
**House District 120**

**Major**  
Ceramic Engineering

**Faculty Mentor**  
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**Mentor's Department**  
Materials Science and  
Engineering

**Funding Source**  
Ford Motors

*Poster Number 38*

## **New Cast Steels for High Temperature Automotive Applications**

Recently, the automotive industry has seen a significant push to innovate cleaner, more efficient engines. The best way to achieve this is by downsizing, creating lighter supercharged engines capable of using less cylinders and operating with smaller displacements. Downsizing leads to a shift in the load points of the engine operating points into areas of higher efficiency and lowers losses due to friction. However, these changes result in higher exhaust temperatures, and a lower thermal inertia and surface area of the turbine housing. The steels used in engines need to be able to withstand these higher loads and temperatures for the entire service life of the vehicle. Dr. Lekakh's team is working with Ford motor company to innovate new austenitic cast steel compositions, characterized by higher creep strength, good resistance to cyclic thermal stress, and easy casting.

## **Mechanical Properties of Steel Fiber Reinforced Concrete made with Recycled Materials**

A push for increasing the lifespan and sustainability of infrastructure has led to a need for more durable, strong, and environmental friendly construction materials. A concrete mix design using recycled steel fibers from rubber tires was chosen to enhance the mechanical properties, durability, and sustainability of the concrete. Concrete mixtures with different quantities of steel and recycled fibers were examined. Compression and flexural tests were performed in order to analyze these properties and used to compare the results with the industry standard reinforced steel fibers. The results show the flexural strength and toughness of recycled fiber reinforced concrete has increased compared to reference mixtures and shows comparable results to manufactured steel fibers. It is found that the recycled fibers present an environmental friendly option to reduce tire waste in landfills and present a cheaper option than the industry used steel fibers.



**Augusta, Missouri**

**Senate District 2  
House District 42**

**Major**  
Civil Engineering

**Faculty Mentor**  
Nicolas Libre

**Mentor's Department**  
Civil, Architectural, and  
Environmental  
Engineering

*Poster Number 33*



**West Plains, Missouri**

**Senate District 33**  
**House District 154**

**Major**  
Civil & Architectural  
Engineering

**Faculty Mentor**  
Mohamed ElGawady

**Mentor's Department**  
Civil, Architectural, and  
Environmental  
Engineering

**Funding Source**  
Missouri Department of  
Natural Resources

*Poster Number 17*

## **Developing a Sustainable Controlled Low-Strength Material (CLSM) by Incorporating Off-Specification Fly Ash and Bottom Ash**

Coal power is 81.3% of Missouri's energy production, and 2.68 million tons of coal ash is generated each year. In 2016, the US generated 107.4 million tons of coal ash and 47 million tons were directly stockpiled in ash ponds and landfills. While the world's natural resources are being depleted, coal ash has increased from 16 million to 130 million tons between 1996 and 2014. To reduce the amount of waste generated and stockpiled, the materials industry is innovating ways to incorporate these waste materials into key building ingredients. While most previous researchers have focused on using the fly ashes that meet the ASTM specifications, only few researchers tried to utilize the off-specification fly ash and bottom ash. This research focuses on reducing coal production waste by fully replacing the cement and fine aggregate content in the controlled low-strength material (CLSM) with off-specification fly ash and bottom ash, respectively. CLSM is a flowable concrete-like material used as a compacted soil replacement for backfills, pipe encasements, and pavement bases; and its strength is limited to 1200 psi. Due to its self-leveling and self-consolidating attributes, CLSM has been a material of choice for reducing labor requirements and scheduling time. This material can reduce greenhouse gas emissions caused by cement production, reduce natural resource depletion, and reduce material disposal. By incorporating coal waste by-products, the cost for CLSM will be dramatically reduced, and the product will be more advantageous for the materials market due to its environmental, economic, and practical feasibility.

## Evaluating the Effect of Text Message Prompts on Miners' Decision Making in a Disaster

Coal mining companies use electronic personal transponders to track miners underground.

Tracking systems are useful to determine the location of personnel located within a mine site. When an emergency arises, it is imperative to locate personnel and quickly establish communication with them. Currently, information available from the sensors within the network is unavailable to the miners working underground during a disaster. If information is provided to the miner, it is uncertain if the information provided to the workers will help or hinder their decision-making process during a disaster situation.

Objective of this research is to determine if information provided to miners during an emergency will help an individual miner make safe decisions. This objective is achieved through surveys that obtain information from miners about what they will do in various circumstances. Respondents are presented with real-life scenarios of emergency and urgent situations during a mining disaster. Analysis of responses will evaluate the effect of the text messages on the respondents' choices using statistical tests (t-test or ANOVA). Research will provide response patterns for endangered workers in various emergency situations



**Portland, Oregon**  
*residing in Rolla, Missouri*

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**House District 120**

**Major**  
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Mining & Nuclear  
Engineering

*Poster Number 25*



**Rolla, Missouri**

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**House District 120**

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**Funding Source**  
Opportunities for  
Undergraduate Research  
Experience

*Poster Number 44*

## **Thunder in the East: Wehrmacht versus RKKA**

During the Second Great War, the clash of tanks dominated the Eastern Front. From the testing grounds in Spain (1936-1939), to the fields of Eastern Europe (1941-1945), Nazi Germany and the Soviet Union fought a continuous battle for tank supremacy which defined the future of armored warfare. In the Western World, we have a common view of the superiority of the German war machine during World War II. The equipment and technology of the Wehrmacht was far better than what the Allies had, and it was the numbers that overwhelmed Germany in the end. We forget that the most well-known of the German Tanks (Tiger I and Panther) were made just to stop and counter the Soviet's T-34 and KV-1. What makes the battlegrounds between these powers important is the development of their tanks before and during the Second Great War. The management of resources during invasions and management of reserves in each tank design became the key factor for both armies. In the East, the thunder of heavy tanks and large guns dominated the battlefields, in a match-up of equipment never before seen in warfare.

## Interchangeable Pollutant Detection in Arabidopsis

Harmful contaminants can accumulate in soil and groundwater and may accrue in plants that are exposed to the contaminated media. In many cases, testing plants or media for specific contaminants may require specialized lab equipment. Further, significant experience and knowledge are likely required to operate lab equipment and carry out the needed tests. These tests can be time consuming and are only immediately useful to a small, specialized group of people. Contaminants may instead be detected by observable changes that occur in organisms when a specific substance is present. Biosensing techniques can be developed into viable methods of detection that are more expedient than running a battery of tests on samples, and may be quite applicable across many disciplines. This pathway is conserved in plants, hence the project's focus on biosensing in *Arabidopsis thaliana*. In the presence of the common groundwater pollutant trichloroethylene, the *Arabidopsis* produces degreening proteins which degrade and prevent production of chlorophyll. The result is an obvious color change. This biosensing technique is expedient for a number of reasons. It can be applied in many circumstances, and can be easily adapted to fit a variety of needs. Any site that monitors water, soil, and/or effluent waste may make use of such methods. Additionally, it does not require an extensive background in life sciences to understand the meaning of color changes, and does not rely on specialized personnel to run time-consuming tests.



**Wildwood, Missouri**

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House District 110**

**Major**  
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**Funding Source**  
Student Activity Funding  
Board

*Poster Number 1*



**Chesterfield, Missouri**

**Senate District 26  
House District 100**

**Major**

Information Science &  
Technology

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**Mentor's Department**

Business and  
Information Technology

## **Neuropsychological Assessment of Fatigue Utilizing Eye-Tracking Data**

Fatigue is one of the leading causes of workplace incidents and car accidents and a rising safety issue for many industries. Many factors can be a source of fatigue, including sleep deprivation and prolonged mental and physical work. Negligence in effectively dealing with fatigue can have enormous consequences, ranging from economic loss due to a lack of productivity, to more extreme outcomes such as death. Therefore, it is essential to gain a better understanding on how to effectively detect fatigue.

The goal of this project is to isolate and determine how eye-tracking data can be used to assess fatigue in a person. Through this, we can better understand the neuropsychological signs of fatigue, and implement measures to improve safety and performance. The results of this research aim to minimize the risk of fatigue-related errors and accidents.



## **Addressing the lack of public awareness in regards to antimicrobial resistance.**

This project is part of a diplomacy lab that is targeting the issue of lack of awareness and education in regards to antimicrobial resistance. The goal of the project is to analyze current messaging tactics that are in place by organizations such as WHO (World Health Organization) and try to find why current messaging has not been successful to slow the issue. Deliverables in the form of infographics and other forms of media will be produced based upon what is found to be effective.



**Maryland Heights,  
Missouri**

**Senate District 24  
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*Poster Number 5*



**Jackson, Missouri**

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**Funding Source**  
OURE

*Poster Number 48*

## **Underwater Acoustic Communication**

Wireless underwater communication is a challenging problem that is often solved by with acoustics rather than electromagnetic waves. In the underwater environment, acoustic waves face significantly less attenuation and can travel much further distances compared to electromagnetic waves. JANUS is a recently accepted open-source standard that will enable underwater acoustic communication for military, commercial, and research applications. This new standard has been designed to account for the harsh underwater environment that introduces exaggerated multipath propagation, slow signal propagation, and power constraints. As part of this research project, a testing environment was developed in MATLAB to evaluate JANUS's performance under various conditions. A method for detecting a received JANUS transmission and a method for countering the effects of underwater multipath propagation were investigated. Finally, the results of an at-sea experiment are used to further understand the effects of the underwater environment on JANUS transmissions.

## Heavy Mineral Analysis of The Viburnum Trend, Southeast MO Lead-Zinc District

Missouri is host to one of the world's largest and highest-grade lead districts. The Viburnum trend, one subset of this district, is the only one currently being mined. Missouri University of Science and Technology conducts research on the formation of the Viburnum Trend and has used it as a case study for students interested in mining and exploration geology. During one such teaching opportunity, students observed drill core samples from the Viburnum trend under reflected light microscopes, discovering a zircon. Certain minerals can reveal a rock's history and chemical composition. Often considered the most helpful of minerals, zircon comprises of zirconium, silicon, oxygen, and numerous other elements that occasionally substitute for zirconium within the crystal structure of zircon. These less abundant elements are called trace elements, and they can help us understand the age and chemical composition of the magma where the mineral crystallized. Analysis of these trace elements is one branch of chemical fingerprinting, a cutting-edge method in exploration geology.

Finding a zircon within the rocks that host the Viburnum trend's lead, zinc, and copper deposits was unexpected. Zircon's presence within the rocks of the Viburnum trend may explain some of the trend's unique chemical characteristics, such as high copper and silver concentrations, by comparison to deposits of similar kind elsewhere. By looking for zircon and similar heavy minerals within the rocks of the Viburnum trend, a better picture of how the deposits formed will emerge, improving mineral exploration in Missouri and elsewhere.



**Lake St. Louis,  
Missouri**

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House District 108**

**Major**  
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Petroleum Engineering

*Poster Number 29*



**St. Louis, Missouri**

**Senate District 15  
House District 99**

**Major**  
Electrical Engineering

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**Mentor's Department**  
Electrical & Computer  
Engineering

*Poster Number 41*

## **Optic Fiber Sensor for Strain Measurements in High Temperature Sensing Applications**

Optic fiber sensors are employed in a variety of applications for the remote measurement of various parameters such as strain, pressure, or temperature. These sensors offer an array of benefits as well including light weight, compactness, and high resolution. In particular, Fabry-Perot interferometers (FPIs) maintain these benefits and can also be made to withstand extremely high temperatures. This advantage of the FPI allows it to be used in harsh environments where many other tools for parameter measurement could not survive. An FPI strain sensor is constructed and tested which has the capabilities to be used at high temperatures of over 1000C for applications in steel-making and structural health monitoring. This project covers the testing and construction of an FPI and discusses the need for high temperature strain sensors in infrastructural settings and this sensor's capabilities in this application.

### **Staying Silent in Response to Sexism: Is it Bad for Your Health?**

In social interactions, women are often encouraged to withhold reactions to sexism to maintain group harmony, even though this can lead to negative effects. One of those negative effects is total peripheral resistance (TPR), the resistance of blood flow throughout the body, which is associated with cardiovascular disease. The present study aims to further test the link between women's experiences of sexism, group harmony, and physiological threat. Female participants engaged in a virtual interaction with a male who had a scripted response. During the interaction the male either made a sexist comment or did not, depending on condition. Participants were told to maintain group harmony or to be their true selves. TPR was collected after the interaction was completed, during the recovery phase. Results indicated a significant difference between women in the control and threat condition when instructed to maintain group harmony. When women experienced the sexist comment, they showed more TPR during the recovery period suggesting increased cardiovascular threat, specifically for those in the harmony condition. These results indicate there are negative physiological outcomes for women in threatening environments, especially when attempting to maintain group harmony.



**O'Fallon, Missouri**

**Senate District 2  
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**Mentor's Department**  
Psychological Sciences

**Funding Source**  
UMSL Research Award,  
Office of Research  
Administration

*Poster Number 28*



**O'Fallon, Illinois**

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House District 55**

**Major**  
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**Mentor's Department**  
Psychological Sciences

**Funding Source**  
University of Missouri  
Research Board

*Poster Number 16*

## **Relationships Between Childhood Reading Experiences and Current Reading Ability**

Reading is a life skill that makes learning easier, provides enjoyment, and is often necessary for employment. However, some individuals experience challenges in reading. This can be formally assessed using questionnaires that ask about an individual's attitudes and experiences with reading during childhood. One such measure, the Adult Reading History Questionnaire, has been widely used. Our study was designed to examine whether a childhood reading challenge is an adequate predictor for reading difficulties in adulthood and whether particular groups of questions predicted adult reading ability. A total of 338 undergraduate students were recruited from University of California, Riverside and University of Missouri-St. Louis to participate in the study. Participants were asked to complete the Adult Reading History Questionnaire to gauge their difficulty in learning to read, difficulty in high school and college English classes, tendency to read recreational printed material, attitude toward school, and ability to remember information. Participants also completed several standardized measure of current reading ability. As expected, our study found a statistically significant correlation between childhood reading challenges and adult reading abilities, such that individuals who showed lower reading ability and more difficulties as children showed lower reading ability and more difficulties as adults. Specifically, our study demonstrated that scores on three particular subscales (Childhood Reading Ability, Current Reading Attitude, and Spelling Skill) were associated with adult reading skills. Our study suggests that early childhood experiences can influence adult reading proficiency. As such, early and successful intervention is important for creating a literate society.

### **Severe and repeated childhood abuse & violence: Do racial groups experience it differently?**

Complex trauma exposure has been defined as multiple or chronic interpersonal trauma that begins early in life, which leads to widespread dysregulation in many domains of functioning. Previous studies have reported that minorities may be at greater risk for trauma exposure as well as trauma-related symptoms; however, in the context of complex trauma, racial differences have not previously been investigated. The aim of the present study was to determine if there are racial disparities in children's trauma exposure and related symptoms among 167 treatment-seeking child survivors of complex trauma (3-18 years,  $M = 9.90$ ,  $SD = 3.92$ ; 61.67% female; 62.2% Black). Black children were more likely to have experienced community violence, to have been placed in child protective custody, and reported a greater number of types of traumatic events than White children. Although minority status was expected to serve as a risk factor for trauma-related symptoms, relatively few differences emerged between groups. Caregivers of White children endorsed higher levels of trauma-related difficulties such as anxiety/depression, social concerns, and internalizing symptoms. Black children self-reported higher levels of sexual concerns than White children, despite equivalent rates of sexual abuse. Thus, White children who experience complex trauma may be at higher risk for some trauma-related difficulties. Alternatively, caregivers of White children may perceive them to have, or be more willing to acknowledge, higher levels of symptoms compared to Black children. Future work is needed to further investigate the role of race in disclosure of trauma exposure and related symptoms.



**O'Fallon, Missouri**

**Senate District 2  
House District 102**

**Major**  
Psychology

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**Mentor's Department**  
Psychological Sciences

*Poster Number 20*



**St. Charles, Missouri**

**Senate District 23  
House District 105**

**Major**  
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**Mentor's Department**  
Anthropology &  
Archaeology

*Poster Number 12*

## **Rediscovering the Healing Waters of Excelsior Springs, Missouri: An Archaeological Investigation**

Beginning in 2015, the University of Missouri-St. Louis Archaeological Field School has taken place at the site of Regent Spring, a popular mineral water spring in Excelsior Springs, Missouri. There is little remaining of the wellspring and pavilion which sat on the bank of the Fishing River due to flooding and erosion. Over the course of this first ever archaeological excavation of the Regent Spring site, students at the field school were able to rediscover long forgotten features of this popular turn of the century tourist attraction and map parts of the site. This project culminates three years of work, and pieces together primary source documents to re-create the original Regent Spring pavilion site. It also highlights gaps in the record and proposes viable solutions, so the stage is set for future research. In addition, this research has given us an idea of site use and significance in the context of Excelsior Springs' story at the height of its popularity as a health retreat in the late nineteenth and early twentieth centuries.



## **Transportation technologies for the 21st century: Hydrogen storage for PEM fuel cells**

Fuel cells have a much higher energy efficiency than gasoline or diesel combustion engines, providing significant savings on transportation costs. Proton exchange membrane (PEM) fuel cells require pure hydrogen as a fuel component. The hydrogen combines with oxygen, and produces  $H_2O$  as a byproduct, making PEM fuel cells an environmentally friendly energy alternative. The storage of hydrogen requires the use of very high pressure compressed gas, or chemical storage of the hydrogen in the form of solid or liquid compounds. Our project is to discover solid compounds that store hydrogen that can be used in a PEM fuel cell. Light metals are desirable to maximize the energy content by weight, and experiments suggest that silicon-based borohydrides may be a viable candidate for hydrogen storage. Combining quantum mechanical simulations and crystal structure prediction techniques, we examined over 2,500 prototype structures for silicon-based borohydride compounds. Interestingly, the low energy structures had a tendency toward forming Si- and Al-based polymer-like chains, all with low structural symmetry. Common structural motifs included  $Al_2Cl_2$  forming a diamond shaped ring with the aluminum additionally coordinated with one or two  $BH_4$  units or a single borane, as well as  $BH_3-SiH_2Cl$  structurally similar to ammonia-borane. We found several hypothetical desorption reactions for these structures and discuss the possibility of experimentally observing them.



**Rolla, Missouri**

**Senate District 31  
House District 55**

**Major**  
Physics

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**Funding Source**  
Department of Energy &  
NASA Space Grant

*Poster Number 32*



**High Ridge, Missouri**

**Senate District 22  
House District 112**

**Major**  
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**Faculty Mentor**  
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**Mentor's Department**  
Psychology

**Funding Source**  
University of Missouri  
Research Board

*Poster Number 4*

## **I take my coffee with cream and cats: The brain's response to the unexpected**

Nationwide, approximately 20% of school-aged children struggle with reading. However, some individuals who had reading problems as children do not have reading difficulties as adults and approximately 25% of children with dyslexia will compensate for their initial difficulties with reading and attend college. Little is known about how individuals with compensated dyslexia read. This knowledge is important because it might be able to improve strategies used in reading teaching and therapeutic methods. One theory is that individuals who struggled to learn to read rely more heavily on meaningful word relationships. In this study, college students with and without self-reported history of reading difficulty completed standardized tests of reading ability and read a series of sentences that ended in expected or unexpected words. We used event-related potential data to measure the brain response to unexpected sentence endings, specifically the part of the electrical signal called the N400. Individuals with a history of reading difficulty showed smaller effects of unexpected endings in the N400 than those without a history of reading difficulties. Self-reported reading difficulty scores were strongly associated with the size of expectancy effects among the entire sample of college students. Surprisingly, students with a history of reading difficulty showed less difference between expected and unexpected sentence endings, suggesting that they are less sensitive to how well words fit in a sentence. Importantly, these results suggest that the brain markers of sentence processing differ between college students with different reading histories.

**Severe and repeated childhood abuse & violence: Do racial groups experience it differently?**

Complex trauma exposure has been defined as multiple or chronic interpersonal trauma that begins early in life, which leads to widespread dysregulation in many domains of functioning. Previous studies have reported that minorities may be at greater risk for trauma exposure as well as trauma-related symptoms; however, in the context of complex trauma, racial differences have not previously been investigated. The aim of the present study was to determine if there are racial disparities in children's trauma exposure and related symptoms among 167 treatment-seeking child survivors of complex trauma (3-18 years,  $M = 9.90$ ,  $SD = 3.92$ ; 61.67% female; 62.2% Black). Black children were more likely to have experienced community violence, to have been placed in child protective custody, and reported a greater number of types of traumatic events than White children. Although minority status was expected to serve as a risk factor for trauma-related symptoms, relatively few differences emerged between groups. Caregivers of White children endorsed higher levels of trauma-related difficulties such as anxiety/depression, social concerns, and internalizing symptoms. Black children self-reported higher levels of sexual concerns than White children, despite equivalent rates of sexual abuse. Thus, White children who experience complex trauma may be at higher risk for some trauma-related difficulties. Alternatively, caregivers of White children may perceive them to have, or be more willing to acknowledge, higher levels of symptoms compared to Black children. Future work is needed to further investigate the role of race in disclosure of trauma exposure and related symptoms.

**St. Louis, Missouri****Senate District 4  
House District 80****Major**  
Psychology**Faculty Mentor**  
Rachel Wamser-Nanney**Mentor's Department**  
Psychological Science*Poster Number 20*



**St. Louis, Missouri**

**Senate District 27  
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Evolutionary and  
Tropical Ecology

## **Lizards, Warming Climate and Body Temperature: How Hot is Too Hot?**

It is evident cold-blooded animals (ectotherms) native to equatorial environments are adapted to relatively stable temperatures, and so may be threatened with extinction by even slight increases in temperature due to in global warming. This expectation prompted my project, whose goal was to record the first year of neotropical collared lizard (*Tropidurus hispidus*) body and air temperatures for a multiyear study to examine the effects of global warming. Daylight hours were divided into experimental treatments such that four 3-hour time blocks, starting at 6:00AM and ending at 6:00PM, were created. I recorded body temperatures using an infrared thermometer on lizards with defined territories at Karanambu Lodge in the north Rupununi savannas of Guyana. Ambient air temperatures were also recorded with a digital thermometer. These data were used to test the following: if mobile ectotherms can elevate and lower body temperatures by behavioral means, then body temperatures of the lizards will significantly differ from ambient temperatures. This generated three predictions (i) body temperatures will always differ from ambient (air) temperatures, (ii) lizard temperatures will be relatively stable throughout the day, and (iii) positive correlations between ambient and body temperatures should be evident. For the most part, these predictions held true. However, because lizards maintained temperatures lower than ambient for most of the time blocks, the lizards appear to be shade seeking, consequently reducing activity time available for foraging, mate seeking, and territorial defense. Overall, my results suggest rising global temperatures could already be having serious negative effects on *T. hispidus*.

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