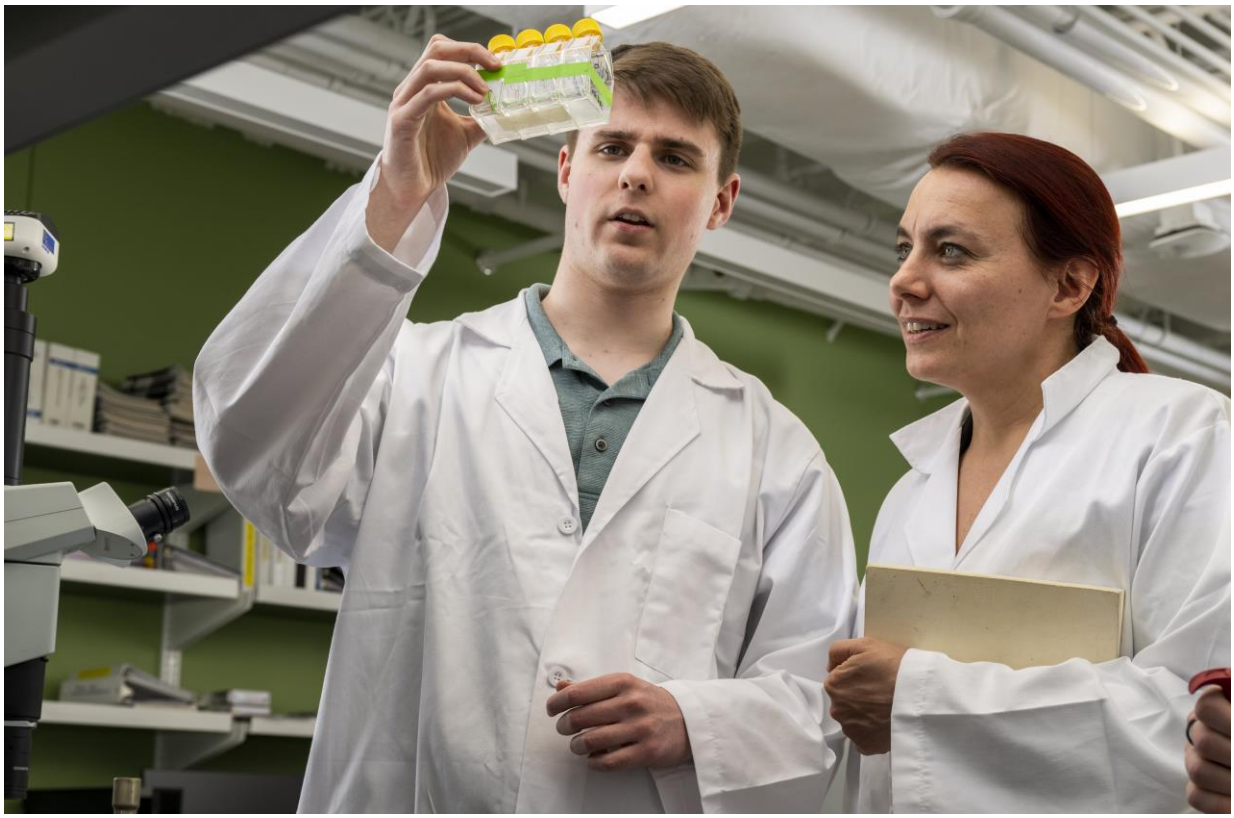
MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

19th Annual Undergraduate Research Conference



Erik Bergstrom, an undergraduate student in biological sciences, is hoping to find therapeutic strategies to counteract age-related diseases by studying the effects of different lifespans and varying reproductive rates of roundworms in both the laboratory and through simulations. This will help them understand how aging occurs in various animal populations, which could one day help with developing treatments for age-related diseases and conditions. The collaborative project is advised by Dr. Andrea Scharf, as assistant professor of biological sciences at S&T.

Erik is actively involved in undergraduate research and is a member of IGEM. During 2021/2022, he was involved in research in Dr. Melanie Mormile's lab studying dessication tolerance in halophiles. From 2022 until currently, he has participated in OURE and an OURE fellows project in Dr. Andrea Scharf's lab studying the population dynamics of C. elegans in the Scharf lab's laboratory ecosystem and in wormPOP, a simulation of that ecosystem.

A celebration of experiential learning at Missouri S&T

April 10, 2024

Innovation Forum and Havener Center

19th Annual
Undergraduate Research Conference
April 10, 2024

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19th Annual Undergraduate Research Conference

8:30am – 9:00am	**Registration** *(Upper Atrium – Havener Center)*
9:00am – 12:00pm	**Oral Sessions** **Engineering** *(Carver Room)*
9:00am – 12:00pm	**Poster Sessions** **Engineering *(section 2)* --- Sciences *(section 1)*** *(Innovation Forum – 1st Floor Innovation Lab)*
12:00pm – 1:00pm	**Welcome – Dr. Colin Potts** **Provost and Executive Vice Chancellor for Academic Affairs** **Luncheon & Guest Speaker** ***Mart Berutti*** ***will present*** "Synthetic Biology to Hallucinating AI … the Critical Role of Missouri S&T Research in a Safer, Sustainable, and Rewarding Future" *(St. Pat's A Ballroom)*
1:00pm – 4:00pm	**Oral Sessions** **Sciences** *(Carver Room)* **Social Sciences** *(Turner Room)*
1:00pm – 4:00pm	**Poster Sessions** **Arts & Humanities --- Research Proposals --- Social Sciences** **Engineering *(section 1)* --- Sciences *(section 2)*** *(Innovation Forum – 1st Floor Innovation Lab)*
3:00pm – 4:00pm	**Reception** *(St. Pat's A Ballroom)*
4:00pm – 5:00pm	**Awards Ceremony** *(St. Pat's A Ballroom)*

**Judges Conference Room – (Mark Twain)*

Guest Speaker

Mr. Mart Berutti

Alumnus

BS in Chemical Engineering ‘84

Presents

“Synthetic Biology to Hallucinating AI … the Critical Role of Missouri S&T Research in a Safer, Sustainable, and Rewarding Future”

Mr. Berutti, graduated with a Bachelor of Science in Chemical Engineering in 1984, from University of Missouri Rolla. His career in the process, process automation, and industrial software industry spans almost 40 years, including serving as President of MYNAH Technologies, VP Process Simulation, VP Sales and Marketing, Digital Transformation, VP Software Commercialization, and VP Sales Life Sciences at Emerson. He is currently leading a strategic initiative to scale-up the industrial software business for a consortium of North American companies. Mart also serves on the Academy of Chemical and Biochemical Engineers at Missouri S&T.

Mart loves to talk and write about AI, data systems, process simulation, and building high performance teams. His papers and presentations include:

- **Sophisticated Analytics Build Sustainability for Renewable Diesel Projects**, Hydrocarbon Processing, June 2022
- **Who’s Afraid of the Big Bad AI?**, Emerson Global Users Exchange, October 2022
- **Digital Transformation, People Transformation - It Begins with You**, Keynote Address, Regional Emerson Digital Transformation Seminars, June - August 2019
- **Understanding and Applying Simulation Fidelity**, July 2018
- **Leaving the Kids In Charge...**, June 16, 2016 Control Magazine
  How a high-tech company is attracting and developing the next generation of professionals.
- **Improving plant operations with life-cycle dynamic simulation**, Feb 2016, Intech Magazine

The Berutti family has deep Rolla roots. Mart met his wife Karin during her freshman year in Rolla before she transferred to University of Missouri, Kansas City, to pursue her degree of Music Performance. His two daughters are currently attending Missouri S&T, Ava a sophomore in Psychology and Leah a freshman in Education. Mart’s happy place is on a boat on Table Rock Lake so, if you call him, and he doesn’t answer, he is probably fishing.

Look him up on LinkedIn at www.linkedin.com/in/martberutti or follow him on Twitter/X at www.twitter.com/mberutti

Conference Judges

The Office of Experiential Learning wishes to thank the faculty, staff, and students for their valuable contributions to the 19th Annual Missouri S&T Undergraduate Research Conference.

Dr. Mohanad Abdulazeez of Center for Infrastructure Engineering
Dr. Md Arifuzzaman of Computer Science
Dr. Andrew Behrendt of History & Political Science
Dr. Mario Buchely of Materials Science & Engineering
Dr. Xiaosong Du of Mechanical and Aerospace Engineering
Dr. Kelvin Erickson of Electrical & Computer Engineering
Dr. Jossalyn Gale of English & Technical Communication
Dr. Michel Gueldry of Arts, Languages, and Philosophy
Dr. Halyna Hodovanets of Physics
Dr. Matt Insall of Mathematics & Statistics
Dr. Irina Ivliyeva of Arts, Languages, and Philosophy
Dr. Ashish Kumar of Mining and Explosives Engineering
Dr. Wesley Lewis of Undergraduate Education
Dr. Charmayne Lonergan of Materials Sciences and Engineering
Dr. CJ Lungstrum of Mathematics and Statistics
Dr. Suman Maity of Computer Science
Ms. Sharon Matson of Graduate Education
Dr. Gabriel Nicolosi of Engineering Management & Systems Engineering
Ms. Georgette Nicolosi of Library & Learning Resources
Dr. Smriti Nandan Paul of Mechanical & Aerospace Engineering
Mr. Mike Pleimann of Undergraduate Education
Dr. V. Prakash Reddy of Chemistry
Dr. Andrea Scharf of Biological Sciences
Dr. Davide Viganò of Mechanical & Aerospace Engineering
Mr. Roger Weaver of Library & Learning Resources

Oral Presentations

Wednesday – April 10, 2024

Engineering

Name	Department	Time	Location
Zachary Baldwin	Architectural Engineering	9:00-9:15AM	Carver Room
Allie Dingfield	Mechanical Engineering	9:15-9:30AM	Carver Room
Grace Duong	Environmental Engineering	9:30-9:45AM	Carver Room
Joshua Gary	Aerospace Engineering	9:45-10:00AM	Carver Room
Rowan Torbitzky-Lane	Computer Science	10:00-10:15AM	Carver Room
Ashton Ventura	Metallurgical Engineering	10:15-10:30AM	Carver Room
Kevin Lai Chubi Adejoh Yug Patel	Computer Science	10:30-10:45AM	Carver Room

Sciences

Name	Department	Time	Location
Megan Benkendorf	Applied Mathematics	1:00-1:15PM	Carver Room
Rosalee Brown	Chemical Engineering	1:15-1:30PM	Carver Room
Tylor Cheatham	Environmental Science	1:30-1:45PM	Carver Room
Chambre Garcia	Biological Sciences	1:45-2:00PM	Carver Room
Steven Karst	Physics	2:00-2:15PM	Carver Room
Clare Koerkenmeier	Biological Sciences	2:15-2:30PM	Carver Room
Kaitlin Miles	Chemistry	2:30-2:45PM	Carver Room
Samuel Schrader	Physics	2:45-3:00PM	Carver Room

Social Sciences

Name	Department	Time	Location
Emily Copeland	History	1:00-1:15PM	Turner Room
Jessica Frame	Psychology	1:15-1:30PM	Turner Room
Love Gami	Information Science and Technology	1:30-1:45PM	Turner Room
Daniel Stutts	Applied Mathematics	1:45-2:00PM	Turner Room

List First then Last Name

Chubi Adejoh

Joint Project with Yug Patel and Kevin Lai

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

A User-Friendly Interface for Life Cycle Simulation

SHORT ABSTRACT

Understanding the complexities of Caenorhabditis elegans (C. elegans) life cycles is important for advancing knowledge in developmental biology, genetics, and population dynamics. Our team introduces a novel software tool designed to improve the accessibility and interpretability of simulations dedicated to C. elegans population dynamics. This tool complements an existing simulator, meticulously tracking each worm's progression through key life stages such as egg, larva, adult, dauer, and death.

The software transforms simulation data into a visually intuitive representation, using a directed graph. This graph not only delineates C. elegans life cycle transitions but also dynamically adapts to illustrate population density at each stage. Node sizes reflect the number of worms in respective life stages, while directed arrows adjust proportionally to signify transition volumes between stages. Featuring a user-friendly web interface, the software caters to both tech-savvy and non-technical users. It enables multiple simulation instances, allows manipulation of run-time parameters, and provides functionality for downloading and graphically presenting simulation data. This interactive approach empowers users to explore diverse scenarios and parameters, fostering greater comprehension of C. elegans population dynamics.

SHORT BIO IN 3rd PERSON

Chubi, a senior pursuing a major in computer science, employs technological solutions to tackle biological complexities. Beyond academic pursuits, he exhibits a keen interest in investment strategies, political discussions, and participating in debates. Post-graduation, Chubi aspires to pursue a career in software engineering, with a specific emphasis on specializing in information security.

Zachary Baldwin

Department: Department of Civil, Architectural, and Environmental Engineering
Major: Architectural Engineering
Research Advisor: Dr. Nicolas Libre
Advisor Department: Department of Civil, Architectural, and Environmental Engineering

Funding Source: OURE/Dr. Nicolas Libre

Feasibility of Using Hemp Fiber Reinforcement in 3DPC

This research is aimed at investigating the feasibility of implementing natural fibers, such as hemp fibers, in lieu of synthetic fibers as sustainable and environmentally friendly resources in concrete production. In the first stage of this study, a surface treatment was applied to hemp fibers 12 mm ± 2 mm in length using a 5 wt% sodium hydroxide (NaOH) solution to determine the effect treated hemp fibers have on cementitious composites. Additionally, three cement mortars were made with different fiber ratios (0.75%, 1.5%, 3%) to determine the optimal hemp fiber content of the mortars. Concrete samples were cast also concrete filaments were printed using the custom-made 3D concrete printer. Form cast samples and printed filament samples were produced to determine the compressive, tensile, and flexural strengths as well as the shrinkage capacity, rheological properties, structural build up, extrudability, buildability, and fiber dispersion of the mortars.

Zachary is in his 5th as an undergraduate Architectural Engineering student. He came to Missouri S&T with prospects to continue his football career, but after three years decided that researching the development of eco-friendly, sustainable building materials was his true passion. Since then, he has worked tirelessly to research the feasibility of implementing hemp fibers as a more sustainable means of reinforcing 3D printable cementitious composites.

List First then Last Name

Megan Benkendorf

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mathematics and Statistics
Major: Applied Mathematics
Research Advisor: Dr. Yanzhi Zhang
Advisor Department: Mathematics and Statistics

Funding Source: OURE Fellows

SHORT PROJECT TITLE

Numerical Studies on Bose-Einstein condensates

SHORT ABSTRACT

Bose-Einstein condensate (BEC) is a state of matter near absolute zero temperature for which all atoms lose their individual properties and condense into a macroscopic coherent “super-wave”. The superfluidity of BEC has been the focus of active research since the first experimental realization of BEC in 1995. The recent launch of the Cold Atom Laboratory to the space station on May 21, 2018 has once again drawn spotlights to this fascinating properties of BEC. In this project, we will carry out numerical studies to understand the behavior of exciton-polariton BECs. A modified Gross-Pitaevskii equation is used to model the dynamics of the condensate. Numerical methods will be developed for efficiently simulating the dynamics. Numerical experiments are provided to verify the accuracy of our method and study the properties of the exciton-polariton BECs.

SHORT BIO IN 3rd PERSON

Megan Benkendorf is a junior majoring in Applied Mathematics and working on minors in computer science, physics, and music. She has enjoyed working on research projects, both at Missouri S&T and over the summer at an NSF funded REU at Fairmont State in West Virginia. In spring of 2022, she worked with Dr. Han through the First Year Research Experience (FYRE). Over the summer, she had the opportunity to travel to West Virginia to participate in Discrete and Continuous Analysis in Appalachia under Dr. Cuchta. Last year, she worked with Dr. Murphy on Numerical Approaches for the Inverse Scattering. In addition to her research activity, she also enjoys being involved in other groups and activities on campus, including Foundation for Undergraduate Mathematicians, Lutheran Student Fellowship, Aerial Swing Dance, and the music fraternity Kappa Kappa Psi.

List First then Last Name

Rosalee Brown

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemistry
Major: Chemical Engineering
Research Advisor: Dr. Klaus Woelk
Advisor Department: Chemistry

Funding Source: Chemistry Department

SHORT PROJECT TITLE

Quantifying Asphalt Binder UV Effects with Relaxome

SHORT ABSTRACT

Asphalt deterioration involves many physical and chemical changes caused by environmental factors such as automotive strain, extreme heat, and UV exposure. Asphalt binder assessment in the industry is currently based on structurally destructive testing methods and tests of physical performance without accounting for chemical structure. An emerging evaluation of asphalt binder uses relaxometry, a field of nuclear magnetic resonance (NMR) spectroscopy, to directly observe how asphalt binder is changed by causes of deterioration such as UV exposure. NMR relaxometry explores nuclear spins' interactions with their environment. This noninvasive method can provide a detailed view into the chemical environment of virgin and aged asphalt binder to observe effects of aging without damage to either the sample or collection site. This research experiment will use NMR relaxometry to observe the effects of UV and extreme temperatures on asphalt quality before aging can be detected by current industry methods, and before physical signs or failures are apparent.

SHORT BIO IN 3rd PERSON

Rosalee Brown is a sophomore student at MST from Saint Louis, Missouri, studying chemical engineering with an emphasis in biochemistry. She has been conducting research with the Chemistry department since January 2023. Alongside this, she is an active participant in her campus community. She is a member of ASDC, a founding member of MWG, and an officer of DOL

List First then Last Name

Tylor Cheatham

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Environmental Science
Research Advisor: Dr. Dev Niyogi, and Dr. Mark Fitch
Advisor Department: Biological Sciences & Civil, Architectural, Environmental Engineering

Funding Source: OURE

SHORT PROJECT TITLE

Water Quality Profiles in Two Rolla Ponds

SHORT ABSTRACT

Eutrophication is a growing global issue due to anthropogenic inputs. One of the main issues associated with eutrophication is fish death. Eutrophic waters can lead to algal blooms, resulting in hypoxic conditions where there is not enough oxygen to support the oxygen-breathing organisms like fish. This can happen in lakes or where rivers meet the ocean. These hypoxic conditions are a concern for lake managers and people who make a living fishing in waters that are now experiencing fish death. One method to target the oxygen levels in lakes is adding aerators. Because of how dynamic ecosystems are, a change in one variable is likely to influence other variables in the ecosystem. This study aimed to measure some of these differences. We determined vertical profiles for temperature, dissolved oxygen, nitrate, ammonia, and phosphorus at two urban ponds in Rolla. The ponds serve as a great model because Frisco Pond experiences a duckweed bloom every summer including occasional fish deaths, while Ber Juan Pond has had multiple aerators installed to combat this. Ammonia concentrations for each vertical profile are higher with depth corresponding with a decrease in dissolved oxygen. SRP readings for Frisco decrease with depth which suggests internal loading may not be happening even with the oxygen levels near zero. The nitrate concentrations show more variation across sites, indicating more complex pathways involving the nitrogen cycle.

SHORT BIO IN 3rd PERSON

Tylor Cheatham is a junior in Environmental Science at Missouri S&T. His academic interests include nutrient cycles, restoration ecology, landscape limnology, and environmental ethics. In Tylor's free time he enjoys kayaking, spending time with friends, and exploring new music.

List First then Last Name

Emily Copeland

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: History
Major: History
Research Advisor: Petra DeWitt
Advisor Department: History

Funding Source:

SHORT PROJECT TITLE

American Resistance: The Bund and Their Opposition

SHORT ABSTRACT

This Honors Thesis investigates American opposition to the German American Bund during the turbulent 1930s. It reveals the differing attitudes within American society during the German American Bund's peak. While some embraced fascist ideologies, others protested against them, highlighting the intricacy of American politics leading up to World War II. This study explores the efforts undertaken by Americans to counter the fascist doctrine of the German American Bund on democratic soil.
The research gathered insight from documents and artifacts at institutions such as the St. Louis Kaplan Feldman Holocaust Museum, Curtis Laws Wilson Library, and other archival sources, investigating the rise, reinforcement, and repercussions of fascist movements and the American public's opposition.

SHORT BIO IN 3rd PERSON

Emily is a Senior at Missouri University of Science & Technology majoring in History with a Teacher Certification. Emily is set to complete student teaching in the fall of 2024 and graduate at the end of the semester.

List First then Last Name

Allie Dingfield

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner
Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Davide Vigano
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: OURE, Nasa Missouri Space Grant Consortium

SHORT PROJECT TITLE

Density fluctuations measurements in supersonic flow

SHORT ABSTRACT

Turbulence in compressible flows plays a major role in a variety of applications such as air/fuel mixing strategies for scramjet combustors. However, compressible turbulence is more challenging to analyze than its incompressible counterpart since fluctuating thermodynamic quantities must be accounted for. Of these quantities, density fluctuations are of high importance due to their role in the production term of the Turbulent Kinetic Energy (TKE). Although velocity measurements, even in supersonic flow, have become relatively accessible, density fluctuation measurements remain more complex in nature. A method to obtain quantitative measurements of density fluctuations has been developed using the optical technique of shadowgraphy. Shadowgraphy and schlieren methods have been frequently used to obtain qualitative information about density gradients in fluids. However, quantitative applications of these methods are much less common. This quantitative shadowgraphy method relates the light intensity in an image taken of the flow to the flow's density and applies statistical techniques to obtain useful information about it. Development of this technique allows measurements of compressible turbulence to be performed in the Missouri S&T supersonic wind tunnel.

SHORT BIO IN 3rd PERSON

Allie Dingfield is a sophomore in mechanical engineering at Missouri S&T. She is involved in the Honors Program, Kummer Vanguard Scholars, and Christian Campus Fellowship, along with her work under Dr. Vigano in the Aerodynamics Research Lab.

List First then Last Name

Grace Duong

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Civil, Architectural, and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Mark Fitch & Dr. Dev Niyogi
Advisor Department: Civil, Architectural, Environmental Engineering & Biological Sciences

Funding Source: OURE

SHORT PROJECT TITLE

Floating Treatment Wetlands for Zinc Phytoremediation

SHORT ABSTRACT

Stormwater pollution from urban and mining areas can pose challenges to downstream waters because of zinc contamination. Floating treatment wetlands (FTWs) have demonstrated the ability to mitigate nutrient and metal contamination. To investigate the effectiveness of native Missouri plants in FTWs, fourteen 10-liter mesocosms were constructed, dosed with nutrients, and placed in a greenhouse. Four mesocosms acted as controls, five contained pickerelweed, and five contained palm sedge. After one week of acclimation, mesocosms were dosed with ZnCl2 in concentrations of 0, 5, and 10 mg/L of zinc. Objectives of this study include characterizing zinc immobilization and assessing both pickerelweed and palm sedge within FTWs for zinc uptake. Grab samples were taken immediately after dosing, one hour, one day, three days, and weekly for six weeks. Data collected in week one shows zinc concentrations decreasing immediately after dosage and mixing, pointing to possible adsorption to precipitating iron from the nutrient solution. In week two, mesocosms containing plants demonstrated an increase in soluble zinc, followed by a steady decrease through week six. This may be a result of the complexing of zinc with root exudates, which increase the solubility of zinc for plant uptake. To confirm such zinc uptake, investigation of zinc within roots and shoots is necessary in future research.

SHORT BIO IN 3rd PERSON

Grace Duong is a graduating senior in Environmental Engineering at Missouri S&T with plans to pursue graduate studies, beginning a Ph.D. program at Washington University in Fall 2024. Her academic interests span emerging contaminants, nutrient and bioproduct recovery, remediation, and environmental justice. Beyond her studies, she enjoys rock climbing, playing the guitar, and spending time with her cat, Smokey.

List First then Last Name

Jessica Frame

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Psychological Sciences
Major: Psychological Sciences & Biological Sciences
Research Advisor: Dr. Amy Belfi
Advisor Department: Psychological Sciences

Funding Source: OURE Fellowship, CSTS Seed Grant

SHORT PROJECT TITLE

Modality's Effect on Aesthetic Ratings of Poetry

SHORT ABSTRACT

Previous research has shown that vividness of evoked imagery is the strongest contributor to aesthetic pleasure for poetry. However, it is unknown whether modality of the poem has an effect on the relationship between vividness and aesthetic appeal, as past work has only used written poems. In this study we want to evaluate rating of vividness, valence, arousal, and aesthetic appeal based on the modality in which poems are presented (listening only, reading only, or combined). Participants were randomly assigned to one of the three modalities: text-only (N=81), audio-only (N=74), or combined audio/text (N=78). Our results showed that participants found the audio-only modality to be the least aesthetically appealing, as compared to visual-only and combined audiovisual. Additionally, we found that vividness of imagery was the most important predictor of aesthetic appeal overall (across all three modalities) but also identified a significant interaction between stimulus modality and imagery such that vividness was most important for text-only poems. Finally, we replicated prior work on individual differences in aesthetic appeal, as our results indicate low interrater agreement for aesthetic appeal ratings of poems. These findings contribute to our understanding of the complexity of the aesthetic experience in poetry and highlight the significance of individual differences and the role of modality in its appreciation.

SHORT BIO IN 3rd PERSON

Jessica Frame is a senior graduating in May 2024 with majors in Biology and Psychology with an emphasis in Cognition and Neuroscience as well as a minor in Chemistry. During her four years she has been a participant of the FYRE, OURE, and OURE fellowship programs as well as presented her research at the capitol. Outside of the college, Jessica has taken research to 3 regional psychology conferences and 1 national where she won the audience choice award. Upon graduation, Jessica will be pursuing her interests in cognitive aging and memory at the University of Iowa within their Interdisciplinary Neuroscience Ph.D. Program.

List First then Last Name

Love Gami

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Business and Information Technology
Major: Information Science and Technology
Research Advisor: Yishu Zhou
Advisor Department: Economics

Funding Source: OURE

SHORT PROJECT TITLE

CO2 Pricing Impact on Partially Regulated Market

SHORT ABSTRACT

With climate change becoming a growing concern, carbon trading has gained attention as a key solution to reducing carbon emissions. However, this raises a concern about whether polluters pass the cost of carbon to electricity prices. This study aims to assess the impact of CO2 pricing on electricity prices in the PJM market where some areas are regulated by carbon trading while others are not. Our findings reveal a significant impact of CO2 prices across all regulated areas, encompassing both real-time and day-ahead markets. Moreover, the impact extends to non-regulated areas, indicating a spillover effect within the PJM market. Interestingly, the electricity price increase in unregulated areas is negatively correlated with their distance to regulated areas. The strongest impact is observed during peak hours. These findings highlight how carbon trading policies affect electricity prices, showing how regulations in one area can influence pricing across the energy market.

SHORT BIO IN 3rd PERSON

Love Gami is a sophomore at Missouri S&T, pursuing a degree in Information Science and Technology. His academic journey took an intriguing turn in Fall 2023 when he delved into undergraduate research alongside Professor Yishu Zhou in the Department of Economics. Together, they embarked on a study focusing on the intricate dynamics of carbon price pass-through to electricity prices under partial regulation. This experience ignited Love's passion for detailed research in similar domains, driving him to seek further exploration and contribution in this field.

Chambre Garcia

Department: Biological Sciences
Major: Biology
Research Advisor: Dave Westenberg
Advisor Department: Biological Sciences

Funding Source:

Overview of Cancer Detection Using CRISPRCas13

Most cancers have been shown to alter microRNA expression, so the development of platforms that are able to detect extracellular miRNA has become a promising new field in cancer research. CRISPR-Cas13 systems are guided by RNA and are used by prokaryotes like bacteria to have immunity against things like bacteriophages. This ability of Cas13 to target RNA makes it a potential new technology in cancer diagnostics and therapeutics. My research will review recent studies regarding the potential of Cas13 based systems to create minimally invasive diagnostic tests for cancers in humans. The studies reviewed will evaluate the efficacy of Cas13 as a detector of miRNA and investigate improvements to specific aspects of Cas13 biosensors, like specificity and sensitivity. The results of past research demonstrates that there are multiple functional Cas13-based diagnostic systems that are able to detect very small amounts of miRNA with incredible specificity.

Chambre is a senior biology major graduating in Spring 2024. She is active with the S&T Honors Academy and the Kummer Vanguard Scholars.

List First then Last Name

Gary Joshua

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Davide Viganò
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: Startup funds

SHORT PROJECT TITLE

New Testing Capabilities of the S&T Supersonic Tunnel

SHORT ABSTRACT

The development of non-intrusive, laser-based diagnostic techniques has significantly enhanced supersonic experimental aerodynamics, enabling the measurement of many parameters in complex flowfields. Among these techniques, Tomographic Particle Image Velocimetry, capable of measuring 3 components of velocity in 3-dimensional volumes, is now available at the Aerodynamics Research Laboratory of the Missouri University of Science and Technology. To integrate this new system into the university's supersonic wind tunnel, a redesigned nozzle, test section, and diffuser have been implemented. The upgraded modular test section features 4 large ports which can be configured with windows for optical diagnostics or lead plates for model mounting/intrusive diagnostics. This work presents the design of the facility upgrade and highlights the new diagnostic capabilities of the Missouri S&T Supersonic Wind Tunnel.

SHORT BIO IN 3rd PERSON

Joshua Gary is a 4th year Aerospace Engineering major attending the Missouri University of Science and Technology. He is currently employed by the university as an undergraduate research assistant in the Mechanical and Aerospace Engineering department. Upon graduation, he plans to continue attending Missouri S&T in pursuit of a PhD in Aerospace Engingeering. His greatest research interests include experimental hypersonics and spaceplane applications. Josh is from Lake Saint Louis, MO and also enjoys playing piano and rock climbing in his free time.

List First then Last Name

Steven Karst

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Physics
Major: Physics & Computer Science
Research Advisor: Dr. Shun Saito
Advisor Department: Physics

Funding Source: NSF

SHORT PROJECT TITLE

Enhancing Galaxy Surveys with Machine Learning

SHORT ABSTRACT

Applications of machine learning (ML) or artificial intelligence (AI) to problems in astrophysics and cosmology have recently entered a golden era. In response, we have updated two of our recent ML/AI efforts that contribute to galaxy surveys whose main scientific target is to reveal the nature of the Comsic Acceleration or Dark Energy. We first revised our effort to infer cosmological information beyond the survey geometry using Graph Neural Networks (GNNs) to take advantage of supercomputing resources on campus. We then updated our methods for galaxy target selection in the Subaru Prime Focus Spectrograph (PFS) survey with modern reinforcement learning techniques such as A2C and revised reward functions. In both cases, we found that these changes dramatically improved the speed and performance of the ML models, especially when locating faint galaxies with high redshifts.

SHORT BIO IN 3rd PERSON

Steven Karst is a senior from Ballwin, Missouri majoring in Physics and Computer Science at Missouri S&T, where he is the Computing Lead for the Underwater Robotics Team as well as the vice president of ACM Game Dev. He was originally introduced to the Institute for Multi-Messenger Astrophysics and Cosmology through the National Merit Semifinalist Package. His research for that program won first prize at the 2021 Undergraduate Research Conference as well as at the 2021 Fuller Prize Competition.

List First then Last Name

Clare Koerkenmeier

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Data Analysis Pipeline of C. elegans Dynamics

SHORT ABSTRACT

Population dynamics follows the fluctuations in birth and death rates. The effects of varying reproductive schedules and aging trajectories play important roles in population survival. Previous projects have aimed to draw connections between these traits through the analysis of data collected from laboratory ecosystems and a computational simulation (wormPOP) comparing wild type and mutant populations of Caenorhabditis elegans. However, these data sets are extensive, and the analysis has proven to be challenging and time consuming. The goal of my project was to optimize the data analysis process. Using data that had been previously collected in these experiments, I worked to produce a data analysis pipeline using the programming language R. Additional simulations were also used to provide supplemental data for analysis. Finally, this data analysis pipeline was used to gain a deeper understanding of how the life history traits of reproduction and lifespan are connected to support population survival.

SHORT BIO IN 3rd PERSON

Clare Koerkenmeier is an undergraduate student at Missouri University of Science and Technology majoring in Biological Sciences. There, she is active in the SCRUBS pre-health organization. She is also a part of the Kummer Vanguard Scholars program and Honors Academy. In the future, Clare intends to attend medical school.

List First then Last Name

Kevin Lai

Joint Project with Yug Patel and Chubi Adejoh

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

A User-Friendly Interface for Life Cycle Simulation

SHORT ABSTRACT

In biological research, understanding the life cycles of Caenorhabditis elegans (C. elegans) is pivotal for insights into developmental biology, genetics, and population dynamics. Our team developed a software tool that enhances the accessibility and interpretability of C. elegans population dynamics simulations. This tool is designed to complement an existing simulator that models each worm individually, tracking its progression through various life stages including egg, larva, adult, dauer, and death. The software transforms simulation data into a directed graph for visualization. This graphical representation delineates the life cycle transitions of C. elegans but also dynamically adjusts to reflect the population density at each stage. The nodes within the graph change in size corresponding to the quantity of worms in each life stage, while the directed arrows change in size to depict the volume of transitions between stages. The software is equipped with a user-friendly web interface, making it accessible to both technical and non-technical users alike. It facilitates the execution of multiple simulation instances, enables the adjustment of run-time parameters, and provides functionalities for downloading and graphically representing the simulation data. This level of interactivity and control empowers users to explore various scenarios and parameters, fostering a deeper understanding of C. elegans population dynamics.

SHORT BIO IN 3rd PERSON

Kevin is a Computer Science senior who applies technology to biological challenges. Beyond his academic pursuits, he's a passionate social swing dancer, and a musician, playing the cello and violin. Kevin balances his tech-driven pursuit with daily reading and exercise. Post-graduation, Kevin hopes to pursue a career in software engineering while attending graduate school for bioinformatics.

List First then Last Name

Kaitlin Miles

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Klaus Woelk
Advisor Department: Chemistry

Funding Source: OURE/ Summer Scholars Program

SHORT PROJECT TITLE

Heat's Effect on Asphalt Binders Using NMR

SHORT ABSTRACT

Nuclear Magnetic Resonance (NMR) spectroscopy is a well-known analytical technique that uses the excitation of nuclear spins for solving chemical structures and conformations. Relaxometry is a special field of NMR spectroscopy where information is gained about interactions of nuclear spins with their molecular surroundings. The deterioration of asphalt is a major infrastructure problem, and its rejuvenation back toward its original virgin state is an important field of research and development. The current asphalt industry relies on visual inspection on site and invasive or destructive physical methods to assess emerging asphalt failures. This study examines the chemical changes environmental factors have on asphalt binders by using NMR relaxometry. The effects heat treatments have on virgin and UV aged binder samples are quantified by the relaxation times of the organic hydrogen atoms in bituminous asphalt-binder samples. The research is aimed at providing insight into the integrity of asphalt before failures become apparent.

SHORT BIO IN 3rd PERSON

Kaitlin Miles came to Missouri S&T from Griggsville Illinois. She is a sophomore Vanguard Scholar majoring in chemistry with an emphasis in Biochemistry. She was awarded First-Year Research Experience (FYRE), Summer Scholars Program, and Opportunities for Undergraduate Research Experiences (OURE) from the College of Arts, Science, and Education to conduct a research project in physical chemistry and spectroscopy. Kaitlin's career goals involve exploring an interest in toxicology and enviornmental conservation.

List First then Last Name

Yug Patel

Joint Project with Kevin Lai and Chubi Adejoh

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Visualizing C. elegans Population Dynamics

SHORT ABSTRACT

In biological research, understanding the life cycles of Caenorhabditis elegans (C. elegans) is pivotal for insights into developmental biology, genetics, and population dynamics. Our team developed a software tool that enhances the accessibility and interpretability of C. elegans population dynamics simulations. This tool is designed to complement an existing simulator that models each worm individually, tracking its progression through various life stages including egg, larva, adult, dauer, and death. The software transforms simulation data into a directed graph for visualization. This graphical representation delineates the life cycle transitions of C. elegans but also dynamically adjusts to reflect the population density at each stage. The nodes within the graph change in size corresponding to the quantity of worms in each life stage, while the directed arrows change in size to depict the volume of transitions between stages. The software is equipped with a user-friendly web interface, making it accessible to both technical and non-technical users alike. It facilitates the execution of multiple simulation instances, enables the adjustment of run-time parameters, and provides functionalities for downloading and graphically representing the simulation data. This level of interactivity and control empowers users to explore various scenarios and parameters, fostering a deeper understanding of C. elegans population dynamics.

SHORT BIO IN 3rd PERSON

Yug Patel is a 2nd year Computer Science Student at Missouri S&T. He is currently working with Dr. Scharf in Biological Sciences and Dr. Madria's student Ademola in the Computer Science department. He plans to pursue a PhD in Computer Science.

List First then Last Name

Samuel Schrader

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Physics
Major: Physics
Research Advisor: Daniel Fischer
Advisor Department: Physics

Funding Source: OURE Program/Scholarship

SHORT PROJECT TITLE

Visualization of Ultracold Atomic Samples

SHORT ABSTRACT

Laser cooling techniques have evolved into a powerful experimental tool to perform precision spectroscopy (for instance, atomic clocks), study fundamental few-body dynamics, and create well-controlled systems for quantum information applications. When the atoms are captured, it is critical to analyze the laser-cooled atomic samples carefully, and characterize their properties, such as density, temperature, population distribution, etc., in order to perform these advanced tasks. A straightforward way to measure these properties is detecting the visible optical photons emitted from the sample with a camera. In this OURE project, I aim to do exactly this, and write a computer application that controls a camera and extracts relevant information from the sample for further analysis.

SHORT BIO IN 3rd PERSON

Samuel is a Physics major graduating this semester with plans to start working in the healthcare industry before eventually returning to grad school. At S&T, he's been involved in Fencing, Society of Physics Students and Residential Life, all in addition to his academic work and research. He's proud of of far he's come and hopes to do well in the future to get the S&T name out there.

List First then Last Name

D. Steven Stutts

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: non-degree seeking undergraduate student
Major: non-degree seeking
Research Advisor: Dr. Jeong
Advisor Department: Economics

Funding Source: none

SHORT PROJECT TITLE

Test-Optional Policy's Impact on Statewide ACT Scores

SHORT ABSTRACT

This study investigates the causal impact of test-optional policies on statewide average ACT scores. A panel dataset comprised of participation rates and average composite ACT scores over an eight year period for nine states that began the period with 100 percent participation was collected using annual reports released by the ACT corporation each year. A generalized differences in differences design with staggered treatment periods was implemented, with states using a test-mandatory regime spanning the eight-year period constituting the control group and states that began the period as test-mandatory and switched to test-optional at some point the treatment group. Clustered standard errors was implemented with linear regression for improved statistical inference. Test-optional policy was found to increase scores by about 1.7 points on average compared to test-mandatory policy. These results can inform educational policymakers that want to understand the impact of test-optional policy on aggregate statistics.

SHORT BIO IN 3rd PERSON

Steven is a non-degree-seeking undergraduate student at S&T who is independently studying educational policy and its effect on student performance.

List First then Last Name

Rowan Torbitzky-Lane

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Dr. Chen
Advisor Department: Civil, Architectural and Environmental Engineering

Funding Source: Grant

SHORT PROJECT TITLE

Optical Flow for Bridge Component Annotation

SHORT ABSTRACT

Optical flow is an algorithm that follows apparent motion of objects in a video. It could be used to track bridge structures such as: piers, girders, cross-girders, and more. MODOT employees connect to our website, upload a video of a bridge they have taken themselves, preferably with a drone, and annotate structures themselves with an integrated VGG annotator. Optical flow expedites the process by automatically labeling structures between annotated frames. In the end, the employee saves time, and we have more training data.

SHORT BIO IN 3rd PERSON

Rowan is a senior at the Missouri University of Science and Technology studying Computer Science. He is on track to graduate in Fall 2024 with his bachelor's degree. Ever since Rowan was in elementary school, he was setting up Minecraft servers. Now, he built his own server to self-host web services and train neural networks. Along with his personal projects, in his professional life, he has taken opportunities to work in data science.

List First then Last Name

Ashton Ventura

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Materials Sciences
Major: Metallurgical Engineering
Research Advisor: Dr. Mario Buchely
Advisor Department: Materials Sciences

Funding Source: The Timken Company

SHORT PROJECT TITLE

Induction Hardened Alloy Development

SHORT ABSTRACT

To increase the hardenability of Timken 4150 steel, the material was alloyed with either vanadium; vanadium and silicon; or received no alloying. The material underwent hot rolling and induction heating to simulate Timken's forming and heat treatment processes for their windmill bearings. Hardness, and toughness were tested and compared between the three materials. Both alloyed metals reported better hardness and toughness compared to the original steel with the vanadium-silicon steel recording the highest for both properties.

SHORT BIO IN 3rd PERSON

Ashton is a junior in metallurgical engineering and has been conducting research for the department since 2022. He is currently testing the impact strength of titanium alloys at extreme temperatures.

Poster Presentations

Wednesday – April 10, 2024

Arts and Humanities

Poster #	Name	Department	Time	Location
1	Ben Brown	Chemistry	1:00 – 4:00PM	Innovation Forum
2	Brileigh Cates	Applied Mathematics	1:00 – 4:00PM	Innovation Forum
3	Joely Hall	Psychology	1:00 – 4:00PM	Innovation Forum

Engineering – section 1

Poster #	Name	Department	Time	Location
4	Logan Banker	Aerospace Engineering	1:00 – 4:00PM	Innovation Forum
5	Noah Brown	Mechanical Engineering	1:00 – 4:00PM	Innovation Forum
6	Noah Cain	Aerospace Engineering	1:00 – 4:00PM	Innovation Forum
7	Jordan Hartfield	Mechanical Engineering	1:00 – 4:00PM	Innovation Forum
8	Ian Hodge	Engineering Management	1:00 – 4:00PM	Innovation Forum
9	Gracie May James	Nuclear Engineering	1:00 – 4:00PM	Innovation Forum
10	Clark Nguyen	Metallurgical Engineering	1:00 – 4:00PM	Innovation Forum
11	Mikaela Ritchie	Chemical Engineering	1:00 – 4:00PM	Innovation Forum
12	Noah Sparks	Chemical Engineering	1:00 – 4:00PM	Innovation Forum
13	Aaron Spillars	Aerospace Engineering	1:00 – 4:00PM	Innovation Forum
14	Sophia Strathman	Electrical Engineering	1:00 – 4:00PM	Innovation Forum
15	Henry Tien	Mechanical Engineering	1:00 – 4:00PM	Innovation Forum

Engineering – section 2

Poster #	Name	Department	Time	Location
16	Benjamin Cuebas Justin Fausto Preston Carroll	Electrical Engineering	9:00AM – 12:00PM	Innovation Forum
17	Rebekah Floyd Kayla Walters	Architectural Engineering	9:00AM – 12:00PM	Innovation Forum
18	Briannah Spisak Kaylee Denbo	Environmental Engineering	9:00AM – 12:00PM	Innovation Forum

Research Proposal

Poster #	Name	Department	Time	Location
19	Rae Tordilla	Biological Sciences	1:00 – 4:00PM	Innovation Forum

Sciences – section 1

Poster #	Name	Department	Time	Location
20	Galayna Baur	Biological Sciences	9:00AM – 12:00PM	Innovation Forum
21	Erik Bergstrom	Biological Sciences	9:00AM – 12:00PM	Innovation Forum
22	Jasmin Billingsley	Chemistry	9:00AM – 12:00PM	Innovation Forum
23	Emily Cahill	Chemical Engineering	9:00AM – 12:00PM	Innovation Forum
24	Joshua Caruso	Computer Science	9:00AM – 12:00PM	Innovation Forum
25	James Elverson	Physics	9:00AM – 12:00PM	Innovation Forum
26	Kamden George	Biological Sciences	9:00AM – 12:00PM	Innovation Forum
27	Katharine Gray	Chemistry	9:00AM – 12:00PM	Innovation Forum
28	Harrison Hawxby	Chemistry	9:00AM – 12:00PM	Innovation Forum
29	Vale Miller	Environmental Science	9:00AM – 12:00PM	Innovation Forum
30	Landon Oelschlaeger	Applied Mathematics	9:00AM – 12:00PM	Innovation Forum
31	Lindsay Schneider	Biological Sciences	9:00AM – 12:00PM	Innovation Forum
32	Grace Wilbanks	Biological Sciences	9:00AM – 12:00PM	Innovation Forum
33	Alexis Winner	Biological Sciences	9:00AM – 12:00PM	Innovation Forum
34	Sage Wood	Biological Sciences	9:00AM – 12:00PM	Innovation Forum

Sciences – section 2

Poster #	Name	Department	Time	Location
35	Matthew Dominicis Mason Toombs Gabriel Riddle Parineeta Puja Saha	Computer Science Physics Physics Computer Science	1:00 – 4:00PM	Innovation Forum
36	Ryan Fagan Shelby Wallen	Chemical Engineering	1:00 – 4:00PM	Innovation Forum
37	Charles Green Elena Zobel	Biological Sciences	1:00 – 4:00PM	Innovation Forum
38	Amelia Markwell Nicole Militante	Biological Sciences	1:00 – 4:00PM	Innovation Forum
39	James Ramette Patrick Appiah	Biological Sciences	1:00 – 4:00PM	Innovation Forum

Social Sciences

Poster #	Name	Department	Time	Location
40	Akira Durbin	Psychology	1:00 – 4:00PM	Innovation Forum

List First then Last Name

Patrick Appiah

Joint project with James Ramette

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biology
Major: Biology
Research Advisor: David Duvernell
Advisor Department: Biology

Funding Source: MS&T

SHORT PROJECT TITLE

Genetic diversity of Ericymba dorsalis

SHORT ABSTRACT

The study of North American freshwater ichthyofauna reveals a diversity shaped by the continent's geologic past and the extensive effects of Pleistocene glaciation on river systems. Ericymba dorsalis (Bigmouth Shiner) is a minnow species with a broad distribution in the Mississippi River basin from Wyoming to New York. Despite exhibiting consistent morphological features across its range, the species' widespread northern distribution suggests the potential existence of multiple, genetically distinct lineages. This research tested the hypothesis that separate drainage systems harbor genetically distinct groups of E. dorsalis. Our results identified five clades, each associated with major drainages. Populations of the Missouri River, upper Mississippi River, and Illinois River, respectively, grouped into three clades with divergence of 1.3-1.6%, indicating a Pleistocene origin. Three disjunct populations located in Great Lakes tributaries in western Michigan, Ohio, and New York, respectively, formed a fourth clade, and population samples from the Allegheny River in Pennsylvania formed a fifth clade. The divergence of the Great Lakes and Allegheny clades from the western clades ranged 4.3-5.3%, suggesting an early Pleistocene or Pliocene origin. This pattern of distribution underscores the role of vicariance biogeography during Pleistocene glaciation, on the current distribution of genetic diversity in E. dorsalis.

SHORT BIO IN 3rd PERSON

Patrick Appiah is a Ghanaian student who initially pursued agricultural biotechnology at Kwame Nkrumah University of Science and Technology before transferring to Missouri University of Science and Technology to study biology. With a strong understanding of genetics, Patrick brings a diverse academic background to his studies. Patrick is aspiring to become a molecular geneticist, and his experience working in a lab has been invaluable in shaping his understanding of the field. He believes that the skills and knowledge gained will significantly contribute to his personal growth and long-term career success in molecular genetics.

List First then Last Name

Logan Banker

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Davide Vigano
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: Summer Scholars Program

SHORT PROJECT TITLE

Modeling of a Slug Calorimeter for High-Enthalpy Flows

SHORT ABSTRACT

Thermal capacitance calorimeters are the standard instrument used to measure cold wall heat fluxes in high-enthalpy flows that simulates hypersonic flight conditions. These instruments play a fundamental role in the development and testing of Thermal Protection Systems for space re-entry conditions. However, despite their rugged and simple design, they are affected by large uncertainty errors. These have been estimated in literature at 15%. Despite their importance, and large errors, no proper uncertainty analysis has been performed. Uncertainty analysis is difficult due to the complex physics of the environment these calorimeters have to operate into.

SHORT BIO IN 3rd PERSON

Logan is a senior majoring in Aerospace Engineering. She is a part of the Aerodyanmics Reasearch Lab run by Dr. Davide Vigano, and is also a member of the Missouri Satellite Research Team.

List First then Last Name

Galayna Baur

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biology
Research Advisor: Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Are Pheromones Necessary to Survive?

SHORT ABSTRACT

Caenorhabditis elegans (C. elegans) is a species of nematodes widely found on rotting plant material due to the presence of their primary food source, bacteria. These animals utilize pheromones for communication to signal larval stages to enter the dauer phase—a survival strategy enabling them to withstand periods of minimal to no food availability, thereby regulating their population size.

This study investigates the role of pheromone signaling in population dynamics and survival strategies of C. elegans using a population dynamics experiment. We employ two strains: N2, a laboratory strain with intact pheromone signaling, and a mutant strain lacking the ability to signal via dauer pheromones. Both strains are cultured in liquid medium with fluctuating food supply to examine their growth and survival patterns.
We hypothesize fluctuating population sizes in the N2 strain, characterized by cyclical rises and falls in response to the food supply, contrasted with more pronounced fluctuations in the mutant strain, reflecting an inability to regulate population size effectively.

SHORT BIO IN 3rd PERSON

Galayna Baur is a Junior in Biological Sciences with a minor in Chemistry and very active on campus. She is the president of the National Society of Leadership and Success, an assistant to the chair of the Student Activity Financial Board, an active member of the Biological Honors Society Phi Sigma, Helix, and iGEM. Beginning of the year, Galayna joined the Scharf lab and is investigating pheromone communication in the roundworm C. elegans. In the future, Galayna plans to stay at Missouri S&T for her Master's degree.

List First then Last Name

Erik Bergstrom

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Mathmatical analysis of C elegans population dynamics

SHORT ABSTRACT

Understanding how populations fluctuate is important for understanding how evolutionary pressures have shaped the life histories of species, such as reproductive patterns and aging. A laboratory ecosystem consisting of Caenorhabditis elegans and Escherichia coli and wormPOP, a simulation of this laboratory ecosystem, developed by Scharf and colleagues (Scharf et al., 2022) provides an opportunity to better understand population dynamics by tracking individual simulated worms and computing the emergent population dynamics. However, the output data consist of curves with peaks and troughs that are challenging to analyze and that were hypothesized to fit the mathematical definition of chaotic behavior. This project used mathematical methods to detect chaotic behavior in data from wormPOP under various culling conditions and implemented a second species of nematode, Pristionchus pacificus, in wormPOP to test the effect of a predatory species on the dynamics of the simulated ecosystem. Pristionchus pacificus is a nematode species related to Caenorhabditis elegans that is capable of feeding on the larvae of other nematode species.

SHORT BIO IN 3rd PERSON

Erik Bergstrom is actively involved in undergraduate research and is a member of IGEM. During 2021/2022, he was involved in research in Dr. Melanie Mormile's lab studying dessication tolerance in halophiles. From 2022 until currently, he has participated in OURE and an OURE fellows project in Dr. Andrea Scharf's lab studying the population dynamics of C. elegans in the Scharf lab's laboratory ecosystem and in wormPOP, a simulation of that ecosystem.

List First then Last Name

Jasmin Billingsley

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Physics
Major: Chemistry
Research Advisor: Hyunsoo Kim
Advisor Department: Physics

Funding Source: Faculty Startup

SHORT PROJECT TITLE

Development of Colpitts Self Oscillator

SHORT ABSTRACT

Topological materials can serve as promising platforms for next-generation technology. Magnetism in such systems is often a consequence of emergent quantum phenomena, and the traditional framework is insufficient to fully describe their magnetic properties. In this project, we will perform precision magnetic measurements utilizing the Colpitts self-oscillator to determine the temperature- and field-dependent AC magnetic susceptibility in the topological magnetic materials. The collective knowledge learned from this proposed research would shed light on the understanding of exotic magnetism in topological materials, potentially leading to new physics of magnetism.

SHORT BIO IN 3rd PERSON

The sudent involved in this project is an undergraduate in their second year (a junior-by-credit). Her major is chemistry, and she is conducting this project with Hyunsoo Kim of the physics department.

List First then Last Name

Ben Brown

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemistry
Major: Chemistry
Research Advisor: Justin Pope
Advisor Department: History and Political science

Funding Source: FYRE

SHORT PROJECT TITLE

The Search for the Akwamu people, 1729-1733

SHORT ABSTRACT

This Poster presentation attempts to trace the journey of one nation of Africans into the Americas. In 1729, the Akwamu Empire, in modern day Ghana, West Africa, suffered a terrible collapse. Rival African armies enslaved thousands of Akwamu subjects and sold them to European slavers on the Gold Coast. This nation later led the biggest island wide slave revolt prior to the age of revolution in the Americas. Using primary and secondary resources such as the "Transatlantic Slave Trade Database," we will attempt to identify the European slave ships that purchased enslaved Akwamu people and trace their journey into the ports of the Americas. The goal of the project is to identify the most likely landing places of the Akwamu people in the western hemisphere following their dissemination into the America's from 1729 to 1733.

SHORT BIO IN 3rd PERSON

Born in St.Louis, Benjamin Brown grew up looking for answers for questions about the smaller mechanics of life. He later became a chemist and went to upper peninsula michigan to a college named Michigan Technological University before he later decided to come back to Missouri and pursue his education closer to home but still determined to be a Chemist.

List First then Last Name

Noah Brown

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Materials Science and Engineering
Major: Mechanical Engineering
Research Advisor: David Lipke
Advisor Department: Materials Science and Engineering

Funding Source: Summer Research Scholars

SHORT PROJECT TITLE

The Aerodynamic Levitator Project

SHORT ABSTRACT

After the development and successful demonstration of a hyperbaric aerodynamic levitator, work to redesign the nozzle was proposed for increasing levitation height and stability. ANSYS Fluent (some computer software used for simulating fluid flow) is perfect for this application. After learning to use the software several simulations were employed and compared to experimental data in order to assess its validity before applying the software to the nozzle redesign. Results are promising and work on the nozzle is planned to continue this school year.

SHORT BIO IN 3rd PERSON

Noah Brown is a Sophomore studying Mechanical Engineering. He is involved on campus in the Christian Campus Fellowship, the Rock Climbing Club, and the Kummer Vanguard Scholars Student Steering Committee. He also enjoys hobbies such as playing the fiddle and parkour.

List First then Last Name

Emily Cahill

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr.Choudhury
Advisor Department: Chemistry

Funding Source: OURE

SHORT PROJECT TITLE

FeDoped Zeolite for Propane Dehydrogenation Catalyst

SHORT ABSTRACT

This research describes the synthesis of iron-doped zeolitic catalysts for the transformation of propane to propylene. The goal of this research is to develop a dehydrogenation catalyst to convert shale-gas derived cheap propane feedstock to economically valuable propylene, while at the same time making this catalyst sustainable and non-toxic to the environment. Fe-doped zeolitic frameworks have shown promising activity in percentage of conversion and in selectivity. In our study we analyzed zeolites ZSM-5 and AlPO-5. These were chosen because they have differences in pore structure , channel sizes, and connectivity between channels. Most importantly the differences in the chemistry as ZSM-5 is pure silica (Si – O – Si) framework and AlPO-5 is Al-O-P network. These differences allow propane dehydrogenation to be done to their Fe-Doped doped frameworks while being able to understand selectivity based on the different structures of the pores and channels. In this presentation, we will present preliminary data on the successful synthesis of these materials by hydrothermal route and characterization by powder X-ray diffraction, IR- and Mössbauer spectroscopy.

SHORT BIO IN 3rd PERSON

Emily Cahill is a junior in Chemical Engineering at Missouri S&T. She has been doing research with Dr. Choudhury's group since May 2023. On campus she is also involved with Alpha Chi Sigma, a professional, academic, chemistry based fraternity. In her free time she enjoys making quilts and spending time outside with her dogs.

List First then Last Name

Noah Cain

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Davide Vigano
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: Start-Up, and Dean's Undergraduate Research Scholar Award

SHORT PROJECT TITLE

Mathematical Modelling of a Supersonic Wind Tunnel

SHORT ABSTRACT

Supersonic wind tunnels are essential for high-speed aerodynamics research, allowing studies ranging from fundamental flow physics to the advancement of supersonic transport. This work presents a physics-based model developed for the Missouri S&T supersonic wind tunnel, a blow-down facility employing a converging-diverging nozzle to achieve high-speed flow. The model accounts for real gas effects, including Joule-Thomson phenomena, as well as predictions of pressure losses and heat transfer. Implemented in Matlab, the model's accuracy was validated through comparison with experimental measurements, demonstrating excellent agreement. This research contributes to the reliable prediction of supersonic wind tunnel performance, thus advancing the understanding and development of high-speed aerodynamic systems.

SHORT BIO IN 3rd PERSON

Noah Cain is a current Senior in Aerospace Engineering who will be graduating in the spring of 2024. He has been performing researh on the MST supersonic wind tunnel under the advisorship of Dr. Davide Vigano in the Aerodynamics Research Laboratory since the summer of 2023.

List First then Last Name

Preston Carroll

Joint project with Benjamin Cuebas and Justin Fausto

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Rohit Dua
Advisor Department: Electrical and Computer Engineering

Funding Source: OURE funds/Self funded

SHORT PROJECT TITLE

Deconstructed 555 Timer for Engineering Education

SHORT ABSTRACT

The Deconstructed 555 Timer and Application Circuits for Interactive Educational Experience offers interactional implementation of three fully discrete 555 Timer example circuits. The research project goal was to gain knowledge of the 555 Timer by deconstructing the device down to the component level. Three independent example application circuits, which showcase the application versatility of the 555 Timer in different modes, include Monostable, Astable, and Bistable circuits. Each mode has a hardware interface that can be used to adjust the operation of the 555 Timer allowing for a full interactive experience. The user can observe the differences in the internal working of the 555 Timer for the implemented applications. The built product is an educational and engaging interactive board which uses LEDs and LCD displays to describe the internal functionality of a 555 Timer and its application versatility. The undergraduate research concentrated on building skills in circuit design and product development.

SHORT BIO IN 3rd PERSON

Preston Carroll started out by earning an Associates Degree in Industrial Maintenance Technology at OTC. After a break from school he realized what trully interested him and set out to earn his Bachelors Degree in Electrical Engineering. Having experienced many odd jobs up to that point, he then obtained an internship at John Deere as a quality engineer. Through his journey back to college he also decided to pursue a minor in Computer Engineering and took up the position as a teaching assistant for the Circuits I Laboratory. His love for learning and helping others has helped fuel him through this long journey which brings us to the present day where he and two fellow students undertook the responsibility of an OURE project to build a discrete 555 Timer that shows the architecture and modes of the infamous IC.

List First then Last Name

Joshua Caruso

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Ardhendu Tripathy
Advisor Department: Computer Science

Funding Source: None

SHORT PROJECT TITLE

Improve labeling-efficiency for active learning

SHORT ABSTRACT

Active learning is a framework for training machine learning models where the goal is to reduce the number of labels used during training. Neural network models used for image classification require a large training dataset to achieve good accuracy. This project will use active learning to reduce the number of labels needed for training neural network models. We propose to use the Fisher information of the neural network parameters to actively select which images are labelled and included in the training data. A key challenge is the large number of parameters in commonly-used neural network models, which significantly increases the cost of computing the Fisher information. To mitigate this challenge, we plan to identify a subset of the parameters that can be considered to be more relevant for the classification task. This project will obtain theoretical justification for our approach and implement it in the CIFAR10 benchmark dataset.

SHORT BIO IN 3rd PERSON

Joshua Caruso is a Junior and National Merit Scholar working towards a F2024 graduation with a Bachelor's in Computer Science and a minor in Mathematics. He has worked under Professor Tripathy as a research assistant for 2.5 years and for the past year has helped design and implement strategies to increase labelling efficiency in active training of neural network models.

List First then Last Name

Brileigh Cates

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mathematics and Statistics
Major: Applied Mathematics
Research Advisor: David Samson
Advisor Department: Arts, Languages, and Philosophy

Funding Source: OURE

SHORT PROJECT TITLE

Gender and the Billboard Top-40 Charts 1958-2023

SHORT ABSTRACT

Is there an inherent bias towards male artists in the music industry? Evidence has been shown in previous studies, the most recent being from 2017, that there may be bias towards male artists appearing in Billboard Magazine ’s Hot 100 list. This study not only updates previous data to include 2017 through 2023, but also looks at the top 40 charts on a week-by-week bias as opposed to the year-end charts that other studies used for their data.

We coded each song so as to indicate the gender of the artist(s) as well as whether or not the artists appeared as a soloist or as part of a group/band. When analyzing each individual song, we examined how often it appeared in the top 40 and how high it peaked.

Looking at the data, we have realized that the claim of bias towards male artists may not be as cut and dry as other studies have suggested. In certain eras, many male artists who frequently top the charts are those marketed to the demographic of young female listeners. The data supports an argument that while male artists may dominate the Billboard charts, it is in fact female audiences that drive that domination.

SHORT BIO IN 3rd PERSON

Brileigh Cates is an Applied Mathematics junior studying statistics. She is Drum Major of the Miner Marching Band and Recording Secretary of the honorary band sorority on campus, Tau Beta Sigma. She plans on graduating and entering the S&T Statistics Doctorial Program by August of 2025. She plans on pursuing a degree in pharmaceutical statistics after graduation.

List First then Last Name

Benjamin Cuebas

Joint project with Preston Carroll and Justin Fausto

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Rohit Dua
Advisor Department: Electrical and Computer Engineering

Funding Source: Missouri S&T OURE

SHORT PROJECT TITLE

Deconstructed 555 Timer for Engineering Education

SHORT ABSTRACT

The Deconstructed 555 Timer and Application Circuits for Interactive Educational Experience offers interactional implementation of three fully discrete 555 Timer example circuits. The research project goal was to gain knowledge of the 555 Timer by deconstructing the device down to the component level. Three independent example application circuits, which showcase the application versatility of the 555 Timer in different modes, include Monostable, Astable, and Bistable circuits. Each mode has a hardware interface that can be used to adjust the operation of the 555 Timer allowing for a full interactive experience. The user can observe the differences in the internal working of the 555 Timer for the implemented applications. The built product is an educational and engaging interactive board which uses LEDs and LCD displays to describe the internal functionality of a 555 Timer and its application versatility. The undergraduate research concentrated on building skills in circuit design and product development.

SHORT BIO IN 3rd PERSON

In 2022, Benjamin Cuebas graduated from Ozarks Technical Community College with an Associate's degree in Electrical Engineering. Since then, he has been taking Electrical Engineering courses at the Missouri State University Cooperative Engineering program and expects to graduate with his BS in spring 2025.

Benjamin has worked as an electrician and electronics technician during his pursuit of an EE degree. In the summer of 2023, he did his first engineering internship, where he designed test equipment for RF MMICs.

Currently, Benjamin stays busy with school work, OUREs, Embedded Systems Club, and by participating in the Missouri State University IEEE student chapter.

List First then Last Name

Kaylee Denbo

48

Joint project with Briannah Spisak

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Civil, Architectural and Environmental Engineering

Major: Environmental Engineering

Research Advisor: Dr. Joel G Burken

Advisor Department: Civil, Architectural and Environmental Engineering

Funding Source:

SHORT PROJECT TITLE

Analysis of 1,4 Dioxane in Plants

SHORT ABSTRACT

Missouri S&T collaborates with University of Iowa on projects to identify the presence of 1,4 Dioxane in tree core samples. The research group will replicate the situation in smaller reactors on campus. The following materials will be used: conetainers, willow cuttings, biochar, and perlite. The plants will be dosed with 1,4-Dioxane and analyzed with Gas Chromatography-Mass Spectrometry (GCMS). Plant growth and health will be monitored and related to growth conditions and pollutant exposure. Larger mesocosms will be dosed over the summer and will have in-planta analysis as well.

To replicate the field site, exact biochar and perlite from the manufacturer will be used. There will be four species of willow tree planted in three ratios of perlite and amended with biochar. The three ratios are 0% perlite with 100 % biochar, 10% perlite with 90% biochar, and 20% perlite with 80% biochar. There are 10 replicates of each ratio. The plants will be dosed with 1,4-Dioxane. Plant growth will be analyzed by measuring biomass, height, leaf count, taking images for image analysis, and scanning root structure. Cuttings will be taken for analysis and placed in the centrifuge. Then, solution will be extracted to run in GCMS. Data will be compared to the University of Iowa site.

SHORT BIO IN 3rd PERSON

List First then Last Name

Matthew Dominicis

Joint project with Gabriel Riddle, Mason Toombs, and Parineeta Puja Saha

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Avah Banerjee
Advisor Department: Computer Science

Funding Source: N/A

SHORT PROJECT TITLE

T Gates on a Quantum Circuit to Achieve Randomness

SHORT ABSTRACT

T gates can be inserted into a randomly generated Clifford circuit with the aim of enhancing its capacity for creating a universal unitary. This study investigates the impact of incorporating T gates on the overall randomness of the circuit output. The experiments focused primarily on the generation of random clifford circuits using different techniques and the effect of T gates on the generated circuit. Through a series of simulations and analyses, the research assesses the effectiveness of this modification in achieving a more unpredictable output while minimizing the necessary number of Clifford gates. The findings contribute valuable insights into randomly generated quantum circuits, shedding light on potential applications in quantum computing.

SHORT BIO IN 3rd PERSON

Matthew Dominicis is a Junior in Computer Science graduating in May 2025. His interests lie in the fields of Artificial Intelligence and Quantum Computing. He participated in the 2023-2024 OURE cohort, where he did research under Dr. Avah Banerjee studying the theory of Quantum Computation. In his free time, he conducts research, spends time with organizations including the Eta Kappa Nu honors society, the Society of Hispanic Professional Engineers, the Google Developer Student Club, and works part-time as an intern at World Wide Technology.

List First then Last Name

Akira Durbin

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Music Cognition & Aesthetics Lab
Major: B.S. Psychology
Research Advisor: Dr. Amy Belfi
Advisor Department: Psychology Department

Funding Source:

SHORT PROJECT TITLE

Stimuli-evoked spontaneous recall, ages 18-35 vs 65-85

SHORT ABSTRACT

Music has the power to take us back in time. Previous research indicates that music is a potent autobiographical memory cue, and that recall often happens with no effort on the part of the listener. Our research is also informed by the reminiscence bump phenomenon, which describes the tendency of older adults to recall autobiographical memories formed from the ages of 18-35. Informed by this phenomenon, we presented older participants with stimuli that were relevant during their youth. We displayed different stimuli to younger and older adult participants on a desktop computer. The stimuli we presented were popular music clips, movie scenes , celebrity faces, and a verbal memory prompt. If participants experienced a spontaneous autobiographical memory recall during one of these 15-second trials, then we recorded their reaction time and their verbal narrative of the memory. After the experiment, the memories are transcribed and assessed for detail quality. By comparing the details of memories provided by younger and older adults, we hope to illustrate any differences that exist between the experience of memory in these different age groups.

SHORT BIO IN 3rd PERSON

Akira is a sophomore at S&T who started research involvement through the Summer Scholars program in June of 2023. She hopes to go on to graduate school and pursue a career in psychological or neuroscientific research, and is specifically passionate about improving the criminal justice system. In this experiment, Akira was most involved with the transcribing of memory recordings and the assessment of detail quality using a standardized framework for scoring/operationalizing recollected autobiographical memories.

List First then Last Name

James Elverson

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Physics
Major: Physics
Research Advisor: Thomas Vojta
Advisor Department: Physics

Funding Source: Dr. Vojta's Curators' Professors Funds

SHORT PROJECT TITLE

Stripe Order in a 3d model of diluted frustrated magnet

SHORT ABSTRACT

Many quantum materials feature low-temperature phases that break real-space symmetries in addition to spin or charge symmetries. Examples include stripe phases in cuprate superconductors, nematic phases in iron pnictides, and spin-density waves in magnetic materials. Realistic materials always contain some quenched disorder or randomness. To understand the effect of disorder on phases that break real-space symmetries, we investigate the influence of spinless impurities on a frustrated 3-dimensional J1-J2 Ising model through Monte Carlo simulations. Spinless impurities generate random field type disorder for the spin-density wave (stripe) phase in this system. Whereas the long-range stripe order is destroyed by the random fields in two dimensions, preliminary research shows that this is not the case in three dimensions. Preliminary research also shows that the first order phase transition of the undiluted 3- dimensional J1-J2 Ising model becomes second order by the addition of spinless impurities.

SHORT BIO IN 3rd PERSON

James Elverson is a second year physics major in Dr. Vojta's research group and is interested in the subject of condensed matter. He has been working with a 3-dimensional model of a diluted frustrated magnet since joining the group his freshman year.

List First then Last Name

Ryan Fagan

Joint project with Shelby Wallen

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Chemical Engineering
Research Advisor: Dr. Westenberg
Advisor Department: Biological Sciences

Funding Source:

SHORT PROJECT TITLE

Biosensors For Anti-Bacterial Medical Applications

SHORT ABSTRACT

Healthcare associated infections are a significant concern in medicine and as antibiotics are becoming less effective we need new alternative methods to treat them. We are testing various materials that can be used to prevent infections in healthcare settings and in wound treatment. These materials include bio-active glass and modified hydrogel materials. So from these studies we have learned that these effective at killing bacteria and preventing infections. The goal of this project is to determine the mechanism at which these materials kill bacteria. Our approach is to construct biosensor strains that can indicate bacterial stress response to antimicrobial agents. We have used polymerase chain reaction (PCR) to amplify promotors from known bacterial stress response genes. These include RecA, LasR, glpE. We are cloning these promotors in front of a promotor less LacZ gene to serve as an indicator of bacterial stress in response to our antibacterial materials.

SHORT BIO IN 3rd PERSON

Ryan is a senior in Biochemical Engineering with minors in business, chemistry, and biomedical engineering. She is also a member of Zeta Tau Alpha, Omega Chi Epsilon, American Institute for Chemical Engineers, and she works as a student paraprofessional for MST sports medicine. She had an intership for St. Louis County Enviromental Department.

List First then Last Name

Justin Fausto

Joint project with Benjamin Cuebas and Preston Carroll

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Electrical and Computer Engineering

Major: Electrical Engineering

Research Advisor: Dr. Rohit Due

Advisor Department: Electrical and Computer Engineering

Funding Source: Missouri University of Science & Technology

SHORT PROJECT TITLE

Deconstructed 555 Timer for Engineering Education

SHORT ABSTRACT

The Deconstructed 555 Timer and Application Circuits for Interactive Educational Experience offers interactional implementation of three fully discrete 555 Timer example circuits. The research project goal was to gain knowledge of the 555 Timer by deconstructing the device down to the component level. Three independent example application circuits, which showcase the application versatility of the 555 Timer in different modes, include Monostable, Astable, and Bistable circuits. Each mode has a hardware interface that can be used to adjust the operation of the 555 Timer allowing for a full interactive experience. The user can observe the differences in the internal working of the 555 Timer for the implemented applications. The built product is an educational and engaging interactive board which uses LEDs and LCD displays to describe the internal functionality of a 555 Timer and its application versatility. The undergraduate research concentrated on building skills in circuit design and product development.

SHORT BIO IN 3rd PERSON

Justin Fausto began attending Ozarks Technical Community College in the fall of 2020 and graduated in the spring of 2022 with an Associate's degree in Electrical Engineering. In the fall of 2022, he began attending Missouri University of Science & Technology, and will graduate with a Bachelor's degree in Electrical Engineering with a minor in Computer Engineering in the spring of 2025.

Currently, he serves as an Undergraduate Teaching Assistant, facilitating the laboratory portion of the course Introduction to Digital Logic. He is also the current president of a student organization on campus, the Embedded Systems Club.

Justin is employed in an engineering student co-op program at John Deere Remanufacturing as a Manufacturing Engineering Technician in their electronics division.

Any modifications to the abstract form format will result in immediate disqualification

List First then Last Name

Rebekah Floyd

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Civil, Architectural, Environmental Engineering
Major: Civil and Architectural Engineering
Research Advisor: Stuart Baur
Advisor Department: Civil, Architectural, Environmental Engineering

Funding Source: OURE & CArEE Department

SHORT PROJECT TITLE

Using VR Technologies in Built Environment Education

SHORT ABSTRACT

Virtual reality (VR) offers transformative potential in built environment education, including human-made surroundings like buildings and infrastructure. This review explores VR's benefits, challenges, and trends in this field.

VR fosters immersive learning, allowing students to explore architectural designs and urban planning scenarios. It provides hands-on experiences, enhancing spatial understanding and critical thinking. Simulations enable safe experimentation with design ideas and construction techniques without the real-life limitations or risk holding students back. However, challenges include high costs, technical limitations, and the need for educator training. Ensuring accessibility for all students is crucial. Despite challenges, VR's potential to revolutionize built environment education is evident. Future research should address technical and instructional hurdles and evaluate long-term impacts.

In conclusion, VR integration enhances built environment education, preparing students for careers in architecture, construction, and urban planning.

SHORT BIO IN 3rd PERSON

Rebekah Floyd is a transfer junior at Missouri S&T studying civil and architectural engineering. On campus, she has participated in ASCE, AGC, club volleyball, and is most involved with club rugby, serving as the club secretary and co-captain. This year, Rebekah has worked with Dr. Stuart Baur and a couple other students to learn how virtual reality can be used to better aid construction and design groups. She has done this by using plans from a previously made solar house to rebuild it in design software (Revit and Twinmotion) so students can give virtual tours of the solar houses without having to go to them. Outside of school organizations, Rebekah does work for her dad; aiding his project bidding process by providing Revit drawings and 3D renderings for the client.

List First then Last Name

Kamden George

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemistry
Major: Biological Sciences
Research Advisor: Dr. Chariklia Sotiriou-Leventis
Advisor Department: Chemistry

Funding Source: NSF/OURE

SHORT PROJECT TITLE

Drug loading and release based on aerogel morphology

SHORT ABSTRACT

This study explores the potential to predict the drug loading and release profiles of aerogels based on their morphologies: a milestone in drug delivery research which can help save time and cost invested in formulating new aerogel drug carriers and cut-down evaluation of the drug delivery capabilities of aerogels to a few experimental runs. Polyurea (PUA) and poly (isocyanurate-urethane) (PIR-PUR) aerogels were used as model systems while 5-fluorouracil (5-FU) and paracetamol (PM) were used as model drugs. These model systems were chosen because they can be synthesized into different morphologies identified by the so-called K-index (contact angle:porosity). The model drugs were loaded onto the aerogels using a physical adsorption method, and the drug-loaded aerogels were characterized with FT-IR, SEM, DSC, XPS and UV spectroscopy. Drugs could fill the porous network of the aerogels up to about 10% v/v and their release mechanism was predominantly through Fickian diffusion. Comparing all the morphologies studied, aerogels with K-indexes 1.2-1.6 could load larger amounts of drug, those with K-indexes 1.5 and 2.2 were more suitable for immediate-release formulations, those with K-indexes 1.2, 1.3 and 1.6-2.0 were more suitable for sustained release formulations, and nanofibrous morphology (K-index = 1.6) was more suitable for controlled release formulations.

SHORT BIO IN 3rd PERSON

Kamden George is a Junior majoring in Biological Sciences and minoring in Chemistry working as an OURE student in Dr. Chariklia Sotiriou-Leventis' chemistry lab. His research focuses on the effect of morphology on two aerogels, polyurea and poly (isocyanurate-urethane), and how different morphologies affect the ability of the aerogels to hold and release drugs, e.g. 5-fluorouracil and Paracetemol. Outside of the lab, Kamden works as a scribe in the Emergency Department at Phelps Health and enjoys football. Kamden plans to apply to PA school after attaining his baccalaureate degree.

List First then Last Name

Katharine Gray

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Chemistry
Research Advisor: Dr. Katie Shannon
Advisor Department: Biological Sciences

Funding Source: OURE

SHORT PROJECT TITLE

Cytokinesis and Dbf2

SHORT ABSTRACT

During cell division, the cytoplasm must be divided between the parent and daughter cell. The Mitotic Exit Network (MEN) is a signaling pathway that allows a dividing cell to exit mitosis and complete cytokinesis. Dbf2 is a MEN protein kinase in yeast, which provides a simplified model for studying this conserved pathway. By regulating Dbf2s ’ activity through phosphorylation mutants, its effect on cytokinesis can be studied. Cells were viewed under a microscope, to visualize division errors. Yeast cells that fail to complete cytokinesis will form chains, as the budding daughter cells fail to separate from their parents. Chains of 3 or more cells were considered to exhibit cell separation defects. Cells were also treated with Zymolyase, an enzyme that breaks down yeast cells walls, to determine that chain formation was a result of cytokinetic errors, and not the cell being unable to form the bud scar and close the cell wall. Additionally, new mutant strains were developed by transforming yeast cell lines using bacterial plasmids with Dbf2 mutant alleles. This information is relevant to human health. Dbf2 is a member of the Ndr kinase family. Its human homologue plays a role in the Hippo tumor suppressor pathway. Thus, mutations in this gene can lead to cancer. By studying the impact of mutations and phosphorylation in a simplified system, the overall mechanism can be better understood.

SHORT BIO IN 3rd PERSON

Katharine is a sophomore in the Chemistry department, with a focus area of Biochemistry. She is also working towards a minor in Biology, and is interested in pursuing academic research after graduation. She enjoys spending time in the lab, and learning new techniques. She was drawn to this project due to its real world implications in human health.

List First then Last Name

Charles Green

Joint Project with Elena Zobel

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: S&T OURE Program

SHORT PROJECT TITLE

C. elegans populations in the presence of P. pacificus

SHORT ABSTRACT

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

SHORT BIO IN 3rd PERSON

Charles Green is a Biological Sciences student at The Missouri University of Science and Technology. He has completed 3 semesters and has had multiple semesters of research, as well as a published research paper. He is looking at multiple options to further his education in the future and is excited to continue research in biology.

List First then Last Name

Joely (Grace) Hall

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: English and Technical Communication
Major: Psychological Sciences
Research Advisor: Jossalyn Gale Larson
Advisor Department: English and Technical Communication

Funding Source: OURE Department and Outside Grant

SHORT PROJECT TITLE

Neurodivergence & Artificial Intelligence (AI) in Writing

SHORT ABSTRACT

Neurodivergent individuals encompass a broad spectrum of cognitive profiles, including autism, ADHD, dyslexia, depression, anxiety and other neurological differences and learning disabilities. Over the past decade, artificial intelligence (AI) technologies have rapidly evolved, permeating various aspects of society, from healthcare to education and employment. AI often makes mistakes when analyzing papers written by neurodivergent students and flags them for plagiarism, when there is no plagiarism in the paper. We want to investigate why this happens and ways to work around this. We have put together a Prolific survey to get general opinions on AI, neurodiversity types and writing classes. With this, we will analyze the results of those who have been wrongly accused of cheating, and said to be using an AI, to get a better understanding of artificial intelligence use in the writing classroom. On the other hand, we highlight emerging research and innovative applications of AI that offer promising avenues for supporting neurodivergent individuals. From personalized learning platforms and assistive technologies, AI-driven solutions have the potential to enhance accessibility, facilitate neurodiversity acceptance, and foster inclusive environments. In conclusion, this analysis underscores the complex interplay between neurodiversity and AI, urging for a nuanced approach that recognizes the diverse needs and strengths of neurodivergent individuals.

SHORT BIO IN 3rd PERSON

Joely (Grace) Hall is a dedicated athlete and aspiring researcher with a passion for both volleyball and artificial intelligence (AI). Currently representing Missouri S&T on the volleyball court, Grace's enthusiasm for sports drives her to be successful in the classroom and maintain a 3.7 GPA. Currently working under esteemed professors Dr. Shank and Dr. Canfield, Grace is deeply involved in a groundbreaking research project aimed at enhancing the organ transplant system by designing an AI algorithm to optimize kidney allocation, striving to increase transplant success rates and save lives. Grace's interdisciplinary pursuits in Psychology and Biology reflect her commitment to leveraging AI for impactful solutions in healthcare and beyond.

List First then Last Name

Alexis Winner

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Wild Worms vs. Lab Worms in a Laboratory Ecosystem

SHORT ABSTRACT

The model organism Caenorhabditis elegans lives artificially in labs since the 1970s. The question at hand is how well adapted the so-called wild-type strain is to these lab conditions. We developed a laboratory ecosystem based on wild type C. elegans and E. coli as food resource to investigate the impact of mutations that affect life history traits. In this project, we explore whether the observed population dynamics reflect wild C. elegans populations. In more detail, we compare the population dynamics of wild type worms and worms collected recently in different parts of the world.

SHORT BIO IN 3rd PERSON

Alexis Winner is a third year student at Missouri S&T. She graduated from East Central College with an Associate of Arts Degree and transferred to Missouri S&T to major in biological sciences. After She graduates, she hopes to continue her education in medical school to obtain her CRNA license.

List First then Last Name

Jordan Hartfield

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Zhi Liang
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: NSF Grant No. 2310833

SHORT PROJECT TITLE

Effects of Surface Contaminants on the MAC of Water

SHORT ABSTRACT

The evaporation or condensation rate of a liquid surface is directly proportional to the mass accommodation coefficient (MAC). Since the MAC is difficult, if not impossible, to experimentally measure, molecular dynamics (MD) simulations have been employed to study it. Experimental studies have shown that airborne hydrocarbon contaminants from a variety of sources can adsorb on liquid surfaces and significantly alter the surface properties. We have therefore studied the effects of organic surface contaminants, which are immiscible with water, on the MAC using equilibrium and nonequilibrium MD simulations. Our equilibrium MD simulation results show that the MAC decreases linearly with increases in surface coverage by contaminants while the nonequilibrium MD simulations show that the Schrage equation, which has been proven to be accurate in predicting the evaporation and condensation rates of clean liquid surfaces, is also accurate in predicting the evaporation and condensation rates of contaminated water surfaces. We have also validated the key assumption about the molecular velocity distribution in the Schrage analysis for vapor molecules near the water surfaces. When the water surface is almost completely covered by contaminants, we find that the adsorption flux of vapor molecules dominates over evaporation or condensation flux and leads to a false prediction of the MAC from the Schrage equation.

SHORT BIO IN 3rd PERSON

Jordan Hartfield is a senior mechanical engineering student who has been working with Dr. Zhi Liang on the research of water evaporation and condensation rates for nearly a year. He spent the summer of 2023, funded by the Future Research Pioneers Program (FRPP) and the Opportunities for Undergraduate Research Experiences (OURE), working on the effects of organic surface contaminants on water surfaces and has since been deepening his understanding of the underlying principles of molecular dynamic simulations. Jordan plans to start his Ph.D of mechanical engineering in the fall of 2024 with a focus on thermal fluid sciences. He hopes to use MD simulations for conducting more research on the effects of surface contaminants in evaporation and condensation processes so that he might be able to better model these processes and their applications.

List First then Last Name

Harrison Hawxby

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemistry
Major: Chemistry
Research Advisor: Grubbs
Advisor Department: Chemistry

Funding Source: United States Department of Energy

SHORT PROJECT TITLE

Laser Ablation pulsing on a CP-FTMW

SHORT ABSTRACT

The goal of this research is to study metal containing molecules in the gas phase for structural determination. In order to do this, a metal rod that is turning on a 12V motor is struck by a Nd:YAG laser. Rotational spectra were recorded on a chirped-pulse Fourier transform microwave spectrometer (CP-FTMW) with laser ablation sourcing. Along the way, maintenance on the setup was required, new code was written to accomodate for new problems, as well as production and parametrization of the gas to optimize signal.

SHORT BIO IN 3rd PERSON

List First then Last Name

Ian Hodge

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Engineering Management and Systems Engineering
Major: Engineering Management
Research Advisor: Dr. Abhijit Gosavi
Advisor Department: Engineering Management and Systems Engineering

Funding Source: N/A

SHORT PROJECT TITLE

Analysis of the benefits/risks of Just in Time Inventory

SHORT ABSTRACT

Just in time (JIT) inventory management has become increasingly popular in industry due to its well known benefits. JIT aims to streamline inventory processes by minimizing excess stock, reducing holding costs, and improving operational efficiency overall. This approach introduces inherent risks, by minimizing the safety stock the company becomes more vulnerable to supply chain disruptions. If unexpected circumstances lead to a supply delay, the company will rapidly deplete their supplies and may have to cease operations until they are resupplied, resulting in decreased revenue and leaving customers unfulfilled.This research project will examine case studies of companies that adopted JIT methodology to comprehend the factors influencing its success or failure. The factors that affect the benefits and risks will be discussed, and risk mitigation strategies will be proposed. Computer simulations will be created to collect data on how the benefits and risks of varying inventory sizes result, and to determine the ideal safety stock level to ensure the risks do not outweigh the rewards. It is crucial to first understand the benefits, risks, and influencing factors before implementing JIT inventory management, or any process change so that the potential benefits can be maximized and the risks are accounted for and mitigated. This research aims to produce insights that will benefit organizations considering JIT inventory management.

SHORT BIO IN 3rd PERSON

Ian Hodge is a senior in Engineering Management with an emphasis in Industrial Engineering and a minor in Psychology. He intends to graduate in May of 2024 as an Honors Academy Fellow. He has held two internships so far. The first internship was working for Distribution Management as a Supply Chain Intern. After this internship, Ian developed a strong interest in how business operations can be improved and made more efficient. His second internship was working as a Supply Chain Intern at a PepsiCo manufacturing facility in St. Louis. Ian will be working full time as a Supply Chain Campus Hire for PepsiCo after his graduation.

List First then Last Name

Gracie May James

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Nuclear Engineering
Major: Nuclear Engineering
Research Advisor: Catherine Johnson
Advisor Department: Mining and Explosives Engineering

Funding Source: Energetics Reasearch Lab - Missouri S&T

SHORT PROJECT TITLE

TNT Equivalence of Binary Energetics

SHORT ABSTRACT

TNT equivalency is a standard used to measure and quantify the effects of energetic materials. Using these equivalencies, the safety factors for minimum distances and storage of explosives are determined. Having a known TNT equivalence of energetic materials also helps estimate potential blast damage and risks for individuals. The TNT equivalencies for numerous energetic materials, such as binaries, have no published values, but are regularly used in industry, military, and research testing. To determine TNT equivalence, three tests were performed: 1) a plate dent test for direct dent comparison, 2) air blast tests to measure air overpressure and calculate impulse, and 3) velocity of detonation test.The data collection methods were validated by also testing commonly published explosive equivalencies, namely Composition B. New values for Helix, Texpak, Tannerite, dynamite, and Kinepak were determined. This research produced TNT equivalency values for commonly used explosives and provided recommendations for an inexpensive and repeatable method of determining TNT equivalence. These results aim to provide helpful insight for law enforcement and the military into the effects of different energetic materials. Standardizing these TNT equivalency values for energetic materials will ensure safe procedures that mitigate the potential risks and blast damage for the military and law enforcement when handling, storing, or detonating explosives

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SHORT BIO IN 3rd PERSON

Gracie May James is a junior at Missouri S&T who is majoring in nuclear engineering and minoring in explosives engineering. She helps conduct research for the explosive engineering department under Dr. Catherine Johnson.

List First then Last Name

Amelia Markwell

Joint project with Sophia Nicolette Militante

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department:

Major: Biological Sciences

Research Advisor: Dr. David J Westenberg

Advisor Department: Biological Sciences

Funding Source: Biological Sciences Department

SHORT PROJECT TITLE

Microbe Emulation: Cell-Cell Communication

SHORT ABSTRACT

This research project focuses on looking at different quorum-sensing positive strains in bradyrhizobium japonicum, a species of legume-root bacteria found in soybean plants across the Midwest. Soybean plants are a high-yield crop produced here in the midwest, bringing in more than 8 billion dollars in monetary output for our state, making it Missouri's economic engine. Our objective, is to use different chemical testing methods to distinguish genetic differences between negative strains. This can be done through polymerase chain reaction, gel electrophoresis, and gene editing. Our goal has been to PCR amplify a fine-tuned promoter then clone it into the gene. In previous studies, drought has been shown to reduce nitrogen fixation in plants. When bacteria infect these plants, they leave behind nodules containing different chemical compounds, and so by studying these strains grown in Missouri and learning what we can about the existing bacteria, we could potentially create a drought-resistant bacteria strain and focus on the genetics and competition that go into each compound makeup.

SHORT BIO IN 3rd PERSON

Amelia Markwell is a current Undergraduate Student at Missouri S&T, majoring in Biological Sciences.She has been working in Dr. Westenberg's lab since she was a freshman, and is involved in various campus extra curriculars including SCRUBS, HELIX, the Student Union Board, and more. Oringinally from Seattle, WA, Amelia graduated from Mary Institute and St. Louis Country Day School in the Spring of 2022, and hopes to continue her education in Medical School after her bachelor's degree. Outside of the classroom, Amelia enjoys playing in Viola in the Missouri S&T Orchestra, and can often be seen walking her Beagle, Winston around campus. In her free time, she enjoys reading, cooking, and volunteering.

List First then Last Name

Sophia Nicolette Militante

Joint project with Amelia Markwell

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: B.S. Biological Sciences
Research Advisor: Dr. David J. Westenberg
Advisor Department: Biological Sciences

Funding Source: Biological Sciences Department

SHORT PROJECT TITLE

Microbe Emulation: Cell-Cell Communication

SHORT ABSTRACT

This research project focuses on looking at different quorum-sensing positive strains in bradyrhizobium japonicum, a species of legume-root bacteria found in soybean plants across the Midwest. Soybean plants are a high-yield crop produced here in the midwest, bringing in more than 8 billion dollars in monetary output for our state, making it Missouri's economic engine. Our objective, is to use different chemical testing methods to distinguish genetic differences between negative strains. This can be done through polymerase chain reaction, gel electrophoresis, and gene editing. Our goal has been to PCR amplify a fine-tuned promoter then clone it into the gene. In previous studies, drought has been shown to reduce nitrogen fixation in plants. When bacteria infect these plants, they leave behind nodules containing different chemical compounds, and so by studying these strains grown in Missouri and learning what we can about the existing bacteria, we could potentially create a drought-resistant bacteria strain and focus on the genetics and competition that go into each compound makeup.

SHORT BIO IN 3rd PERSON

Sophia Nicolette Militante is a freshman majoring in B.S. Biological Sciences, with an emphasis on Medical Laboratory Science. An international student from the Philippines, she is currently a First Year Research Experience (FYRE) participant under Dr. David Westenberg.

List First then Last Name

Vale Miller

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Environmental Science & Philosophy
Research Advisor: Dev K. Niyogi
Advisor Department: Biological Sciences

Funding Source: OURE

SHORT PROJECT TITLE

Stream Fungal Biodiversity and Leaf Decomposition

SHORT ABSTRACT

CURRENTLY ONGOING PROJECT

We are investigating the possible impact of aquatic fungi biodiversity on leaf litter decomposition and respiration. Four different species of aquatic fungi were placed into flasks with leaf cores (A, B, C, and D), one with no fungi as a control, and one with all four species in equal amounts (ABCD). So far, there seems to be little to no effect on respiration between the species and similar results in the flasks with all four species. Based on this information, biodiversity has yet to show a signifiant impact in leaf respiration and little to no effect on decomposition.

SHORT BIO IN 3rd PERSON

Vale is an environmental science major with an interest in wetland conservation and research. They are currently researching with freshwater ecology professor Dr. Dev Niyogi. Vale enjoys video games, spelunking, and the color pink.

List First then Last Name

Clark Nguyen

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Material Science Department
Major: Metallurgical Engineering (B.S.)
Research Advisor: Dr. Mario Buchely
Advisor Department: Material Science Department

Funding Source: PSMRC

SHORT PROJECT TITLE

Thermogravimetric Analysis of High & Low Alloy Steel

SHORT ABSTRACT

Oxidation phenomena play a critical role in high temperature metallurgical processing and the performance during life cycle of components made of both high and low alloy steels. Therefore, the development of a precise experimental methodology to quantify oxidation processes is critically important. This report summarizes my experimental study of the oxidation behavior of high and low alloy steel, including kinetics of surface oxide layer formation and spallation. The focus of study was in determining the complex interactions between alloying elements in steel matrix and oxidation environment, composition and surface morphology of formed oxides. This report will also explore how the introduction of a low oxygen or high oxygen atmosphere along with the various temperatures affects the growth of scale. The developed methodology allowed me to investigate the real industrially produced steels with as-cast and machined surfaces. Such investigations were limited before when used equipment permitted only small test specimens. This summary also discusses the methods of thermo-gravimetric analysis(TGA) and its use to quantify oxidation effects and what this data reveals about the relationship between oxidation and the conditions experienced by steel samples.

SHORT BIO IN 3rd PERSON

Clark Nguyen is a dedicated junior in Metallurgy with a passion for understanding the intricate properties and behaviors of metals. Clark's academic journey has been filled with many experiences and opportunities related to the field of material science. As an honor's student, his honor's projects like in PHY 2235 where he studied the concept of energy in materials or MATH 3304, where he analyzed and reported on the use of differential equations and the Laplace transformation in metallurgy, specifically during heat transfer and phase transformation. Beyond his classwork academics, Clark is also an undergraduate researcher with the PSMRC project where he works on The Scale Research Project which is ran by Dr. Mario Buchely and Dr. Ron O'Malley. Here he has studied and worked on the effects of scale and the kinetics of steel as observed by thermogravimetric analytics.

List First then Last Name

Landon Oelschlaeger

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mathematics and Statistics
Major: Applied Mathematics
Research Advisor: Gayla Olbricht
Advisor Department: Mathematics and Statistics

Funding Source: OURE

SHORT PROJECT TITLE

Drosophila Sleep Modeling

SHORT ABSTRACT

In this research, a statistical model was developed to predict the lifespan of the fruit fly, Drosophila melanogaster, based on the sleep characteristics of the fly using the first 30 days of data. Previously, a model was developed using variables based on the transition probabilities of a fly staying awake or asleep from minute-to-minute. This research builds on the previous work by incorporating additional variables based on traditional sleep metrics along with the transition probability variables into the modeling process. A method was first developed to automate the generation of the traditional sleep metrics, enabling them to be included in the model. Forward stepwise selection was used to determine an appropriate number of predictor variables before using best subset selection to determine the strongest model for that number of variables. Models were evaluated by comparing the original model with the model including the traditional variables.

SHORT BIO IN 3rd PERSON

Landon Oelschlaeger is a sophomore studying Applied Mathematics with a focus in Data Science and Statistics as well as Computer Science at the Missouri University of Science and Technology. He is a member of the Missouri University of Science and Technology Honors Academy. Landon is also a member of the Missouri University of Science and Technology Men's Track and Field Team where he throws javelin.

List First then Last Name

James Ramette

Joint Project with Patrick Appiah

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: David Duvernell
Advisor Department: Biological Sciences

Funding Source: PSMRC

SHORT PROJECT TITLE

Genetic Diversity of Ericymba Dorsalis

SHORT ABSTRACT

The study of North American freshwater ichthyofauna reveals a diversity shaped by the continent's geologic past and the extensive effects of Pleistocene glaciation on river systems. Ericymba dorsalis (Bigmouth Shiner) is a minnow species with a broad distribution in the Mississippi River basin from Wyoming to New York. Despite exhibiting consistent morphological features across its range, the species' widespread northern distribution suggests the potential existence of multiple, genetically distinct lineages. This research tested the hypothesis that separate drainage systems harbor genetically distinct groups of E. dorsalis. Our results identified five clades, each associated with major drainages. Populations of the Missouri River, upper Mississippi River, and Illinois River, respectively, grouped into three clades with divergence of 1.3-1.6%, indicating a Pleistocene origin. Three disjunct populations located in Great Lakes tributaries in western Michigan, Ohio, and New York, respectively, formed a fourth clade, and population samples from the Allegheny River in Pennsylvania formed a fifth clade. The divergence of the Great Lakes and Allegheny clades from the western clades ranged 4.3-5.3%, suggesting an early Pleistocene or Pliocene origin. This pattern of distribution underscores the role of vicariance biogeography during Pleistocene glaciation, on the current distribution of genetic diversity in E. dorsalis.

SHORT BIO IN 3rd PERSON

James Ramette is a Junior in Biological Sciences who plans to apply to medical school this coming cycle. James enjoys challenging himself academically and learning new information. He is currently the Service Chair for the fraternity Kappa Alpha here on campus, a child mentor for Mentoring Makes a Difference, and a member of the AHEC Scholars program along with being an undergraduate researcher. In his free time, James enjoys hiking and reading.

List First then Last Name

Gabriel Riddle

Joint project with Matthew Dominicis, Mason Toombs, and Parineeta Puja Saha

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Physics
Research Advisor: Avah Banerjee
Advisor Department: Computer Science

Funding Source: N/A

SHORT PROJECT TITLE

T Gates on a Quantum Circuit to Achieve Randomness

SHORT ABSTRACT

T gates can be inserted into a randomly generated Clifford circuit with the aim of enhancing its capacity for creating a universal unitary. This study investigates the impact of incorporating T gates on the overall randomness of the circuit output. The experiments focused primarily on the generation of random clifford circuits using different techniques and the effect of T gates on the generated circuit. Through a series of simulations and analyses, the research assesses the effectiveness of this modification in achieving a more unpredictable output while minimizing the necessary number of Clifford gates. The findings contribute valuable insights into randomly generated quantum circuits, shedding light on potential applications in quantum computing.

SHORT BIO IN 3rd PERSON

Gabriel Riddle is a third-year physics student. His past research includes a FYRE project, an OURE project, and a summer internship, all focused on Nuclear Magnetic Resonance spectroscopy research in the chemistry department with Dr. Woelk. He also completed an internship with Dr. Banerjee in the computer science department. Additionally, Gabriel is involved in an OURE project, both pertaining to the theory of quantum computation.

Gabriel is a member of the Honors Academy and a Kummer Vanguard Scholar. He serves as a physics tutor and has consistently made the dean's list every semester. In his spare time, he enjoys writing poetry, playing Dungeons & Dragons, and training in various physical disciplines, including heavyweight training and aikido.

List First then Last Name

Mikaela Ritchie

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Jee-Ching Wang
Advisor Department: Chemical Engineering

Funding Source: OURE Scholarship and MS&T ChE Department

SHORT PROJECT TITLE

PCL Nanoparticles to Remove Endotoxin in Water

SHORT ABSTRACT

Lipopolysaccharides (LPS), also known as endotoxins, are toxins released from the cell walls of gram-negative bacteria upon their death. Ingestion of LPS by humans or animals can initiate inflammatory immune responses, resulting in blood vessels dilation, organ dysfunction and potential death. These toxins contaminate a variety of manufacturing processes from the pharmaceutical industry to animal feed production, posing a risk to humans and animals alike. This study details the production of PCL nanoparticle capable of removing LPS from water and a preliminary analysis of the removal efficiency. The outcomes of this research hold significant implications for industries reliant on bacterial cultures and biological material, offering an inexpensive potential solution to mitigate LPS contamination.

SHORT BIO IN 3rd PERSON

Mikaela Ritchie is a senior studying Biochemical Engineering at Missouri University of Science and Technology. She enjoys combining her knowledge of math, physics, chemistry and biology in research beneficial across industries. Outside of the lab, Mikaela enjoys serving in her local community as well as traveling to Central America with various Christian ministries and humanitarian efforts.

List First then Last Name

Parineeta Puja Saha

Joint project with Gabriel Riddle, Mason Toombs and Mathew Dominicis

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Avah Banerjee
Advisor Department: Computer Science

Funding Source: N/A

SHORT PROJECT TITLE

T-Gates on a Quantim Circuit to Achieve Randomness

SHORT ABSTRACT

T-gates can be inserted into a randomly generated Clifford circuit with the aim of enhancing its capacity for creating universal unitary. This study investigates the impact of incorporating T-gates on the overall randomness of the circuit output. The experiments focused primarily on the generation of random clifford circuits using different techniques and the effect of T-gates on the generated circuits. Through a series of simulations and analyses, the research assesses the efffectiveness of this modification in achieving a more unpredictable output while minimizing the necessary number of Clifford gates. The findings contribute valuable insights into randomly generated quantum circuits, shedding light on potential applications in quantum computing.

SHORT BIO IN 3rd PERSON

Parineeta Puja Saha is a Junior with a major in Computer Science and a minor in mathematics. She is soon to graduate in December of 2025. She is currently doing research under Dr. Avah Banerjee for OURE and her main focus of topic is theory of Quantum Computation. In her free time she enjoys reading and photography. She is also a member of SWE(Soceity of Women Engineers) and attented the national SWE conference in Fall of 2023. She is also an active member of the International Student Club (ISC) as a financial officer and hosted ISC day in May 2023. She currently works for the IT Help Desk as her part time job for Missouri S&T.

List First then Last Name

Lindsay Schneider

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Xenobiotic-Induced Developmental Neuropathology

SHORT ABSTRACT

As new drugs and pollutants are introduced, a larger subset of people are exposed. The question that arises is whether exposure of a pregnant woman to drugs/pollutants will have negative effects on the neurobiology of her unborn child. We are establishing a screen to test the effects of drugs and pollutants on the developmental neuropathology of the model organism, Caenorhabditis elegans. The roundworm has 302 neurons that are structurally similar to human neurons, and defects in single neurons can be detected by impairment in their neural behaviors such as chemotaxis towards an attractant. Using a chemotaxis assay, we can investigate whether pollutants and xenobiotics induce neuropathologies in animals exposed in early developmental stages. We will discuss our approach and first results.

SHORT BIO IN 3rd PERSON

Lindsay Schneider is a freshman in biological sciences at Missouri S&T. In addition to participating in the FYRE program, Lindsay is a PR Chair of the iGEM design team and an active member of SCRUBS and Helix. After graduating from S&T, she hopes to pursue medical lab science.

List First then Last Name

Noah Sparks

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemical Engineering
Major: Chemical Engineering with Biochemical emphasis
Research Advisor: Dr. Hu Yang
Advisor Department: Chemical Engineering

Funding Source: Dr. Yang's lab

SHORT PROJECT TITLE

Ionizable Lipid Nanoparticles Characterization

SHORT ABSTRACT

In this project ionizable lipids were analyzed for their efficacy in delivery of mRNA in multiple metastatic lung cancer cells. Different ionizable lipids with their molar ratio in making the LNPs were analysed in order to enhance the nucleic acid delivery to cytoplasm. Phospholipids also play a role in targeting efficacy of the LNPs to the lung cells. Different combination of ionizable lipids with multiple phospholipids were studied for physical characterization and in-vitro transcription efficiency. Transcription efficiency was then quantified using flow cytometry and optimal particles for transcription were noted.

SHORT BIO IN 3rd PERSON

Noah Sparks is a senior Chemical engineering student with a passion for research. He has worked in Dr. Yang's lab since freshman year and had OURE projects with them for the past two years. He is a hardworking student who works to maintain good grades, while getting experience within the lab. He hopes to work in the biochemical research field and believes undergraduate research will give him the experience necessary to thrive in the field.

List First then Last Name

Aaron Spillars

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: MAE
Major: Aerospace Engineering
Research Advisor: Xiaosong Du
Advisor Department: MAE

Funding Source: n/a

SHORT PROJECT TITLE

Airfoil Design Optimization using Machine Learning

SHORT ABSTRACT

Machine learning and optimization are the stepping blocks in broad engineering areas, such as computational fluid dynamics (CFD) and CFD-based design optimization. Using the CFD-based optimization framework, MACH-Aero, we were able to use the SLSQP optimizer and compared the results with a reference case completed by the SNOPT optimizer. Results verified that our SLSQP optimizer was working properly. The solver created showed that our objective function had a difference in magnitude of 0.000019 allowing us to conclude that our solver was working as intended. However there were several failed attempts before reaching a successful run that gave us a satisfactory result. Further work was done to attempt to make a solver that can handle cases of similar types to the failed one. Efficient global optimization will eventually be paired with the CFD solver, which is expected to result in successful runs using the previous unsuccessful conditions while alleviating computational costs.

SHORT BIO IN 3rd PERSON

Aaron Spillars is a senior undergraduate student studying Aerospace Engineering. Last summer he joined Dr. Du's research team "Phlai Lab" and began working on airfoil optimization. While not working on research, he is a member, and secretary, of the volleyball club, and can be found working at the student rec center. Once graduated, Aaron would like to find a job involving failure analysis.

List First then Last Name

Briannah Spisak

76

Joint project with Kaylee Denbo

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Civil, Architectural, and Environmental Engineering

Major: Environmental Engineering

Research Advisor: Dr. Joel G Burken

Advisor Department: Civil, Architectural, and Environmental Engineering

Funding Source:

SHORT PROJECT TITLE

Analysis of 1,4 Dioxane in Plants

SHORT ABSTRACT

Missouri S&T collaborates with University of Iowa on projects to identify the presence of 1,4 Dioxane in tree core samples. The research group will replicate the situation in smaller reactors on campus. The following materials will be used: conetainers, willow cuttings, biochar, and perlite. The plants will be dosed with 1,4-Dioxane and analyzed with Gas Chromatography-Mass Spectrometry (GCMS). Plant growth and health will be monitored and related to growth conditions and pollutant exposure. Larger mesocosms will be dosed over the summer and will have in-planta analysis as well.

To replicate the field site, exact biochar and perlite from the manufacturer will be used. There will be four species of willow tree planted in three ratios of perlite and amended with biochar. The three ratios are 0% perlite with 100 % biochar, 10% perlite with 90% biochar, and 20% perlite with 80% biochar. There are 10 replicates of each ratio. The plants will be dosed with 1,4-Dioxane. Plant growth will be analyzed by measuring biomass, height, leaf count, taking images for image analysis, and scanning root structure. Cuttings will be taken for analysis and placed in the centrifuge. Then, solution will be extracted to run in GCMS. Data will be compared to the University of Iowa site.

SHORT BIO IN 3rd PERSON

List First then Last Name

Sophia Strathman

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Jonathan Kimball
Advisor Department: Electrical and Computer Engineering

Funding Source: N/A

SHORT PROJECT TITLE

Data Driven Enhanced VSG Control for Microgrids

SHORT ABSTRACT

This research explores the fusion of deep reinforcement learning and virtual synchronous generator control in a bid to enhance microgrid operations. Microgrids typically consist of multiple inverter-based distributed generators (IBDGs) connected in parallel to mismatched line impedances. This results in unequal reactive power sharing which negatively impacts the performance of IBDGs in microgrids. To achieve enhanced control, a solution utilizing deep reinforcement learning (DRL) is proposed. DRL agents are trained to control variables in each IBDG using a well-designed reward function capable of achieving the following objectives: 1.) ensure output voltage of each IBDG remains within the designated operating boundary and 2.) minimize IBDG RPSE. The proposed DRL method is then compared to the classical droop method under various system disturbances. This exploration into the integration of DRL into microgrid applications holds the potential to revolutionize future grid control methods.

SHORT BIO IN 3rd PERSON

Sophia Strathman is a fourth-year undergraduate electrical engineering student at the Missouri University of Science and Technology with a passion for renewable energy technology and the possibilities of deep reinforcement learning. She actively contributes to research projects focused on microgrids, deep reinforcement learning, renewables, electric vehicle fast charging, and power electronics. She has interned at Spire Energy and Burns & McDonnell and is planning to intern at Oak Ridge National Lab for the summer of 2024. Driven by a desire to make a positive impact, she is eager to continue exploring the frontiers of deep reinforcement learning within microgrid applications.

List First then Last Name

Henry Tien

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Yun Seong Song
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: National Science Foundation

SHORT PROJECT TITLE

Development of Purturbation Device for pHHI Research

SHORT ABSTRACT

The vision of developing more advanced robots that physically interact with people begins with the study of how people interact with each other. Even the simplest interactions between humans, such as shaking hands, provides tremendous challenges for current robots and minimal research has been conducted on the inner workings of these interactions. Understanding the process and mechanics behind effective and intuitive physical human-human interaction (pHHI) will yield meaningful insight into designing robots capable of assisting the elderly, operating side by side with workers, or even dancing with people. To study this process, a custom Force Perturbation Handle (FPH) was developed, including the necessary mechanical, electrical, and software components, to study the haptic communication between humans. The device records the forces and torques generated by an interacting human pair and provides controlled outward actuations to measure the pair's response to a sudden force. This device will allow the collection of pHHI data that will be analyzed using a novel stiffness estimation technique developed at pHRI-lab to gain valuable insight into how physical interactions are modulated in humans and its applications for future collaborative robots.

SHORT BIO IN 3rd PERSON

Henry Tien is a senior in Mechanical Engineering with plans to pursue graduate education at Missouri University of Science and Technology. Since January 2023, he has been conducting undergraduate research in physical Human-Robot Interaction under Dr. Song. He has completed five internships in robotics and warehouse automation and hopes his research will help bridge the gap between humans and robots in industry.

List First then Last Name

Mason Toombs

Joint project with Matthew Dominicis, Gabriel Riddle, and Parineeta Puja Saha

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Physics, Computer Science
Research Advisor: Avah Banerjee
Advisor Department: Computer Science

Funding Source: N/A

SHORT PROJECT TITLE

T Gates on a Quantum Circuit to Achieve Randomness

SHORT ABSTRACT

T gates can be inserted into a randomly generated Clifford circuit with the aim of enhancing its capacity for creating a universal unitary. This study investigates the impact of incorporating T gates on the overall randomness of the circuit output. The experiments focused primarily on the generation of random Clifford circuits using different techniques and the effect of T gates on the generated circuit. Through a series of simulations and analyses, the research assesses the effectiveness of this modification in achieving a more unpredictable output while minimizing the necessary number of Clifford gates. The findings contribute valuable insights into randomly generated quantum circuits, shedding light on potential applicaitons in quantum computing.

SHORT BIO IN 3rd PERSON

Mason Toombs is a senior double majoring in Physics and Computer Science and will graduate in May of 2024. After graduation he plans to attend graduate school in order to pursue a career in quantum computing technology. Mason is participating in OURE, and is a member of Misouri S&T's Honors Academy. He serves as the Aerial Swing Dance Club's President and as one of its dance instructors, alongside being the Perfect 10 Improv Troupe's Treasurer with previous experience in serving as the troupe's Vice President. He has work experience through his internship at Southwest Research Institute during the summer of 2023, and will work at Garmin for his next internship this summer.

List First then Last Name

Rae Tordilla

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Katie Shannon
Advisor Department: Biological Sciences

Funding Source: FYRE

SHORT PROJECT TITLE

How does the C-terminus of Iqg1 work in cytokinesis?

SHORT ABSTRACT

During cytokinesis, the division of the cytoplasm between cells is controlled by the contraction of an actomyosin ring. Iqg1, a crucial regulator of cytokinesis in Saccharomyces cerevisiae, is needed for the assembly and contraction of this ring. Already, it has been found that a domain in the Iqg1 C-terminus is crucial for S. cerevisiae survival. In this study, a regulated Iqg1 allele is introduced to yeast. This will allow researchers to turn off the wild-type allele of the Iqg1 gene under specified conditions, which allows for the study of the effects of the C-terminal Iqg1 deletion. Progress towards making the desired yeast strain is monitored by making protein extracts e to examine Iqg1 expression. This research into Iqg1 could potentially provide insight into public health, as IQGAP proteins, a family in which Iqg1 is a member, have implications in human cancer.

SHORT BIO IN 3rd PERSON

Rae Tordilla is currently a B.S. Biological Sciences freshan at Missouri S&T. They are currently involved in iGem, Kummer Vanguard, and helping Dr. Shannon with her research in FYRE.

List First then Last Name

Shelby Wallen

Joint project with Ryan Fagan

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Bio-Chemical Engineer
Research Advisor: Dave Westenburg
Advisor Department: Biological Sciences

Funding Source: N/A

SHORT PROJECT TITLE

Biosensors for Anti-Bacterial Medical Applications

SHORT ABSTRACT

Healthcare associated infections are significant concern in medicine and as antibiotics are becoming less effective we need new alternative methods to treat them. We are testing various materials that can be used to prevent infections in healthcare settings and in wound treatments. These materials include bioactive glass and modified hydrogel materials. From these studies we've learned these are effective in killing bacteria and preventing infections. The goal of this project is to determine the mechanism at which these materials kill bacteria. Our approach is to construct biosensor strains that can indicate bacterial stress response to antimicrobial agents. We have used polymerase chain reaction (PCR) to amplify promoters from known bacterial stress response genes. These include recA, lasR, and glpE. We are cloning these promoters in front of a promoter less lacZ gene to serve as an indicator of bacterial stress in response to antibacterial materials.

SHORT BIO IN 3rd PERSON

Shelby is a senior in Biochemical engineering. She is apart of the Lambda Sigma Pi service organization and held many executive board positions. Shelby has had an internship at Brewer Science and enjoys being in the lab. She hopes to go into a career that is very hands on and in the medicinal field.

List First then Last Name

Kayla Walters

Joint project with Rebekah Floyd

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Civil, Architectural, and Environmental Engineering
Major: Architectural Engineering
Research Advisor: Stuart Baur
Advisor Department: Civil, Architectural, and Environmental Engineering

Funding Source: OURE & CArEE Department

SHORT PROJECT TITLE

Virtual Reality in Built Environment Education

SHORT ABSTRACT

This research explores the utilization of Virtual Reality (VR) technologies in the built environment, focusing on enhancing visual communication. Recognizing the significance of visual comprehension in industries involving belt environment, the study investigates the effectiveness of VR in providing immersive learning experiences. By analyzing various applications and virtual environments, the research aims to bridge the gap between theoretical knowledge and practical skills. Utilizing a mix of qualitative and quantitative methods, including surveys and interviews, the study assesses the perceived benefits of VR in spatial understanding and collaborative problem-solving. It also addresses challenges such as accessibility and cost associated with VR implementation. The findings contribute valuable insights for educators and stakeholders, offering a comprehensive understanding of VR's potential to transform built environment education. Ultimately, this research informs the ongoing discourse on integrating immersive technologies to improve visual communication skills within architectural and engineering disciplines.

SHORT BIO IN 3rd PERSON

Kayla is a Junior in Architectural Engineering at Missouri S&T. She is the president of the Solar House Design Team and is on the Women's Club Volleyball Team.

List First then Last Name

Grace Wilbanks

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences BS
Research Advisor: Dr. Dev Niyogi
Advisor Department: Biological Sciences

Funding Source: The Summer Scholars Program and Biological Sciences Department

SHORT PROJECT TITLE

Evaluation of Phosphorus Uptake for Nutrient Removal

SHORT ABSTRACT

Stormwater runoff from urban areas can lead to excess nutrients, such as phosphorus or nitrogen, in our waterways. These waste nutrients can lead to overgrowth of algae and plants, deoxygenation of ponds and streams, and death of the aquatic life in these important ecosystems. Currently, floating treatment wetlands are being used to combat these excess nutrients, combining a floating element with an absorptive media, either man-made or natural aquatic plants, into a model to float on an impacted lake. In this research project, multiple small-scale microcosm level experiments were run with different native aquatic plants to test their uptake ability for future use in a full-scale floating treatment wetland. Nutrient uptake was measured through soluble reactive phosphorus (SRP) tests, total phosphorus (TP) tests, and ash digestion of plant and algal samples. Algae and pondweed proved the most efficient in the trials for removing phosphorus from water. Coontail was also very effective, while duckweed and watercress were the least effective in their phosphorus removal.

SHORT BIO IN 3rd PERSON

Grace Wilbanks is an undergraduate research student at Missouri University of Science and Technology with research in nutrient impairment and water rehabilitation under Dr. Dev Niyogi, a professor within the Biological Sciences Department. She plans to go into Veterinary Medicine after her graduation in 2026.

List First then Last Name

Sage Wood

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Robin Verble
Advisor Department: Biological Sciences

Funding Source: United States Department of Defense

SHORT PROJECT TITLE

Insect Collection Methods at Fort Leonard Wood

SHORT ABSTRACT

This project is part of a larger survey examining the terrestrial insect diversity at Fort Leonard Wood in summers 2021 and 2022. The data analyzed in this poster includes specimens collected during the 2022 collection period. This project attempts to elucidate the most effective method of insect collection at Fort Leonard Wood, as well as any hotspots of insect presence or diversity on the base. Specimens were collected using hand and net collection, Lindgren funnel trapping, leaf litter sampling, and three colors of pan trapping (blue, yellow, white). Specimens were processed in the lab, pinned, sorted, and identified. Preliminary analysis shows that hand trapping methods collected insects of more differing orders than all other methods in a manner that was statistically significant compared to all methods except white pan traps (Shannon Diversity t-test, $p < 0.001$). These results will better inform future insect collection methods at Fort Leonard Wood and beyond.

SHORT BIO IN 3rd PERSON

Sage Wood is a Biological Sciences major at Missouri S&T. They are interested in behavioral ecology in insects and the ways they interact with their environments. They have worked in the Verble Pyroecology and Insect Ecology Laboratory for three years, doing a variety of entomology and fire ecology projects. Over the 2022 summer they were part of the fellowship tasked with surveying terrestrial insects on Fort Leonard Wood. Sage is from Jefferson City, Mo, where their parents and younger sister reside.

List First then Last Name

Elena Zobel

Join Project with Charles Green

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri University of Science and Technology

SHORT PROJECT TITLE

C. elegans Populations in the Presence of P. pacificus

SHORT ABSTRACT

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

SHORT BIO IN 3rd PERSON

Elena Zobel is a sophmore biology student at Missouri S&T. She is involved in the Opportunities for Undergraduate Research (OURE) program, the International Genetically Engineered Machine (iGEM) design team, the Kummer Vanguard Scholors program and the Missouri S&T honors collage.

OURE Fellows Program

Oral Abstracts

Applicants

List First then Last Name

Jasmin Billingsley

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Physics
Major: Chemistry
Research Advisor: Hyunsoo Kim
Advisor Department: Physics

Funding Source: Faculty Startup

SHORT PROJECT TITLE

Development of Colpitts Self Oscillator

SHORT ABSTRACT

Topological materials can serve as promising platforms for next-generation technology. Magnetism in such systems is often a consequence of emergent quantum phenomena, and the traditional framework is insufficient to fully describe their magnetic properties. In this project, we will perform precision magnetic measurements utilizing the Colpitts self-oscillator to determine the temperature- and field-dependent AC magnetic susceptibility in the topological magnetic materials. The collective knowledge learned from this proposed research would shed light on the understanding of exotic magnetism in topological materials, potentially leading to new physics of magnetism.

SHORT BIO IN 3rd PERSON

The sudent involved in this project is an undergraduate in their second year (a junior-by-credit). Her major is chemistry, and she is conducting this project with Hyunsoo Kim of the physics department.

List First then Last Name

Brileigh Cates

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mathematics and Statistics
Major: Applied Mathematics
Research Advisor: David Samson
Advisor Department: Arts, Languages, and Philosophy

Funding Source: OURE Fellows

SHORT PROJECT TITLE

The History of the Billboard Hot 100 and its Process

SHORT ABSTRACT

The Billboard Hot 100 has been around for decades, and it is believed without much accreditation. What really is Billboard, and why is it so popular? Why have other charting companies not taken up as much popularity? How does Billboard determine the popularity of artists? How has this changed with the introduction of the internet? This research project addresses all of these question, allowing the validity of the data collection to be addressed.

SHORT BIO IN 3rd PERSON

Brileigh Cates is an Applied Mathematics junior studying statistics. She is Drum Major of the Miner Marching Band and Recording Secretary of the honorary band sorority on campus, Tau Beta Sigma. She plans on graduating and entering the S&T Statistics Doctorial Program by August of 2025. She plans on pursuing a degree in pharmaceutical statistics after graduation.

List First then Last Name

Tylor Cheatham

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Environmental Science
Research Advisor: Dr. Dev Niyogi, and Dr. Mark Fitch
Advisor Department: Biological Sciences & Civil, Architectural, & Environmental Eng.

Funding Source: OURE

SHORT PROJECT TITLE

Phytoremediation of Nonpoint Source Pollution

SHORT ABSTRACT

Stormwater can bring high concentrations of nutrients into urban ponds resulting in eutrophic conditions and subsequent algal blooms. These blooms can lead to hypoxic water that will ultimately cause fish deaths and loss of recreation. Often, the majority of urban stormwater flows into local ponds through an inlet, which provides a target area for nutrient removal methods. One method being explored by researchers is the use of floating treatment wetlands (FTWs). FTWs are floating mats with plants anchored to them, allowing the roots to be suspended in the water column for nutrient removal. Our previous research focused on optimizing FTW design and quantifying stormwater nutrient reduction with mesocosm-scale experiments, setting the stage for full-scale implementation. For this project, FTWs will be anchored near the inlet of Ber Juan Pond in Rolla. The experimental design will consist of a short, longitudinal divider in the pond with FTWs on one side and a control channel on the other side. I aim to compare the nutrient concentrations, dissolved oxygen levels, and other water quality parameters in each channel to understand how they are affected by FTWs. This research will help inform lake managers, so they can effectively reduce eutrophication in urban ponds.

SHORT BIO IN 3rd PERSON

Tylor Cheatham is a junior in Environmental Science at Missouri S&T. His academic interests include nutrient cycles, restoration ecology, landscape limnology, and environmental ethics. In Tylor's free time he enjoys kayaking, spending time with friends, and exploring new music.

List First then Last Name

Benjamin Cuebas

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Rohit Dua
Advisor Department: Electrical and Computer Engineering

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Experiential Learning in RF Circuit Design

SHORT ABSTRACT

This research project will explore the intricacies of Radio Frequency (RF) circuitry design, demonstrating acquired insights by constructing a discrete RF amplifier with digital input attenuation control. The study will delve into a multitude of RF topics such as serial communication, digital data storage, transmission line theory, impedance matching, network parameters, amplifier classes, and Smith chart analysis.

The RF amplifier will be designed to have an approximately 15dB input gain/attenuation digitally controlled by an external microcontroller. The device will operate at 50 MHz, in the VHF frequency range, with an input and output impedance of 50Ω. A network analyzer will be used to facilitate thorough testing of prototypes and product functionality through its S-parameters. Final analysis will include measurement of gain and attenuation accuracy, efficiency, P1dB linearity, amplifier PAE, total bandwidth, and K-factor.

This learning endeavor will not only enrich understanding of RF and high-speed digital concepts and design strategies, but also provides hands-on experience in the design, construction, and testing of high frequency circuitry with digital controls.

SHORT BIO IN 3rd PERSON

Benjmain Cuebas is pursuing his BS in Electrical Engineering degree at Missouri University of Science and Technology via the Cooperative Engineering Program (CEP). He plans to graduate in 2025. He received his associate degree in electrical engineering from Ozarks Technical Community College in 2022. Benjamin has worked as an electrician and electronics technician during his pursuit of an EE degree and has always had a passion for electronics. In the summer of 2023, he did his first engineering internship, where he helped design test equipment for Monolithic Microwave Integrated Circuits and gained a new interest in the RF side of Electrical Engineering. He is a member of the CEP Embedded Systems club and the IEEE student club.

List First then Last Name

Allie Dingfield

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Davide Vigano
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: OURE

SHORT PROJECT TITLE

Turbulence characterization for supersonic wind tunnel

SHORT ABSTRACT

Turbulence in compressible flows holds significant importance across various applications, such as optimizing air/fuel mixing in scramjet combustors. However, managing compressible turbulence presents distinct challenges compared to incompressible flows, as fluctuations extend to thermodynamic quantities, including density. Density fluctuations notably influence the production term of Turbulent Kinetic Energy (TKE). Despite advancements in velocity measurements, particularly in supersonic flows, density measurement remains inherently complex.
This study focuses on further refining a turbulence density measurement technique utilizing shadowgraph imaging, tailored for application in the recently upgraded Missouri S&T supersonic wind tunnel. The developed technique will enable the student to quantify turbulent density fluctuations within the wind tunnel's free stream. Accurate quantification of free stream turbulence is paramount prior to initiating any experimental testing.
The original development of this technique received recognition through an OURE scholarship in 2023, and its research proposal secured first place at the 2023 UGRC in the "research proposal poster" category.

SHORT BIO IN 3rd PERSON

Allie Dingfield is a sophomore in mechanical engineering at Missouri S&T. She is involved in the Honors Program, Kummer Vanguard Scholars, and Christian Campus Fellowship, along with her work under Dr. Vigano in the Aerodynamics Research Lab.

List First then Last Name

Matthew Dominicis

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Ardhendu Tripathy
Advisor Department: Computer Science

Funding Source: N/A

SHORT PROJECT TITLE

TA Theoretical Framework for Comparing RLHF Method

SHORT ABSTRACT

Reinforcement Learning from Human Feedback (RLHF) can be used as a means to align AI agents and Large Language Models (LLM) to better represent human expectations. There are a myriad of RLHF methods that exist, however it is difficult to benchmark and compare such methods in terms of alignment, training cost, data collection cost, and other metrics. This project aims to create a robust classification for different RLHF methods from a theoretical point of view. Additionally, this project will attempt to propose bounds for the degree of influence on LLMs that stems from human feedback. Open source LLMs will be the prime focus of this project. They will be fine-tuned using different RLHF methods and will have their outputs compared using various criteria. This topic sits at the intersection of Computer Science, Math, and Philosophy, as researchers attempt to determine the impact of a human's unconscious bias on AI.

SHORT BIO IN 3rd PERSON

Matthew Dominicis is a Junior in Computer Science graduating in May 2025. His interests lie in the fields of Artificial Intelligence and Quantum Computing. He participated in the 2023-2024 OURE cohort, where he did research under Dr. Avah Banerjee studying the theory of Quantum Computation. In his free time, he conducts research, spends time with organizations including the Eta Kappa Nu honors society, the Society of Hispanic Professional Engineers, the Google Developer Student Club, and works part-time as an intern at World Wide Technology. He looks forward to branching out and learning more about AI.

List First then Last Name

Firle, Sophie

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Psychology
Major: Biology
Research Advisor: Dr. Jessica Cundiff
Advisor Department: Psychology

Funding Source:

SHORT PROJECT TITLE

Silent bystanders facing bias. is silence always harmful

SHORT ABSTRACT

In STEM, women face bias that lowers their sense of belonging, identity safety, and self-esteem. These biases often occur in daily interactions with male peers in STEM, such as subtly sexist comments that doubt women's competence in STEM. A previous study that we conduction titles "Effects of Ally Confrontation on Target Outcomes" tested whether a subtly sexist comment that was confronted by a male ally would help increase women's sense of belonging, identity safety, and self-esteem relative to when a male bystander remained silent and did not confront the comment. We found that confrontation does help women feel better than silence, suggesting that silence is harmful. But does it matter who is silent? Which silence is most harmful? In this study, we will conduct an experiment focusing on Black women in STEM to see whether the gender and/or race of the bystander is a factor in determining which silence is most harmful. This research is interdisciplinary by integrating social psychology, intersectionality, feminist theory, and real-world STEM experiences to understand that may contribute to gender and racial gaps in STEM contexts. The results of this study have broader implications for interventions targeted at confronting bias, for understanding factors that contribute to identity safety for marginalized groups in STEM, and for inspiring future research directions.

SHORT BIO IN 3rd PERSON

Sophie Firle is a sophomore in Biological Sciences from Festus, MO. She has participated in the First Year Research Program, Opportunities for Undergraduate Research Experiences, and won first place in the Social Sciences Poster category in the Undergraduate Research Conference 2023 with her partner Gemma Flores-Olivas.

List First then Last Name

Love Gami

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Business and Information Technology
Major: Information Science and Technology
Research Advisor: Yishu Zhou
Advisor Department: Economics

Funding Source: OURE

SHORT PROJECT TITLE

CO2 Pricing Impact on Partially Regulated Market

SHORT ABSTRACT

With climate change becoming a growing concern, carbon trading has gained attention as a key solution to reducing carbon emissions. However, this raises a concern about whether polluters pass the cost of carbon to electricity prices. This study aims to assess the impact of CO2 pricing on electricity prices in the PJM market where some areas are regulated by carbon trading while others are not. Our findings reveal a significant impact of CO2 prices across all regulated areas, encompassing both real-time and day-ahead markets. Moreover, the impact extends to non-regulated areas, indicating a spillover effect within the PJM market. Interestingly, the electricity price increase in unregulated areas is negatively correlated with their distance to regulated areas. The strongest impact is observed during peak hours. These findings highlight how carbon trading policies affect electricity prices, showing how regulations in one area can influence pricing across the energy market.

SHORT BIO IN 3rd PERSON

Love Gami is a sophomore at Missouri S&T, pursuing a degree in Information Science and Technology. His academic journey took an intriguing turn in Fall 2023 when he delved into undergraduate research alongside Professor Yishu Zhou in the Department of Economics. Together, they embarked on a study focusing on the intricate dynamics of carbon price pass-through to electricity prices under partial regulation. This experience ignited Love's passion for detailed research in similar domains, driving him to seek further exploration and contribution in this field.

List First then Last Name

Gracie May James

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Explosives Engineering
Major: Nuclear Engineering
Research Advisor: Catherine Johnson
Advisor Department: Mining and Explosives Engineering

Funding Source: Energetics Reasearch Lab - Missouri S&T

SHORT PROJECT TITLE

TNT Equivalence of Binary Energetics

SHORT ABSTRACT

TNT equivalency is a standard used to measure and quantify the effects of energetic materials. Using these equivalencies, the safety factors for minimum distances and storage of explosives are determined. Having a known TNT equivalence of energetic materials also helps estimate potential blast damage and risks for individuals. The TNT equivalencies for numerous energetic materials, such as binaries, have no published values, but are regularly used in industry, military, and research testing. To determine TNT equivalence, three tests will be performed: 1) a plate dent test, 2) air blast tests to measure air overpressure and calculate impulse, and 3) velocity of detonation test.The data collection method will be validated by also testing commonly published explosive equivalencies, namely Composition B. New values for Helix, Texpak, Tannerite, dynamite, and Kinepak will be determined. This research will produce TNT equivalency values for commonly used explosives and provided recommendations for an inexpensive and repeatable method of determining TNT equivalence. These results aim to provide helpful insight for law enforcement and the military into the effects of different energetic materials. Standardizing these TNT equivalency values for energetic materials will ensure safe procedures that mitigate the potential risks and blast damage for the military and law enforcement when handling, storing, or detonating explosives.

SHORT BIO IN 3rd PERSON

Gracie May James is a junior at Missouri S&T who is majoring in nuclear engineering and minoring in explosives engineering. She helps conduct research for the explosive engineering department under Dr. Catherine Johnson.

List First then Last Name

Kevin Lai

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Computer Science
Major: Computer Science
Research Advisor: Andrea Scharf
Advisor Department: Biology

Funding Source: S&T

SHORT PROJECT TITLE

Simulating Inter-Species Competition in C. Elegans

SHORT ABSTRACT

In biological research, understanding the life cycles of Caenorhabditis elegans (C. elegans) is pivotal for insights into developmental biology, genetics, and population dynamics. Our project builds on Worm-Pop, a Python-based multi-agent simulation of Caenorhabditis elegans (C. elegans) , to enhance its capabilities in simulating survival strategies, reproductive success, and genetic drift. The current model simulates a uniform population without inter-agent interactions. I plan to introduce multiple species of worms into the simulation to study competitive dynamics and determine which variants are most successful under various conditions. Pheromones significantly influence C. elegans behavior, affecting mating, foraging, and social interactions. To address this, I will develop a model to simulate pheromone interactions. The accuracy of our computational model will be validated through in-vivo experiments with real C. elegans populations. This step is crucial for ensuring the model's reliability and for adjusting it based on actual biological observations. Our work aims to provide a more detailed understanding of C. elegans population dynamics and the factors influencing genetic diversity and adaptation. This enhanced simulation tool will be valuable for research in developmental biology, genetics, and ecology.

SHORT BIO IN 3rd PERSON

Kevin is a Computer Science senior who applies Computer Science to biological challenges. He's a passionate social swing dancer, and a musician, playing the cello and violin. Kevin balances his tech-driven pursuit with daily reading and exercise. Post-graduation, Kevin hopes to pursue a career in software engineering while attending graduate school for bioinformatics.

List First then Last Name

Amelia Markwell

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner
Department:

Major: Biological Sciences
Research Advisor: Dr. David J Westenberg
Advisor Department: Biological Sciences

Funding Source: Biological Sciences Department

SHORT PROJECT TITLE

A New Genetic Tool for Quorum-Sensing Ba

SHORT ABSTRACT

This current research project focuses on the use of cell-to-cell communication in Bacterial Strain competition, specifically in soybean plants. Soybean plants are a high-yield crop produced here in the midwest, bringing in more than 8 billion dollars in monetary output for our state. The lab work focuses on one specific bacteria strain farmers commonly find in soybeans; this is called Bradyrhizobium japonicum. This nitrogen-fixing bacteria improves plant growth drastically. Cells have a way of communicating with each other in order to share information and adjust gene regulation accordingly. This is known as quorum sensing. My research last year focused on characterizing the signal molecules they use to communicate; now, we want to test and see if quorum sensing affects the efficiency of different strains. The lab procedures focus on finding genetic differences between positive and negative quorum-sensing strains and comparing their competitiveness with each other, as opposed to just identifying and sizing the molecules. In previous studies, we showed that certain strains of B. japonicum produce traditional quorum-sensing molecules called homoserine lactones (HSLs) using an indicator bacterium called Agrobacterium tumefaciens. However, even though most strains possess genes that should be capable of producing HSL or HSL-like molecules, they do not produce HSLs that can be detected by the A. tumefa.

SHORT BIO IN 3rd PERSON

Amelia Markwell is a current Undergraduate Student at Missouri S&T, majoring in Biological Sciences.She has been working in Dr. Westenberg's lab since she was a freshman, and is involved in various campus extra curriculars including SCRUBS, HELIX, the Student Union Board, and more. Oringinally from Seattle, WA, Amelia graduated from Mary Institute and St. Louis Country Day School in the Spring of 2022, and hopes to continue her education in Medical School after her bachelor's degree. Outside of the classroom, Amelia enjoys playing in Viola in the Missouri S&T Orchestra, and can often be seen walking her Beagle, Winston around campus. In her free time, she enjoys reading , cooking, and volunteering.

List First then Last Name

Kaitlin Miles

100

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Klaus Woelk
Advisor Department: Chemistry

Funding Source: OURE/ Summer Scholars Program

SHORT PROJECT TITLE

Heat's Effect on Asphalt Binders Using NMR

SHORT ABSTRACT

Nuclear Magnetic Resonance (NMR) spectroscopy is a well-known analytical technique that uses the excitation of nuclear spins for solving chemical structures and conformations. Relaxometry is a special field of NMR spectroscopy where information is gained about interactions of nuclear spins with their molecular surroundings. The deterioration of asphalt is a major infrastructure problem, and its rejuvenation back toward its original virgin state is an important field of research and development. The current asphalt industry relies on visual inspection on site and invasive or destructive physical methods to assess emerging asphalt failures. This study examines the chemical changes environmental factors have on asphalt binders by using NMR relaxometry. The effects heat treatments have on virgin and UV aged binder samples are quantified by the relaxation times of the organic hydrogen atoms in bituminous asphalt-binder samples. The research is aimed at providing insight into the integrity of asphalt before failures become apparent.

SHORT BIO IN 3rd PERSON

Kaitlin Miles came to Missouri S&T from Griggsville Illinois. She is a sophomore Vanguard Scholar majoring in chemistry with an emphasis in Biochemistry. She was awarded First-Year Research Experience (FYRE), Summer Scholars Program, and Opportunities for Undergraduate Research Experiences (OURE) from the College of Arts, Science, and Education to conduct a research project in physical chemistry and spectroscopy. Kaitlin's career goals involve exploring an interest in toxicology and enviornmental conservation.

List First then Last Name

Clark Nguyen

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Material Science Department
Major: Metallurgical Engineering (B.S.)
Research Advisor: Dr. Mario Buchely
Advisor Department: Material Science Department

Funding Source: PSMRC

SHORT PROJECT TITLE

Thermogravimetric Analysis of High & Low Alloy Steel

SHORT ABSTRACT

Oxidation phenomena play a critical role in high temperature metallurgical processing and the performance during life cycle of components made of both high and low alloy steels. Therefore, the development of a precise experimental methodology to quantify oxidation processes is critically important. This report summarizes my experimental study of the oxidation behavior of high and low alloy steel, including kinetics of surface oxide layer formation and spallation. The focus of study was in determining the complex interactions between alloying elements in steel matrix and oxidation environment, composition and surface morphology of formed oxides. This report will also explore how the introduction of a low oxygen or high oxygen atmosphere along with the various temperatures affects the growth of scale. The developed methodology allowed me to investigate the real industrially produced steels with as-cast and machined surfaces. Such investigations were limited before when used equipment permitted only small test specimens. This summary also discusses the methods of thermo-gravimetric analysis(TGA) and its use to quantify oxidation effects and what this data reveals about the relationship between oxidation and the conditions experienced by steel samples.

SHORT BIO IN 3rd PERSON

Clark Nguyen is a dedicated junior in Metallurgy with a passion for understanding the intricate properties and behaviors of metals. Clark's academic journey has been filled with many experiences and opportunities related to the field of material science. As an honor's student, his honor's projects like in PHY 2235 where he studied the concept of energy in materials or MATH 3304, where he analyzed and reported on the use of differential equations and the Laplace transformation in metallurgy, specifically during heat transfer and phase transformation. Beyond his classwork academics, Clark is also an undergraduate researcher with the PSMRC project where he works on The Scale Research Project which is ran by Dr. Mario Buchely and Dr. Ron O'Malley. Here he has studied and worked on the effects of scale and the kinetics of steel as observed by thermogravimetric analytics.

List First then Last Name

Joseph Nguyen

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Hank Pernicka / Dr. Yezad Anklesaria
Advisor Department: Mechanical and Aerospace Engineering

Funding Source: University Nanosatellite Program (UNP) / OURE

SHORT PROJECT TITLE

FEA Analysis on S&T Student Designed Satellite

SHORT ABSTRACT

The Missouri Rolla and Missouri Rolla Second Satellite (MR & MRS) is a paired satellite developed by the Missouri S&T Satellite Reseach Team (M-SAT) designed to test new technologies in support of missions involving proximity operations. The M-SAT team won first place in the Nanosatellite Competition hosted by Air Force Research Laboratory in 2015 and obtained funding to proceed with design development. The MR & MRS satellite today will undergo extensive revisions to meet new design requirements and changing technological advancements. The alterations planned for MR & MRS will not only change the structure but directly affect the thermal profile of the satellite. Previous iterations of MR & MRS produced cold-running temperatures that are to be addressed though integration of passive thermal controls. This project will research alternate design configurations to meet new design requirements and utilize a finite element method to conduct a thermal analysis to simulate thermal behavior, predict temperatures, and optimize designs to ensure components stay within safe operating temperatures. As the M-SAT team prepares to enter into the next phase of satellite design for MR & MRS, the future of M-SAT and newly developing missions lay ahead for possibilities.

SHORT BIO IN 3rd PERSON

Joseph Nguyen is a junior majoring in Mechanical Engineering from Springfield, Missouri. Joseph formerly served as a Team Manager for the Missouri S&T Satellite Research Team (M-SAT) and was a co-founder of the Resource Management Team. Joseph now serves as the Student Director of M-SAT. Outside of M-SAT, Joseph is currently involved with the American Society of Mechanical Engineers, the American Society of Engineering Management, and is a Kummer Vanguard Scholar.

After graduation, Joseph hopes to start a career in the space industry working on satellites, rockets, or any space-related applications. In his spare time, Joseph enjoys photography, traveling, new experiences, and is an adrenaline enthusiast.

Auston Obsuth

Department: Civil, Architectural and Environmental Engineering
Major: Engineering Management
Research Advisor: Dr. Jianmin Wang
Advisor Department: Civil, Architectural and Environmental Engineering

Funding Source: None / OURE & Department

Analyzing the Viability of Novel Reactor Technology

This study explores an innovative anaerobic digestion reactor technology aimed at improving the sustainability and efficiency of organic waste management. By employing a system without mechanical parts, it seeks to significantly enhance energy conversion from waste, tackling waste accumulation and the need for renewable energy sources. The project will use a multidisciplinary approach, incorporating economics, engineering management, and environmental science, to thoroughly evaluate the reactor's performance in terms of gas production, stability, and efficiency. Additionally, it will assess the economic viability and environmental impact, emphasizing advantages such as waste reduction and decreased greenhouse gas emissions.

Additionally, preliminary market analysis and community engagement will assess the technology's applicability and potential impact on current waste management practices. The reactor itself will authentically use a realistic feedstock such as S&T Dining's food waste. The culmination of this research will be a comprehensive report, documenting the findings and offering actionable insights for implementing this innovative technology in organic waste management strategies.

Auston, an honors student in Engineering Management with an emphasis area in Energy and a minor in Quantitative Economics, is deeply engaged in campus leadership. Holding executive positions in the Student Council, the American Society of Engineering Management, and the Kummer Vanguard Scholars, among others, he exemplifies dedication to leadership and innovation. His keen interest in energy has led him to explore the transition to sustainable power systems. In the past year, he has collaborated with the Missouri Department of Natural Resources through the Meramec Regional Planning Commission on a community grant project. This initiative examines local food waste management practices and assesses the feasibility of implementing new technologies. Auston is active on campus and aims to rekindle interest in research on critical issues, focusing on practical implementation and entrepreneurship.

List First then Last Name

Joshua Santy

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Physics
Major: Physics
Research Advisor: Dr. Julia Medvedeva
Advisor Department: Physics

Funding Source: DOE-EERE-SETO program. Potentially, NSF-FuSe program

SHORT PROJECT TITLE

Amorphous Transparent Oxide P-type Semiconductors

SHORT ABSTRACT

For decades, n-type transparent conducting oxides (TCOs) have been extensively studied and applied in various energy and optoelectronic devices. However, the search for high-performance p-type TCOs, crucial for transparent p-n junctions and next-generation microelectronics – remains uncertain. The most studied p-type TCOs (e.g., Cu2O-based delafossite family) exhibit the carrier mobilities (<1 cm2/Vs) that are much smaller than those in typical n-type TCOs (10–100 cm2/Vs). In contrast to the Cu-based layered materials with a relatively flat Cu d10 valence band (resulting in the hole effective mass of 2.5me), Sn2+ in SnO has s2 electronic configuration giving rise to a significantly more dispersed valence band (the hole effective mass is 0.5me) and, hence, to higher hole mobility. Currently, the practical use of SnO is limited due to (i) stability issues of SnO associated with tin preference for valence 4 (as in SnO2, a well-known n-type TCO); (ii) small band gap ~0.7 eV; and (iii) anisotropic hole effective mass in the crystalline phase. Further search for p-type TCOs should involve amorphous phases of SnO-based multi-cation materials where metal composition helps stabilize Sn2+ and open the band gap, whereas the disordered structure is expected to result in uniform isotropic electronic properties and low scattering due to absence of grain boundaries.

SHORT BIO IN 3rd PERSON

Joshua Santy is a junior at Missouri S&T double majoring in Physics and Applied Mathematics. His passion for Physics and research led him to collaborate with Dr. Medvedeva, exploring the structure and electronic properties of Amorphous Tin Oxide for CMOS Applications. Josh enjoys programming in Python and bash scripting for his research, as well as participating in coding competitions such as PickHacks. Beyond his academic pursuits, Joshua is an Officer of the Society of Physics Students at S&T. Additionally, he actively contributes as a member and media team participant for the Christian Campus Fellowship. Moreover, he is a member of the S&T Symphonic Orchestra.

List First then Last Name

Nathan Smith

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biology, Computer Science
Major: Biology, Computer Science
Research Advisor: Andrea Scharf
Advisor Department: Biology

Funding Source: MST

SHORT PROJECT TITLE

Effects of reproduction on senescence in local species

SHORT ABSTRACT

Understanding the impact of reproduction on the aging process within species populations remains an ongoing challenge in ecological and evolutionary research. In this study, we aim to clarify the relationship between reproduction and senescence using agent-based modeling using wild species data sets. Our objectives include investigating how variations inreproductive rates influence the lifespan and aging trajectories of individuals within populations, as well as identifying potential mechanisms underlying these effects.

We will employ agent-based modeling to simulate populations and explore the dynamics of reproduction and senescence using publicly available datasets of local wild species. By manipulating parameters related to reproductive rates and longevity, we will observe and evaluate the effects of reproduction on population-level aging patterns. Additionally, we will utilize a previous OURE project, the C. elegans population simulation, as a case study to further our modeling approach and to uncover correlations between reproduction and senescence.

SHORT BIO IN 3rd PERSON

Nathan Smith is a Computer Science and Biology major that has participated in research programs such as the MST OURE program working with the C. elegans simulation and acted as a fellow on the Fort Leonard Wood field study and insect survey. He has also gained field experience with catching, trapping, and caring for fish, reptiles, and amphibians through his Herpetology and Ichthyology courses during his academic career as Missouri S&T.

List First then Last Name

Noah Sparks

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Chemical Engineering
Major: Chemical Engineering with Biochemical emphasis
Research Advisor: Dr. Hu Yang
Advisor Department: Chemical Engineering

Funding Source: Dr. Yang's lab

SHORT PROJECT TITLE

Lung Cancer Drug Study using ALC Nanoparticles

SHORT ABSTRACT

In a previous project it was determined ALC polarized lipid nanoparticles have a high transfection efficiency in some lung cancer cell lines. Building off this information, these ALC particles will now be tested with an actual lung cancer drug. This process will consist of searching articles for promising lung cancer drugs and selecting one for use. The ALC particles will then undergo a comprehensive drug study using multiple lung cancer cell lines with the selected drug. Aspects such as drug release rate, transfection rate, cytotoxicity, etc. will be determined. The goal is to determine whether ALC nanoparticles show real promise in the field of cancer drug delivery. Hopefully this project will help me to gain insight into drug studies and even show a potential treatment for lung cancer cells.

SHORT BIO IN 3rd PERSON

Noah Sparks is a senior Chemical engineering student with a passion for research. He has worked in Dr. Yang's lab since freshman year and had OURE projects with them for the past two years. He is a hardworking student who works to maintain good grades, while getting experience within the lab. He hopes to work in the biochemical research field and believes undergraduate research will give him the experience necessary to thrive in the field.

List First then Last Name

Briannah Spisak

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Civil, Architectural, and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Joel G Burken
Advisor Department: Civil, Architectural, and Environmental Engineering

Funding Source:

SHORT PROJECT TITLE

Analysis of 1,4 Dioxane in Plants

SHORT ABSTRACT

Missouri S&T collaborates with University of Iowa on projects to identify the presence of 1,4 Dioxane in tree core samples. The research group will replicate the situation in smaller reactors on campus. The following materials will be used: conetainers, willow cuttings, biochar, and perlite. The plants will be dosed with 1,4-Dioxane and analyzed with Gas Chromatography-Mass Spectrometry (GCMS). Plant growth and health will be monitored and related to growth conditions and pollutant exposure. Larger mesocosms will be dosed over the summer and will have in-planta analysis as well.

To replicate the field site, exact biochar and perlite from the manufacturer will be used. There will be four species of willow tree planted in three ratios of perlite and amended with biochar. The three ratios are 0% perlite with 100 % biochar, 10% perlite with 90% biochar, and 20% perlite with 80% biochar. There are 10 replicates of each ratio. The plants will be dosed with 1,4-Dioxane. Plant growth will be analyzed by measuring biomass, height, leaf count, taking images for image analysis, and scanning root structure. Cuttings will be taken for analysis and placed in the centrifuge. Then, solution will be extracted to run in GCMS. Data will be compared to the University of Iowa site.

SHORT BIO IN 3rd PERSON

OURE Fellows Program

Oral Abstracts

Final

List First then Last Name

Megan Benkendorf

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Mathematics and Statistics
Major: Applied Mathematics
Research Advisor: Dr. Yanzhi Zhang
Advisor Department: Mathematics and Statistics

Funding Source: OURE Fellows

SHORT PROJECT TITLE

Numerical Studies on Bose-Einstein condensates

SHORT ABSTRACT

Bose-Einstein condensate (BEC) is a state of matter near absolute zero temperature for which all atoms lose their individual properties and condense into a macroscopic coherent “super-wave”. The superfluidity of BEC has been the focus of active research since the first experimental realization of BEC in 1995. The recent launch of the Cold Atom Laboratory to the space station on May 21, 2018 has once again drawn spotlights to this fascinating properties of BEC. In this project, we will carry out numerical studies to understand the behavior of exciton-polariton BECs. A modified Gross-Pitaevskii equation is used to model the dynamics of the condensate. Numerical methods will be developed for efficiently simulating the dynamics. Numerical experiments are provided to verify the accuracy of our method and study the properties of the exciton-polariton BECs.

SHORT BIO IN 3rd PERSON

Megan Benkendorf is a junior majoring in Applied Mathematics and working on minors in computer science, physics, and music. She has enjoyed working on research projects, both at Missouri S&T and over the summer at an NSF funded REU at Fairmont State in West Virginia. In spring of 2022, she worked with Dr. Han through the First Year Research Experience (FYRE). Over the summer, she had the opportunity to travel to West Virginia to participate in Discrete and Continuous Analysis in Appalachia under Dr. Cuchta. Last year, she worked with Dr. Murphy on Numerical Approaches for the Inverse Scattering. In addition to her research activity, she also enjoys being involved in other groups and activities on campus, including Foundation for Undergraduate Mathematicians, Lutheran Student Fellowship, Aerial Swing Dance, and the music fraternity Kappa Kappa Psi.

List First then Last Name

Erik Bergstrom

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Mathmatical Analysis of C elegans population dynamics

SHORT ABSTRACT

Understanding how populations fluctuate is important for understanding how evolutionary pressures have shaped the life histories of species, such as reproductive patterns and aging. A laboratory ecosystem consisting of Caenorhabditis elegans and Escherichia coli and wormPOP, a simulation of this laboratory ecosystem, developed by Scharf and colleagues (Scharf et al., 2022) provides an opportunity to better understand population dynamics by tracking individual simulated worms and computing the emergent population dynamics. However, the output data consist of curves with peaks and troughs that are challenging to analyze and that were hypothesized to fit the mathematical definition of chaotic behavior. This project used mathematical methods to detect chaotic behavior in data from wormPOP under various culling conditions and implemented a second species of nematode, Pristionchus pacificus, in wormPOP to test the effect of a predatory species on the dynamics of the simulated ecosystem. Pristionchus pacificus is a nematode species related to Caenorhabditis elegans that is capable of feeding on the larvae of other nematode species.

SHORT BIO IN 3rd PERSON

Erik Bergstrom is actively involved in undergraduate research and is a member of IGEM. During 2021/2022, he was involved in research in Dr. Melanie Mormile's lab studying dessication tolerance in halophiles. From 2022 until currently, he has participated in OURE and an OURE fellows project in Dr. Andrea Scharf's lab studying the population dynamics of C. elegans in the Scharf lab's laboratory ecosystem and in wormPOP, a simulation of that ecosystem.

List First then Last Name

Grace Duong

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Civil, Architectural, and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Mark Fitch & Dr. Dev Niyogi
Advisor Department: Civil, Architectural, Environmental Engineering & Biological Sciences

Funding Source: OURE

SHORT PROJECT TITLE

Floating Treatment Wetlands for Zinc Phytoremediation

SHORT ABSTRACT

Stormwater pollution from urban and mining areas can pose challenges to downstream waters because of zinc contamination. Floating treatment wetlands (FTWs) have demonstrated the ability to mitigate nutrient and metal contamination. To investigate the effectiveness of native Missouri plants in FTWs, fourteen 10-liter mesocosms were constructed, dosed with nutrients, and placed in a greenhouse. Four mesocosms acted as controls, five contained pickerelweed, and five contained palm sedge. After one week of acclimation, mesocosms were dosed with ZnCl2 in concentrations of 0, 5, and 10 mg/L of zinc. Objectives of this study include characterizing zinc immobilization and assessing both pickerelweed and palm sedge within FTWs for zinc uptake. Grab samples were taken immediately after dosing, one hour, one day, three days, and weekly for six weeks. Data collected in week one shows zinc concentrations decreasing immediately after dosage and mixing, pointing to possible adsorption to precipitating iron from the nutrient solution. In week two, mesocosms containing plants demonstrated an increase in soluble zinc, followed by a steady decrease through week six. This may be a result of the complexing of zinc with root exudates, which increase the solubility of zinc for plant uptake. To confirm such zinc uptake, investigation of zinc within roots and shoots is necessary in future research.

SHORT BIO IN 3rd PERSON

Grace Duong is a graduating senior in Environmental Engineering at Missouri S&T with plans to pursue graduate studies, beginning a Ph.D. program at Washington University in Fall 2024. Her academic interests span emerging contaminants, nutrient and bioproduct recovery, remediation, and environmental justice. Beyond her studies, she enjoys rock climbing, playing the guitar, and spending time with her cat, Smokey.

List First then Last Name

Jessica Frame

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Psychological Sciences
Major: Psychological Sciences & Biological Sciences
Research Advisor: Dr. Amy Belfi
Advisor Department: Psychological Sciences

Funding Source: OURE Fellowship, CSTS Seed Grant

SHORT PROJECT TITLE

Modality's Effect on Aesthetic Ratings of Poetry

SHORT ABSTRACT

Previous research has shown that vividness of evoked imagery is the strongest contributor to aesthetic pleasure for poetry. However, it is unknown whether modality of the poem has an effect on the relationship between vividness and aesthetic appeal, as past work has only used written poems. In this study we want to evaluate rating of vividness, valence, arousal, and aesthetic appeal based on the modality in which poems are presented (listening only, reading only, or combined). Participants were randomly assigned to one of the three modalities: text-only (N=81), audio-only (N=74), or combined audio/text (N=78). Our results showed that participants found the audio-only modality to be the least aesthetically appealing, as compared to visual-only and combined audiovisual. Additionally, we found that vividness of imagery was the most important predictor of aesthetic appeal overall (across all three modalities) but also identified a significant interaction between stimulus modality and imagery such that vividness was most important for text-only poems. Finally, we replicated prior work on individual differences in aesthetic appeal, as our results indicate low interrater agreement for aesthetic appeal ratings of poems. These findings contribute to our understanding of the complexity of the aesthetic experience in poetry and highlight the significance of individual differences and the role of modality in its appreciation.

SHORT BIO IN 3rd PERSON

Jessica Frame is a senior graduating in May 2024 with majors in Biology and Psychology with an emphasis in Cognition and Neuroscience as well as a minor in Chemistry. During her four years she has been a participant of the FYRE, OURE, and OURE fellowship programs as well as presented her research at the capitol. Outside of the college, Jessica has taken research to 3 regional psychology conferences and 1 national where she won the audience choice award. Upon graduation, Jessica will be pursuing her interests in cognitive aging and memory at the University of Iowa within their Interdisciplinary Neuroscience Ph.D. Program.

List First then Last Name

Steven Karst

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Physics
Major: Physics & Computer Science
Research Advisor: Dr. Shun Saito
Advisor Department: Physics

Funding Source: NSF

SHORT PROJECT TITLE

Enhancing Galaxy Surveys with Machine Learning

SHORT ABSTRACT

Applications of machine learning (ML) or artificial intelligence (AI) to problems in astrophysics and cosmology have recently entered a golden era. In response, we have updated two of our recent ML/AI efforts that contribute to galaxy surveys whose main scientific target is to reveal the nature of the Comsic Acceleration or Dark Energy. We first revised our effort to infer cosmological information beyond the survey geometry using Graph Neural Networks (GNNs) to take advantage of supercomputing resources on campus. We then updated our methods for galaxy target selection in the Subaru Prime Focus Spectrograph (PFS) survey with modern reinforcement learning techniques such as A2C and revised reward functions. In both cases, we found that these changes dramatically improved the speed and performance of the ML models, especially when locating faint galaxies with high redshifts.

SHORT BIO IN 3rd PERSON

Steven Karst is a senior from Ballwin, Missouri majoring in Physics and Computer Science at Missouri S&T, where he is the Computing Lead for the Underwater Robotics Team as well as the vice president of ACM Game Dev. He was originally introduced to the Institute for Multi-Messenger Astrophysics and Cosmology through the National Merit Semifinalist Package. His research for that program won first prize at the 2021 Undergraduate Research Conference as well as at the 2021 Fuller Prize Competition.

List First then Last Name
Clare Koerkenmeier

If joint project, state the following in the box above: Joint project with Joe Miner and Jane Miner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Andrea Scharf
Advisor Department: Biological Sciences

Funding Source: Missouri S&T

SHORT PROJECT TITLE

Data Analysis Pipeline of C. elegans Dynamics

SHORT ABSTRACT

Population dynamics follows the fluctuations in birth and death rates. The effects of varying reproductive schedules and aging trajectories play important roles in population survival. Previous projects have aimed to draw connections between these traits through the analysis of data collected from laboratory ecosystems and a computational simulation (wormPOP) comparing wild type and mutant populations of Caenorhabditis elegans. However, these data sets are extensive, and the analysis has proven to be challenging and time consuming. The goal of my project was to optimize the data analysis process. Using data that had been previously collected in these experiments, I worked to produce a data analysis pipeline using the programming language R. Additional simulations were also used to provide supplemental data for analysis. Finally, this data analysis pipeline was used to gain a deeper understanding of how the life history traits of reproduction and lifespan are connected to support population survival.

SHORT BIO IN 3rd PERSON

Clare Koerkenmeier is an undergraduate student at Missouri University of Science and Technology majoring in Biological Sciences. There, she is active in the SCRUBS pre-health organization. She is also a part of the Kummer Vanguard Scholars program and Honors Academy. In the future, Clare intends to attend medical school.

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