Mid

Mid-Michigan Symposium for Undergraduate Research Experiences

SURE

July 22
2026

Acknowledgements

The goal of the 16th annual Mid-Michigan Symposium for Undergraduate Research Experiences (MidSURE) at Michigan State University (MSU) is to provide a forum for undergraduates to share their research and creative activities with the university community and beyond. Over 280 undergraduate students from over 90 different institutions presented their outstanding research and creative endeavors at MidSURE on July 22, 2026. These students are mentored by more than 290 faculty, staff, post-doctoral fellows, and graduate students.

Partnering Programs

Many of the student presenters participated in an MSU-sponsored summer research program. We would like to thank the following MSU programs for encouraging their students to present at Mid-SURE 2026:

- Advanced Computational Research Experience (ACRES)
- Research Experience for Undergraduates in Structural and Functional Neural Biology (ASPET SURF)
- Bridge to PhD in Neurosciences Program (BPNP)
- Biomedical Research for University Students in Health Sciences (BRUSH)
- Building Bridges
- Early Engagement in Semiconductor Materials and Technologies (EEMST)
- Entomology Research and Outreach Fellowship (EROF)
- Kellogg Biological Station (KBS) Undergraduate Research Experiences and Internships
- Plant Genomics Research Experience for Undergraduates
- Physics and Astronomy Research Experience for Undergraduates
- Summer Research Opportunities Program (SROP)

Behind the Scenes

MidSURE would not be possible without a team of dedicated individuals in the Undergraduate Research Office who coordinate logistics, respond to inquiries, and support students and mentors. Many thanks to:

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Finally, we thank the hundreds of dedicated mentors who guided the research projects and creative activities presented in this program book. We encourage you to learn about the impressive work of our next generation of scholars and researchers.

About the Cover

The cover was designed by Lisa Beatty, ‘26 BFA in Graphic Design from the College of Arts & Letters.

Artist Statement: My concept is about how knowledge grows through connection. The network lines and nodes show connections in research and STEM, using blue and green tones that remind viewers of science and technology. I used vertical gradient shapes to represent research expanding outward over time, with different colors showing diversity in fields of study. To emphasize the title, white text is used to create a soft, glowing effect.

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Agriculture & Animal Science

COMPARING DRONE SCOUTING TO TRADITIONAL SCOUTING FOR COLORADO POTATO BEETLE PEST MANAGEMENT
Presenter(s): Lucy Heim (Michigan State University)
Category: Agriculture & Animal Science
Mentors(s): Karma Thomas (College of Agriculture & Natural Resources), Zsofia Szendrei (College of Agriculture & Natural Resources)

The Colorado potato beetle (Leptinotarsa decemlineata) is a major pest of potatoes. Colorado potato beetle management relies heavily on field scouting and monitoring beetle populations. Drones are a rapidly emerging technology in pest management as they can be useful in monitoring insect populations. Drones can provide data for larger areas of land and are less physically demanding than traditional scouting. This study compared drone scouting flown at 1, 5, and 10 meter altitudes to traditional ground scouting for Colorado potato beetles across their life stages. Drone scouting performed the best at detecting beetles at the 1 meter altitude. Drone imaging detected fewer larvae compared to traditional scouting, but detected similar numbers of adults. The goal of this study is to gain insights into how drone scouting can be used in agricultural pest management and provide a reference for managers and researchers.

IMPACTS OF TRANSITION MILK ON ILEAL AND JEJUNAL DEVELOPMENT IN THE PREWEANING PERIOD IN DAIRY CALVES
Presenter(s): Ava Downie (Michigan State University)
Category: Agriculture & Animal Science
Mentors(s): Paiton McDonald (College of Agriculture & Natural Resources)

Feeding transition milk (TM; milkings 2-6) has recently been explored as a potential nutrition program to benefit preweaning calf health and enhance villi morphology at 5 d of age. However, it's unknown if the potential benefits of TM have lasting impacts on ileal (ILE) and jejunal (JEJ) development beyond the feeding period. The objective of this study was to determine if feeding calves TM diet improved villi development during the preweaning period. Singleton Holstein male calves (n=36) were blocked by birth weight and terminal endpoint, and randomly assigned to one of two preweaning diets, milk replacer (MR) or TM. At 7, 21, or 69 days of age, calves were humanely euthanized, and ILE and JEJ sections were collected for histology. Image analysis was performed using QuPath to take measurements of villi length (VL), width (VW), area (VA), and crypt depth (CD). Data were analyzed using generalized mixed models with fixed effects of diet, age, and their interaction with random effects of block. Average daily gain (ADG) increased when comparing MR to TM fed calves ($P = 0.015$). Increases in the JEJ VA (P 0.05) and villi crypt depth ratio (V:CD) (P 0.05) were mainly driven by TM diet, whereas measurement increases in ILE VA ($P = 0.06$) and V:CD ($P = 0.04$) were primarily due to age. In conclusion, TM supplementation in the preweaning period enhanced ADG, while villi morphology development differed in origin between the JEJ and ILE.

WEED SEED DISPERSAL BY BIRD SPECIES
Presenter(s): Zoey Neree (Indiana University Bloomington)
Category: Agriculture & Animal Science
Mentors(s): Lauren Sullivan (College of Natural Science)

Prairie strips, or swaths of native perennial vegetation within agricultural fields, benefit agriculture by improving soil health, creating habitats for pollinators and enhancing water quality. However, prairie stripes can be a source of weeds that spread into fields. Studies show seed-eating birds spread seeds in their feces, but we still do not understand if prairie strips enhance weed seed dispersal within bird feces. Our research objective is to determine if prairie strips increase bird feces in agricultural fields as a source of weed pressure. We ask the following research questions: 1) do prairie strips increase bird feces in agricultural fields? 2) Is bird feces a source of weed pressure from prairie strips into agricultural fields? And 3) if birds are moving seeds, what plant species are moved? Our study will investigate weed seed dispersal from prairie strips to agricultural fields at the MSU Kellogg Biological

Station (KBS). In 10 replicate fields, we will walk transects in three locations, at the boundary of the prairie strip and the agricultural field, 10 m away from the prairie strip, and at the center of the agricultural field. We will collect and germinate the samples and identify the germinants to species. We hypothesize we will see more feces near the prairie strips because it provides a better habitat and food sources for bird species. By learning about weed dispersal we can better manage and control agricultural weeds and reduce the cost of herbicide and equipment use over time.

AN ANALYSIS ON THE EFFECTS OF DIFFERING EDGE TYPES ON FLOWER VISITOR DIVERSITY WITHIN CANOLA FIELDS

Presenter(s): Wesley Petree (Michigan State University)
Category: Agriculture & Animal Science
Mentors(s): Amelia McGinnis (College of Agriculture & Natural Resources)

In modern agricultural landscapes, it is common to have asymmetrical edge types along the borders of fields. Insect diversity is known to decline with increasing distance from field edges. This effect, also known as edge-biased distribution, has been observed in fields including but not limited to: wheat, cotton, canola, potato, citrus, and blueberry orchards. Despite the extensive research on this topic, the effects on insect diversity between different edge types is much less-studied. It is suggested that in areas of higher plant biodiversity insect diversity would increase, as the wider variety of plants can provide refuge for a greater number of insects. A field with a forest edge may have higher insect diversity than a managed or prairie edge, due to the abundance of unique plant species. As significant decreases in insect biomass are being reported year over year, understanding how the neighboring landscapes can affect flower-visitor populations is important when considering methods to improve crop yields and restore insect populations. This study will analyze the flower-visiting population within two canola fields in the Long-Term Agroecosystem Research site at the Kellogg Biological Station. Sampling will occur along a prairie, managed, and forest edges to determine the effect that each neighboring landscape has on flower-visitor diversity. I hypothesize that flower-visitor diversity will decrease as distance from each edge increases. In addition, I expect that forest edges will have higher diversity than both the managed and prairie edges.

SUSTAINABLY INTENSIVE COVER CROPPING ALLOWS FOR SIMILAR SOIL BIODIVERSITY HEALTH AS SEEN IN RESTORED GRASSLANDS

Presenter(s): Mckayla Schrah (Michigan State University)
Category: Agriculture & Animal Science
Mentors(s): Deshae Dillard (College of Agriculture & Natural Resources)

Agricultural intensification contributes to widespread derogation of soil health that supports crop production. Sustainable intensification seeks to ameliorate these effects by integrating soil health practices that promote biological processes while maintaining productivity. We evaluated whether a sustainably intensified cropping system integrating cover cropping enhanced decomposition and nutrient cycling relative to conventional management. We compared aspirational corn and soybean systems, business-as-usual corn and soybean systems, and restored prairie at the W.K. Kellogg Biological Station Long-Term Agroecosystem Research Aspirational Cropping Systems Experiment in Michigan, USA. Cover crop residue decomposition was quantified using coarse- and fine-mesh litterbags that either permitted or restricted access by soil mesofauna and microfauna. We measured the mean microbial respiration during a 60-day decomposition period. Residue decomposition was greater in aspirational systems and restored prairie than under conventional management, particularly in coarse-mesh bags. Decomposition rates in aspirational fields were approximately 41% greater than in business-as-usual systems when soil fauna were permitted access to residue. Microbial respiration potential was higher in sustainably intensified systems, but realized microbial respiration was constrained by moisture. Differences amongst management systems were greatest in coarse-mesh litterbags, suggesting important roles for soil fauna in regulating decomposition and nutrient cycling. These findings indicate that integrating cover crops as a soil health practice enhance decomposition and nutrient release, frequently approaching levels observed in a semi-natural grassland. Our results support the premise that sustainable intensification can partially restore soil biodiversity-mediated ecosystem functions while maintaining agricultural production.

SEARCHING FOR NEW STRAINS OF CYPRINID HERPESVIRUS-3 AMONG NATURALIZED CARP POPULATIONS IN THE US

Presenter(s): Joseph Zuccola (Michigan State University)
Category: Agriculture & Animal Science
Mentors(s): Bartolomeo Gorgoglione (College of Veterinary Medicine), Santosh Lamichhane (College of Veterinary Medicine)

Cyvirus cyprinidallo3 (aka CyHV-3 or Koi herpesvirus, KHV) is a WOAH-notifiable viral pathogen infecting Common Carp and other cyprinid species. Clinical symptomatology may be seen seasonally in highly susceptible fish, with gill necrosis, breathing difficulties, lethargy, and altered swimming behavior, reaching mortality rate over 80%. Wild and farmed fish populations may suffer severe ecological and economic consequences in countries relying on aquaculture. The pathobiological impact of CyHV-3 on naturalized cyprinids in the USA is not yet fully elucidated. Aiming at retrieving new CyHV-3 strains from wild fish populations, we screened Common Carp sampled from two different lake types. These included: Clear Lake, the largest freshwater waterbody in California with recent history of CyHV-3 outbreak; Bennington Lake, a private man-made residential lake in Nebraska with no history of CyHV-3 detection. DNA was extracted from gills, kidney, spleen, and liver tissues, and the nucleic acid content quality and quantity checked using spectrophotometry. Specimens were tested using PCR protocols targeting CyHV-3 genomic specific sites, followed by target detection analysis (either amplification/melting curve or gel electrophoresis). We successfully detected CyHv-3 from specimens from both lakes, indicating the virus presence in apparently healthy wild fish populations. Attempts to isolate new CyHV-3 strains in cell cultures were unsuccessful, viral induced cytopathic effect was not observed in conventional and neither in newly developed cell lines. This study confirms that CyHV-3 continues to spread in the US through asymptomatic fish populations, in sites with premier sport fishing relevance and in locations with no history of disease outbreaks.

BEAUVERIA BASSIANA AS A MITICIDE AGAINST VARROA DESTRUCTOR IN HONEY BEE (APIS MELLIFERA) COLONIES

Presenter(s): Keith Woolsey (Eastern Michigan University)
Category: Agriculture & Animal Science
Mentors(s): Meghan Milbrath (College of Agriculture & Natural Resources), Peter Fowler (College of Agriculture & Natural Resources)

Varroa destructor is a devastating pest of European honey bees (Apis mellifera), affecting colonies worldwide. Varroa mite control is a huge priority for beekeepers and scientists. Fortunately, multiple synthetic and naturally derived acaricides, provided honey bees with some relief from these parasites; however, this relief was only temporary, as varroa has become resistant to many of these products over time, necessitating different solution. Beauveria bassiana is a fungus that has been used as an insecticide against various insect taxa. In this project we assessed the efficacy and safety of B. bassiana Strain HF23 in honey bee colonies for the control of varroa mites. We utilized two apiaries, dividing hives into groups treated either with B. bassiana or a commercially available miticide (VarroxSan) as a control. Mites were enumerated using standard mite wash and sticky boards of five-day intervals post treatment. Infection was confirmed using an infection assay and SEM microscopy. Data collection is ongoing and will be completed by the summer of 2026.

Biochemistry & Molecular Biology

DEACTIVATION PATHWAYS OF CALCITONIN RECEPTORS WITH MACHINE LEARNING-AUGMENTED MOLECULAR SIMULATIONS

Presenter(s): Campbell Woodruff (Michigan State University)
Category: Biochemistry & Molecular Biology
Mentors(s): Samik Bose (College of Natural Science)

Deactivation of the calcitonin receptor (CTR) involves slow conformational transitions that are difficult to characterize with conventional molecular dynamics. Prior molecular dynamics (MD) simulations from experimentally obtained active and inactive states (crystal structures) did not show spontaneous deactivation, consistent with the expectation that the transition occurs on timescales beyond standard sampling. Previous work by collaborators identified two specific tyrosine residues (191TYR and 391TYR) in CTR that are hypothesized to stabilize a kinked active-state conformation in CTR-RAMP1 complex. To test this, my colleagues had previously carried out straightforward molecular dynamics (MD) simulation with Y191F/Y391F double mutant active CTR-RAMP1 complex embedded in membranes. However, the mutant systems did not undergo expected conformational rearrangement, indicating that CTR-RAMP1 deactivation likely occurs through rare, slow-timescale transitions that require enhanced sampling. In this project I am combining a deep learning based structure prediction tool developed in MSU (aSAM) with enhanced sampling MD simulations to characterize the deactivation pathways of CTR. We generated probable intermediates between active and inactive states with aSAM and ran tICA-guided REVO simulations to explore transitions from active to inactive states and estimate their relative thermodynamic populations. I have generated the simulation inputs using charmm-gui and analyzed the simulation data so far, which will be presented here. As next steps, the aggregated REVO trajectories will be integrated into Markov state models to identify metastable states, dominant deactivation pathways, and kinetic features of CTR-RAMP1 deactivation. Beyond CTR-RAMP1, this workflow provides a general framework for resolving slow conformational switching in difficult-to-sample Class B GPCRs and for validating machine-learning-predicted intermediates using physics-based molecular simulations.

PREDICTING TISSUE-SPECIFIC GENE EXPRESSION FROM PROMOTER SEQUENCE COMPOSITION IN SORGHUM BICOLOR
Presenter(s): Shafay Asghar (Washington University in St. Louis)
Category: Biochemistry & Molecular Biology
Mentors(s): Jedidiah Peek (College of Natural Science)

Plants build specialized tissue types from a single genome, requiring precise control over localized gene expression. Much of this control is transcriptional, achieved in part when transcription factors bind short sequence motifs within a gene's promoter to activate or repress expression. Which sequence features specify tissue-specific expression, however, remains largely unknown. Previous research has shown that k-mer composition of promoters carries information predictive of a gene's expression pattern. However, the combinatorial nature of transcription factor binding makes it hard to identify which motifs drive specificity in a given tissue. In this study, we predict epidermal expression specificity in Sorghum bicolor through promoter k-mer composition. Promoter sequences are encoded as k-mer frequency matrices, and each gene's expression is normalized across tissues into a probability distribution. Jensen-Shannon divergence then quantifies how far that distribution departs from one representing exclusive epidermal expression. We use elastic net regression and gradient boosted trees as separate modeling approaches, contrasting a regularized linear model against one able to capture interactions between motifs. We aim for this study to establish a generalizable strategy for linking promoter sequence to expression, and to identify candidate binding motifs underlying tissue-specific regulation. This work will broaden our understanding of sorghum promoter architecture and take steps towards design of synthetic epidermal promoters.

IDENTIFYING SPECIFIC GENE FUNCTION IN THE ABC1K PROTEIN FAMILY
Presenter(s): Olivia Conkle (Weber State University)
Category: Biochemistry & Molecular Biology
Mentors(s): Tommy Conway (College of Natural Science)

Within plant chloroplasts are lipid-protein particles known as plastoglobules. Plastoglobules, or PGs, form as droplets from the thylakoid membrane, where they remain connected after formation. Our research aims to investigate the function of plastoglobule-localized atypical protein kinases in the ABC1K family, a unique protein kinase family that show very low similarity with other eukaryotic protein kinases. We plan to uncover the roles of ABC1K's in the PG by phenotyping insertion mutants in Arabidopsis thaliana using three stress screening methods; DEPI (Dynamic Environmental Photosynthetic Imager) chamber screens, pigment assays, and reactive oxygen species (ROS) staining techniques. The DEPI chamber monitors the samples while exerting stressors such as cold, heat, and light. Chlorophyll fluorescence measurements are used to assess photosynthetic efficiency and overall plant health. Our pigment assays will assess chlorophyll biogenesis of mutants abc1k1 and abc1k5. These mutants have been reported to display altered leaf color as seedlings compared to the wild type. This phenotypical difference may indicate differing chloroplast development, and we plan to quantify that difference. Lastly, we plan to conduct an oxidative stress screening on several mutant lines and use staining techniques to identify unstable oxygen species that serve as a visual marker of plant stress response. These three methods are expected to provide a novel perspective of the specific functions of the ABC1K family at the plastoglobule, and support the development of genetic tools to improve the stress tolerance and photosynthetic performance of crop plants.

PREDICTIVE PIPELINES FOR PROTEIN FUNCTION
Presenter(s): Anna Yee (California State Polytechnic University - Pomona)
Category: Biochemistry & Molecular Biology
Mentors(s): Josh Vermaas (College of Natural Science)

Across biology, there are over 200 million known proteins to date across thousands of organisms. Each of these proteins carries out a specific function, which is encoded in the protein structure and dynamics. Protein structure is encoded by the specific amino acid sequence, as demonstrated by recent AI structure prediction tools like AlphaFold. Since protein function is directly tied to its structure, AI tools should similarly be able to predict protein function directly from the amino acid sequence. We are testing AlphaFunctor, a tool that assigns Gene Ontology (GO) annotations given an input amino acid sequence by analyzing topological features buried in the amino acid sequence. Concretely, we are comparing the output of AlphaFunctor to the reviewed Swiss-Prot protein dataset to classify the outputs into three classes to create a confusion matrix: 1.) Functions predicted by AlphaFunctor and also found in Swiss-Prot. 2.) Functions predicted by AlphaFunctor but not found in Swiss-Prot 3.) Functions missed by AlphaFunctor. We anticipate that AlphaFunctor may struggle and predict deeper into the GO hierarchy than is supported by experimental evidence. This confusion matrix will be used to improve AlphaFunctor and learn its limitations in its current iteration.

EVALUATING VARIETY-SPECIFIC GROWTH AND PHYSIOLOGICAL RESPONSE IN POTATOES
Presenter(s): Murphy Zabala (Cuyahoga Community College)
Category: Biochemistry & Molecular Biology
Mentors(s): Nicholas Schlecht (College of Natural Science)

Climate change affects potatoes due to heat and drought stress concerns. Potatocrops typically show stress response through changes in the plant's physiology, tuberization process, and loss of total yield. Tubers primarily act as a form of storage for the potato plant to use under stress, making mature tubers smaller as they are drawn from during heat or drought stress. A possible solution to mitigate stress response is utilizing natural products from more stress-resilient plants. A well-documented enzyme involved in plant resilience is Galactinol Synthase (GolS). A stress resilient enzyme found in most plants, Galactinol Synthase (GolS), is the first committed step into the raffinose family of oligosaccharides (RFOs) that protect against radical oxygen species, osmotic stress, and stabilizes cell walls. We will conduct high throughput assays to find ligands that cause GolS2 to overexpress in stress susceptible plants, enhancing yield and plant health. Potatoes will be sprayed with GolS2 ligands and monitored for changes in growth and tuberization under heat and drought stress, intending to produce higher yield of tubers. Eventually, we aim to apply this same procedure to more species of stress-susceptible plants to combat stress responses that impact plant development and cultivation yield.

INVESTIGATING THE ROLE OF ELONGATOR PROTEIN 3 IN HETEROCHROMATIN FORMATION
Presenter(s): Margaret Ver Steeg (Michigan State University)
Category: Biochemistry & Molecular Biology
Mentors(s): Tommy Vo (College of Human Medicine)

Elongator complex participates in tRNA modification by promoting mcm5s2 side chains at wobble uridines. Elongator protein 3 (Elp3) is the highly conserved catalytic subunit of this complex, primarily functioning as a tRNA acetyltransferase. Previous literature concluded that the Elongator complex subunits may regulate heterochromatin assembly. Our lab recently found that Elongator protein 1 (Elp1) can regulate heterochromatin assembly. However, the role Elp3 plays in the formation of heterochromatin remains unclear. I hypothesized that

Elp3 plays a role in heterochromatin formation based on our lab's previous results. The tractable fission yeast Schizosaccharomyces pombe was selected as a model organism because of its conserved mechanisms of heterochromatin assembly. To test my hypothesis, I performed polymerase chain reactions (PCRs), serial yeast growth spotting assays, and isolation of total RNA followed by quantitative PCRs (qPCR). I compared gene expression at pericentromeric heterochromatin between wild-type S. pombe cells and cells with pertinent mutations such as elp3 deletion (elp3Δ) and elp3 domain mutants (elp3-YY, elp3-CC). My results indicate that Elp3 plays a conditional role in heterochromatin formation. This work will expand the understanding of heterochromatin formation and the role the Elp3 plays.

FUTILE-CYCLE INDUCERS THAT DECOUPLE THE TWO STEPS OF ACETYL-COA CARBOXYLASE CATALYSIS

Presenter(s): Rachel Passage (Lake Superior State University)
Category: Biochemistry & Molecular Biology
Mentors(s): Andrea O'Malley (College of Natural Science)

Acetyl-CoA carboxylases catalyze the biotin-dependent carboxylation of acetyl-CoA to malonyl-CoA, the first step in fatty acid and membrane lipid biosynthesis. The Escherichia coli acetyl-CoA consists of four proteins and formation of a protein-complex is involved in allosteric regulation. The E. coli ACC represents the form found in almost all pathogenic bacteria. As such, it is an example for antibiotic drug development to fight the spread of antibiotic resistance. It is also a model of cyanobacteria and plant plastid ACCs as biofuel engineering targets. In contrast, the Shewanella oneidensis MR-1 (Gram-negative bacteria known for dissimilatory metal reduction) has a unique single chain acetyl-CoA carboxylase that likely has unique allosteric regulation. Our goal is to develop futile-cycle inducers that decouple the two steps of ACC catalysis. We have discovered that an enolate analog of acetyl-CoA has a futile cycle inducing effect for both E. coli and Shewanella ACC using a coupled enzyme kinetic assay. This demonstrates ACC futile-cycle inducers should be broadly acting. As a follow-up we are modeling the catalytic interactions and screening virtual libraries for drug leads.

CAN FRAGMENTATION IN SCAFFOLD-CONSTRAINED MOLECULAR GENERATION BE SOLVED WITH ALGEBRAIC GRAPH CONNECTIVITY SCORING?

Presenter(s): Johnathan Ahdout (Princeton University)
Category: Biochemistry & Molecular Biology
Mentors(s): Alexander Dickson (College of Natural Science)

Generating drug-like molecules with desired 3D structure is a central challenge in computational drug discovery. Exploring the chemical space around a validated molecular scaffold by hand is slow and does not scale, motivating generative methods that can propose diverse, valid substituents automatically for lead optimisation. LEVI is a variance-exploding, energy-based diffusion model for de novo 3D small-molecule generation built on equivariant graph neural networks (EGNNs). This project extends LEVI to scaffold-constrained molecular inpainting, where given a fixed molecular scaffold with known 3D coordinates, we can generate chemically valid fragment atoms around it, connected to the scaffold, with EGNNs predicting fragment size and anchor points. A central failure mode of scaffold-conditional sampling is fragment disconnection during generation. We introduce a novel graph Laplacian connectivity loss, a differentiable penalty built from the algebraic connectivity (Fiedler value) of the generated molecular graph, whose gradient is injected as a correction force during reverse diffusion. We further compare models fine-tuned directly on scaffold-conditional data, versus inference-time-only inpainting applied to a pretrained unconditional model, implemented as either fixed scaffold clamping or RePaint-style re-noising of the scaffold at each reverse-diffusion step to keep it in-distribution. We evaluate the connectivity loss across experimental simulations with optimisations to resampling schedule and steric/valence correction terms across independently trained model checkpoints (pretrained, fine-tuned, and trained from scratch), assessing fragment validity, diversity, and connectivity with RDKit. Current results show connectivity rising significantly when the loss is active; the RePaint and fine-tuning comparisons are ongoing. Mathematically rigorous supplementary proofs and visualisations are provided.

INCREASING STATIONARY PHASE SURVIVAL AND EFFICIENCY OF ZYMOMONAS MOBILIS WITH PROTEORHODOPSIN
Presenter(s): Noa Levi (SUNY College of Environmental Science and Forestry)
Category: Biochemistry & Molecular Biology
Mentors(s): Emma Boismier (College of Natural Science), Michaela TerAvest (College of Natural Science)

The bacterium Zymomonas mobilis has been used for thousands of years in the production of ethanol in alcoholic beverages. In modern times, its high efficiency in anaerobic respiration has put it into the spotlight for the use in biofuels. An important goal is engineering Z. mobilis to produce terpenoid bioproducts via the methylerythritol phosphate (MEP) pathway, which generates terpenoid precursors. Recent modeling suggests that one rate limiting step in terpenoid production is production of electron carrier molecules by the Rnf complex, which relies on proton motive force, similar to ATP synthase. We hypothesized that electron carrier production could be improved by expressing proteorhodopsin (PR), which is a protein that functions as a light-powered transmembrane proton pump. The goal of this project was to confirm PR function in Z. mobilis. In S. oneidensis, PR increases survival of bacterial cultures in stationary phase. We will identify if this is also true in Z. mobilis. Additionally, because Z. mobilis wild type is independent of light, addition of PR has the potential to give the organism a phototrophic capability. This may give Z. mobilis the ability to increase biofuel production even under nutrient limited conditions, decreasing the amount of organic inputs needed to produce the same amount of bioproduct, providing a more sustainable approach.

TOWARDS SYNTHETIC PHOTOENDOSYMBIOSIS: ENGINEERING SYNECHOCOCCUS ELONGATUS FOR MALTOSE EXPORT
Presenter(s): Paige Amwoza (University of Illinois Urbana-Champaign)
Category: Biochemistry & Molecular Biology
Mentors(s): Jorge Guio-Martinez (College of Natural Science)

Photoendosymbiosis is a fundamental biological interaction in which a host organism harbors photosynthetic cells that provide fixed carbon, typically in the form of sugars. The overall goal of this project is to engineer S. elongatus to overproduce and export maltose from intracellular glycogen reserves. In doing this, we hope to create strains suitable for functioning as synthetic endosymbionts. To achieve this goal, we will overexpress amylases in a strain of S. elongatus harboring the sugar transporter CscB, which enables secretion of intracellular disaccharides. Amylases degrade starch into smaller sugars, like maltose or maltotriose. By testing amylases from different organisms, we expect to find candidates able to promote the breakdown of glycogen into maltose. This will be carried out by cloning amylases into plasmids for genomic integration into S. elongatus, which will be transformed into a strain overexpressing the CscB sugar transporter. By using commercial kits, we will measure extracellular maltose levels in these engineered strains to assess their capacity to secrete this disaccharide. This work hopes to make progress in photosynthetic sugar production in cyanobacteria and contribute to the study of synthetic endosymbiosis.

ELUCIDATING PROTEIN-PROTEIN INTERACTIONS CONTRIBUTING TO NON-PHOTOCHEMICAL QUENCHING (NPQ) IN PG18 KNOCKOUT ARABIDOPSIS THALIANA.
Presenter(s): Sarah Weber (Michigan State University)
Category: Biochemistry & Molecular Biology
Mentors(s): Lydia Bergerson (College of Natural Science)

Plastoglobules are lipoprotein bodies that bud out from the Thylakoid membrane, and perform regulatory roles such as optimizing photosynthetic activity, influencing plastid development, and responding to environmental stressors. Residing at the Plastoglobule in Arabidopsis Thaliana, Plastoglobular protein 18 (PG18) is thought to play a role in thylakoid formation and potentially be involved in redox-controlled processes during photosynthesis. It is hypothesized that the PG18 protein contributes to a mechanism that reduces the amount of non-photochemical quenching (NPQ) occurring, which is a measure of heat dissipation that is dependent on ATP synthase levels and overall, photosynthetic efficiency. In mutants lacking PG18, plants take on a pale green phenotype, along with a significantly increased NPQ which indicates a defect in thylakoid membrane formation and a lower electron transport rate. Using this PG18 mutant as the background, suppressor screens conducted with ethyl methanesulfonate mutagenesis (EMS) were utilized to provoke extragenic mutations that restore the WT phenotype of low NPQ in pG18 mutant lines. Identifying the mode of the suppression found to restore WT phenotype will elucidate new insight on PG18's involvement in the mechanism that reflects NPQ, and further clarify the role the protein plays in light harvesting and thylakoid structure. In addition to EMS, high light stress cross-linking results gave insight on the specific PG-associated proteins that PG18 is interacting with, as well as structural information regarding PG18's potential active site(s).

PROXIMITY-LABELING BASED APPROACH TO DECIPHERING MRNA INTERCEPTOR PROTEIN BINDING PARTNERS.
Presenter(s): Zach Bickell (Michigan State University)
Category: Biochemistry & Molecular Biology
Mentors(s): Tommy Vo (College of Human Medicine)

Meiotic mRNA interceptor 1 (Mmi1) is a protein critical to regulating the transition between mitosis and meiosis in the fission yeast Schizosaccharomyces pombe. Previous studies revealed that Mmi1 negatively regulates this transition by specifically binding RNAs involved in meiotic progression (meiRNA) and triggering degradation. This is facilitated by the C-terminal YTH domain, which recognizes and binds specific sequences referred to as "determinants of selective removal" (DSRs), which are native to many meiRNAs. Mmi1 then recruits the MTREC exosome adaptor complex to degrade the bound RNA, thereby suppressing meiotic RNA transcript levels and preventing the entry into meiotic prophase. Later studies further implicated Mmi1 in chromatin remodeling processes, where it was observed that Mmi1 regulates chromatin condensation by associating with the histone methyltransferase Clr4 at islands rich in meiotic genes. Mmi1 has also been implicated in mRNA polyadenylation, which relates to the regulation of translation and degradation, adding a third regulatory role to this proteins function. This inherent complexity of behavior has led us to theorize that there are additional protein partners that allows Mmi1 to switch between these functional states in vivo. In this study, we perform proximity-labeling using TurboID to tag potential proximal binding partners, and analyze these proteins by mass spectrometry.

EXPLORING OVERLAPPING HISTONE ACETYLTRANSFERASES IN EPIGENETIC REGULATION
Presenter(s): Erik Howe (Okemos High School)
Category: Biochemistry & Molecular Biology
Mentors(s): Tommy Vo (College of Human Medicine)

Human ELP1 and ELP3 are protein subunits of a conserved complex called Elongator. Mutations of Elongator can lead to severe neurological disorders or cancers. However, the molecular roles of ELP1 and ELP3 are not yet fully understood. Our lab recently found that knocking out the homolog of ELP1, called Elp1, in the fission yeast S. pombe enhances histone acetylation near telomeres. Subsequently knocking out Elp3 in Elp1-deficient yeast cells reduces histone acetylation to near wild-type levels. This suggests that Elp1 may suppress a cryptic function of Elp3 that relates to histone acetylation. Since Elp3 was previously reported to have H3K14 acetylation activity in vitro, I hypothesized that Elp3 has a cryptic function in H3K14 acetylation in Elp1-deficient yeast cells. I tested this by immunoblotting to search for de novo H3K14 acetylation in the absence of the canonical H3K14 acetyltransferases Gcn5 and Mst2. Although I did not detect Elp3-dependent H3K14 acetylation at the total protein level, I spuriously discovered that the genes encoding Elp1, Gcn5, and Mst2 genetically interact to modulate Elp3 protein levels and telomeric gene expression. This suggests a novel molecular coordination between Elp1, Gcn5, and Mst2 that could underlie the regulation of Elp3 abundance and functions. My work in the genetically tractable yeast could reveal new molecular mechanisms of Elp1 and Elp3 that are conserved in humans. This will advance our understanding of the roles of Elongator in various human diseases and disorders.

INCREASING THE SOLUBILITY OF ANCESTRAL RECONSTRUCTED FLAVIN-DEPENDENT HALOGENASES
Presenter(s): Keira Eby (University of Michigan)
Category: Biochemistry & Molecular Biology
Mentors(s): Natalia Harris (University of Michigan Life Science Institute)

Protein insolubility remains a major challenge during recombinant protein purification, often resulting in low yields and limiting downstream biochemical characterization. Fusion tags, such as maltose-binding protein (MBP), are commonly used to improve protein solubility and facilitate purification of difficult-to-express proteins. In this study, we evaluated the ability of MBP to improve the soluble expression of ancestrally reconstructed flavin-dependent halogenases (FDHs), a class of enzymes with significant potential for selective halogenation chemistry. Target FDH genes were amplified by PCR, cloned into an MBP expression vector using Gibson Assembly, and verified prior to small-scale expression testing. Soluble and insoluble protein fractions were analyzed to determine whether fusion to MBP improved protein recovery. This work demonstrates the utility of MBP as a solubility-enhancing fusion tag for ancestrally reconstructed FDHs and establishes a platform for future biochemical characterization of these engineered enzymes. Improving access to soluble ancestral halogenases will facilitate studies aimed at understanding their catalytic properties and expanding their applications in biocatalysis.

IDENTIFICATION OF STAGE-SPECIFIC DISEASE RESISTANCE GENES DURING STRAWBERRY FRUIT DEVELOPMENT
Presenter(s): Brianna Sabbagh (Michigan State University)
Category: Biochemistry & Molecular Biology
Mentors(s): Melanie Leonard (College of Agriculture & Natural Resources), Patrick Edger (College of Agriculture & Natural Resources)

Strawberries are highly susceptible to various fruit diseases, most notably Gray Mold (caused by Botrytis cinerea) and Anthracnose Fruit Rot (caused by Colletotrichum spp.), which often result in devastating crop losses. As the plant shifts resource allocation to support maturation, the genetic underpinnings of stage-specific disease resistance remain poorly understood. In this study, we analyzed global gene expression patterns throughout strawberry fruit development and functionally characterized differentially expressed genes, with a specific focus on those encoding disease resistance. Our results reveal distinct, stage-specific expression profiles for a suite of resistance genes. Furthermore, we investigated whether these genes exhibit subgenome-specific biases, as previously observed for other critical agronomic traits in cultivated octoploid strawberries. These findings provide a framework to guide future breeding and genetic engineering efforts aimed at enhancing disease resistance and ultimately mitigating crop loss.

Biosystems & Agricultural Engineering

SPIDER COMMUNITIES ACROSS A GRADIENT OF VINEYARD MANAGEMENT STYLES IN WEST MICHIGAN
Presenter(s): Abraham Parsons (Grand Valley State University)
Category: Biosystems & Agricultural Engineering
Mentors(s): Lauren Goldstein (College of Agriculture & Natural Resources)

Vineyards are a valuable part of Michigan's agricultural sector: growers generate over $6 billion within Michigan annually. Despite this, grape growers face significant challenges trying to keep their vineyards healthy. Insect pests are a particular concern, damaging fruit and vines. This can represent significant lost income.
Insecticides are typically the first line of defense against insect pests. However, insects can rapidly develop resistance to these chemicals, diminishing their effectiveness over time. Many insecticides, even organic, are also harmful to beneficial insects like bees. Runoff can also pose risks to nearby waterways and other natural habitats. Beneficial arthropods, particularly spiders, are often overlooked as allies in pest control. Spiders are harmless to crops and can be beneficial in controlling insect populations. Spiders also remain active when other predatory arthropods are not. How spider contributions to pest control change across vineyard management styles has not been well documented in Michigan. Cultivation of ideal habitats and natural refugia via tall grass or flowering plant patches adjacent to vineyard crop rows may allow growers to access significant pest control services and facilitate reduced pesticide use. We sampled within crop rows and adjacent non-crop habitat across a range of vineyard management styles in West Michigan, from strictly managed conventional systems to certified organic, regenerative farms. The creation of a catalog of vineyard spider species will contribute to viticulture's growing body of knowledge of beneficial arthropods. We hypothesize that spider abundance and species richness in vineyard crop habitat will vary significantly across vineyard management styles.

COMPARISON OF AREAS AND DIMENSIONS FOR HEAVY METAL TESTING USING BORON DOPED DIAMOND ELECTRODES
Presenter(s): Caroline Tracz (Michigan State University)
Category: Biosystems & Agricultural Engineering
Mentors(s): James Siegenthaler (College of Engineering)

Due to increasing industrialization and technological advancements in the field of agriculture, environmental pollutants are more prevalent than ever. Heavy metal contamination poses a major threat to humans, animals, and ecosystems, especially when accumulated in crops. Boron doped diamond (BDD) has become more common in electrochemistry, due to its significant chemical stability, low background current, and wide potential window. To address the need for heavy metal detection in water, 2mm BDD electrodes were fabricated and heavy metal response for detection was optimized using differential pulse anodic stripping voltammetry for Cd, Pb, Cu, and Hg. Through optimization, electrodes could sense a variety of heavy metals, while further tests in agriculture water could prove BDD electrodes as a key next step in reusable long term heavy metal monitoring systems.

ENHANCING ROBOTIC CHESTNUT HARVESTING THROUGH VISION-BASED LOCALIZATION AND MOTION OPTIMIZATION
Presenter(s): Rona Lei Duldulao (University of Hawaii at Manoa)
Category: Biosystems & Agricultural Engineering
Mentors(s): Yuzhen Lu (College of Agriculture & Natural Resources)

Michigan leads the United States in chestnut production, accounting for approximately 13% of the nation's acreage. Because many chestnut orchards are small-scale operations, harvesting remains labor-intensive and time-consuming. Existing commercial mechanical harvesting systems are often too expensive for small producers, non-selective, and prone to damaging nuts. To address these limitations, this project investigates how a vision-guided Delta-arm robotic harvesting system can be improved to accurately detect, localize, and harvest on-ground chestnuts under realistic orchard conditions, offering a more affordable alternative to costly existing machinery. It is hypothesized that a computer vision model trained on real-world orchard imagery, combined with optimized robotic trajectory planning, will improve positioning accuracy and harvesting performance.
The proposed research will first reproduce and validate a YOLOv11x chestnut detection model using a public dataset of on-ground chestnuts. Following validation, this perception system will be integrated with an RGB-D camera for 3D localization, coordinate transformation algorithms, a Delta-arm manipulator, genetic algorithm-based inverse kinematics, and a vacuum end-effector. Additionally, research will focus on optimizing perception-manipulation integration and trajectory planning to reduce cycle times. System performance will be evaluated based on robotic positioning accuracy (Euclidean distance error) and harvesting metrics, including pick success rate, throughput, visible damage rate, and clogging incidence. Preliminary replication of the YOLOv11x model demonstrates strong detection performance, confirming its suitability. The expected outcome is a more efficient, practical, and affordable robotic platform capable of supporting autonomous harvesting for small-scale orchard environments.

AMPLIFYING CAMPYLOBACTER JEJUNI RETRIEVAL FOR DETECTION THROUGH MAGNETIC FLOCCULATION
Presenter(s): Finnian James (Michigan State University)
Category: Biosystems & Agricultural Engineering
Mentors(s): Anthony James Franco (College of Agriculture & Natural Resources), Evangelyn Alocilja (College of Agriculture & Natural Resources)

Campylobacter jejuni is a leading global bacterial cause of foodborne illnesses. Approximately 1.5 million Americans contract a Campylobacter-related illness annually, leading to an economic cost of up to $6.8 billion annually. Rapid detection plays a crucial role in controlling the spread of such infections. One of the challenges in detecting Campylobacter is the lengthy and cumbersome detection process. This study presents a novel approach to speed up and enhance the recovery of C. jejuni from samples by implementing magnetic flocculation. The process involves using chitosan to flocculate glycan-coated magnetic nanoparticles (gMNPs) and C. jejuni cells into magnetic flocs, which a magnet can easily recover. The recovered cells were subsequently detected by culturing and gold nanoparticle-based DNA detection. Flocculation increased the recovery of C. jejuni across a range of concentrations spanning several orders of magnitude compared to non-flocculated samples. Recovered C. jejuni was successfully detected by both culture and nano-biosensor methods. The recovery process can take as little as 30 minutes, significantly shortening the analysis time. Ongoing experiments focus on optimizing the experimental conditions and validating them in more complex matrices. This approach offers a cost-effective, and rapid means of preparing samples for C. jejuni detection in various matrices.

Cell Biology, Genetics, & Genomics

MODELING PIEZO1-DEPENDENT MECHANOSENSING IN HIPSC-DERIVED TISSUES USING GENEPI
Presenter(s): Alexis White (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Freyda Mannering (College of Osteopathic Medicine)

Piezo1 is a mechanically-gated ion channel that regulates calcium influx in response to membrane tension, shear stress, and stretch, so it is successful at translating cardiac mechanical forces into cellular signaling events. To accurately and precisely monitor Piezo1 activation, the genetically encoded fluorescent GenEPi construct will be carefully integrated into hiPSCs using a transposase system. The GenEPi construct, together with a transposase plasmid, will be delivered via electroporation, an approach optimized for high-efficiency genome engineering in stem cells. This engineered cell line allows for real-time, single-cell visualization of Piezo1-dependent calcium signaling during mechanical stimulation. Further, these hiPSC-GenEPi cells can be differentiated into complex cardiovascular models, including perivascular adipose tissue organoids and heart organoids, to study Piezo1 mechanosensing within tissues. Understanding this mechanotransduction pathway could provide new insights into cardiovascular diseases such as hypertension and heart failure, where altered mechanical forces may contribute to vascular dysfunction.

EXCLUSIONARY GENETIC VARIANTS FOR RETINAL DYSPLASIA IN ENGLISH SPRINGER SPANIELS
Presenter(s): Eshal Sajjad (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Keiko Miyadera (College of Veterinary Medicine)

Retinal dysplasia is an inherited disorder characterized by abnormal retinal formation that can lead to visual impairment in dogs and humans. English Springer Spaniels (ESS) are among the dog breeds affected by this condition, yet the genetic variation that causes retinal dysplasia remains unknown. The purpose of this study is to identify the genetic variant that leads to retinal dysplasia in ESS. A total of ten client-owned ESS dogs, five cases and five controls, were included in this study. Whole genome sequencing was conducted on DNA samples from these ESSs and aligned to a canine reference sequence (UU_Cfam_GSD_1.0_ROSY) and variants called. These variants were sorted through Golden Helix and SnpEff for variants of interest. They were then analyzed in VarElect to determine gene association with RD through keyword based scoring. Variants of interest were selected to be PCR amplified and Sanger sequence among a larger group of ESS samples. Sequencher was used to analyze the Sanger sequencing data, and validate the variants' zygosity based on chromatograms. The study resulted in 17 variants being excluded as possible genetic variant candidates for retinal dysplasia in ESS due to improper segregation. The study's results are inconclusive and further variant filtering must be done. Identifying the causal mutation for retinal dysplasia in ESS is important for the health of the ESS breed. A DNA-based assay can allow for informed breeding decisions. Additionally, this information may contribute to finding the genetic variant for retinal dysplasia in other species.

DROUGHT STRESS GENES IN CAMELINA SATIVA AND THEIR RETENTION ACROSS POLYPLOIDY
Presenter(s): Barman Nasirpour (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Patrick Edger (College of Agriculture & Natural Resources)

This project's aim is to identify genes in Camelina sativa that are related to drought stress tolerance and gauging their significance in that role, as well as examining retention and/or change of gene function and expression across polyploidy.

MODELING GLUCOLIPOTOXIC STRESS IN HIPSC-DERIVED VASCULAR-ADIPOSE ASSEMBLOIDS AS A HUMAN PLATFORM FOR PERIVASCULAR ADIPOSE TISSUE DYSFUNCTION
Presenter(s): Davis Christy (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Aitor Aguirre (College of Engineering), Freyda Mannering (College of Osteopathic Medicine)

Glucolipotoxicity, the cellular stress caused by chronically elevated free fatty acids and glucose, is a key driver of cardiometabolic disease, and contributes to oxidative stress, inflammation, and impaired insulin signaling. An area of growing interest in understanding this condition is the role of local vascular regulators, particularly perivascular adipose tissue (PVAT). PVAT, the adipose tissue that surrounds blood vessels, regulates vascular tone and modulates inflammation through the release of adipokines, gaseous and small molecule mediators, lipids and fatty acids, and immune-derived mediators. Dysfunctional PVAT has been associated with hypertension, atherosclerosis, obesity, and type II diabetes, yet how glucolipotoxic stress disrupts PVAT specifically remains poorly understood due to limited human models. This project aims to create a human in vitro model of PVAT using human vascular-adipose assembloids (hVAAs) derived from human induced pluripotent stem cells (hiPSCs). The vascular and adipose organoids are generated separately and later integrated into assembloids that recapitulate structural and functional characteristics of human PVAT tissue. hVAAs are characterized using molecular and cellular techniques to analyze vascular organization, adipose maturation, and vascular-adipose crosstalk. Building on this model, we are investigating how glucolipotoxic conditions impact PVAT structure and function. Our human-based PVAT model provides a new platform for studying glucolipotoxicity-driven PVAT dysfunction and can be used to improve cardiometabolic therapeutics and assess patient-specific responses.

THE ROLE OF ARC6 IN CAROTENOID SYNTHESIS AND STORAGE
Presenter(s): Trevian Glasper (Central Michigan University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Lauren Stanley (Central Michigan University)

Carotenoids are yellow, orange, and red pigments in photosynthetic organisms. In plants, carotenoids have essential functions in photosynthesis and stress responses. They also have non-essential functions in flowers and fruits, where their colors attract pollinators and seed dispersers. Carotenoids are not only important in plants but are also required for vitamin A production in animals. For these reasons, it is important to know more about how these pigments are made and stored. In this study, we use the crimson monkeyflower (Mimulus verbenaceus) as our model. This species has red flowers due to the layering of two pigments, pink anthocyanins and yellow carotenoids, but our lab has generated a pink-flowered mutant with reduced carotenoids. We mapped the mutation to the ACCUMULATION AND REPLICATION OF CHLOROPLASTS 6 (ARC6) gene, known to be involved in chloroplast division in the model plant Arabidopsis. Because Arabidopsis does not produce storage structures for carotenoids in its flowers or fruits, our arc6 Mimulus mutant provides an opportunity to study this gene's function in non-photosynthetic tissues. The goals of this study are to 1) understand how arc6 mutation alters gene function; 2) check for knockdown of ARC6 in RNAi plants, and 3) build a plasmid to express the functional ARC6 gene in the mutant. This will demonstrate how ARC6 affects pigmentation in flowers, which is important for pollination in M. verbenaceus, and improve our basic knowledge of carotenoid production and storage in plants. This work could be applied to engineer carotenoid production in crops to increase nutritional value.

NUTRIENT SIGNALING AND PHENOTYPING OF ARABIDOPSIS UNDER COMBINED NUTRIENT STRESS
Presenter(s): Landon Debbas (Barry University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Hatem Rouached (College of Agriculture & Natural Resources), Hui-Kyong Cho (College of Agriculture & Natural Resources)

Mineral nutrients play an extensive role in crop growth, with over 16 being essential. Understanding how plants respond to nutrient limitations is fundamental to optimizing global crop yields and agricultural sustainability. Elements such as nitrogen and phosphorus are critical to plant metabolism and photosynthesis. Models show how these nutrients can cause different flowering times when undergoing stress environments. Additionally, there exists crosstalk showing that nitrogen controls the phosphate starvation response (PSR). However, the phenotypic response under the combined nutrient stress is unknown. Here we show that the combined stress environment leads to phenotypic differences in Arabidopsis Thaliana. We observe that under a combined stress (-N, -P), it showed many similarities to nitrogen deficiency but didn't maintain the same flowering timing. Observation of leaves on combined nutrient stress showed purple pigmentation matching that of nitrogen deficiency; however, growth yield was 50% less. Furthermore, the flowering time of the combined nutrient deficiency was 5-6 days delayed, and 1 day delayed compared to the control (full nutrient media). Our results demonstrate that the combined nutrient deficiencies of nitrogen and phosphorus follow a more complex path compared to single nutrient deficiencies. We anticipate that this data can be used to further analyze the signal responses under combined nutrient stress, finding the exact pathways and key players. Observing and accessing these genetic roles could play a major role in developing nutrient-efficient crops for a sustainable future, leaving reliance on fertilizers behind.

THE ELP1 AND RNA INTERFERENCE GENES REGULATE HETEROCHROMATIN IN FISSION YEAST
Presenter(s): Abigail Stein (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Tommy Vo (College of Human Medicine)

While the Elongator (elp) complex is primarily responsible for tRNA modifications, subunits of the complex, including Elp1 have recently been shown to play a role in heterochromatin regulation. This research aims to investigate how genes encoding for Elp1 and RNA interference (RNAi) proteins influence heterochromatin in the fission yeast Schizosaccharomyces pombe. Selective growth assays, PCR, RT-qPCR, and ChIP-qPCR assays will determine how knocking out these genes in yeast strains affect different heterochromatin regions across the S. pombe genome. Expected findings include differences between strains in terms of gene expression, histone modifications, and RNA polymerase II occupancy at heterochromatin regions. These outcomes may provide insights into how conserved Elp1 and RNAi proteins coordinate to epigenetically regulate genes.

UNLOCKING THE SCENT OF STRAWBERRIES: SUBGENOME-SPECIFIC REGULATION OF TERPENES BIOSYNTHESIS
Presenter(s): Sonia De Donno (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Patrick Edger (College of Agriculture & Natural Resources)

The characteristic aroma of strawberries that make the fruit enjoyable are due to a suite of specialized metabolites produced by plants, including terpenes. While terpenes have long been known to contribute to fruit quality, the underlying genes, and genetic variants, that encode for the biosynthesis of these compounds remain poorly understood in strawberry. Our preliminary results not only identified key genes but revealed an increase in terpene expression through developmental stages. Higher expression of these genes can lead to increased production of aromatic molecules, resulting in more fragrant strawberries with an enhanced flavor profile. Furthermore, we analyzed whether these terpene biosynthetic pathways exhibit subgenome-specific expression bias within the complex octoploid genome. Observations in other polyploid crops suggest that specific subgenomes dominate the expression of key agronomic traits. We aim to determine if a particular subgenome is disproportionately contributing to terpene biosynthesis in strawberries. These discoveries will assist in developing future metabolic engineering and breeding programs aimed at enhancing strawberry aroma for commercialized strawberries that are better for consumers.

INVESTIGATING K17 MEDIATED REGULATION OF IL-33 IN HEAD AND NECK CANCERS
Presenter(s): Nery Gonzalez-Garcia (North Carolina State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Wei Wang (College of Human Medicine)

Keratin 17 (K17) is an intermediate filament protein localized within the epithelial cells of the mucosal membranes. While K17 is functionally linked to wound healing, it is also overexpressed in various malignancies. These include head and neck squamous cell carcinoma (HNSCC), the sixth most common cancer worldwide. Immune checkpoint inhibitors present a possible therapeutic avenue, despite low clinical response rates. This challenge is attributed primarily to a "cold" tumor microenvironment characterized by limited immune cell infiltration. Previous studies have demonstrated that K17 contributes to immune evasion in HNSCC and that K17 loss reduces Interleukin-33 (IL-33), a cytokine involved in promoting an immunosuppressive tumor microenvironment. However, the precise mechanisms by which K17 regulates IL-33 expression remain poorly understood. In this study, we aim to elucidate the role of K17 in regulating IL-33 by generating a K17 knockout HNSCC cell line using CRISPR-Cas9 and restoring K17 expression through wild-type plasmid transfection. K17 expression will be verified by flow cytometry, while IL-33 expression will be quantified using RT-qPCR. These approaches will determine whether loss and restoration of K17 alter IL-33 expression and provide insight into the role of K17 in tumor signaling. This study seeks to define the mechanisms of K17-mediated immune evasion, potentially highlighting K17 as a therapeutic target for improving immunotherapy responses in HNSCC.

MECHANOSENSORY CONTROL OF PVAT LIPOLYSIS IN HYPERTENSION
Presenter(s): Joey Norton (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Andres Contreras (College of Veterinary Medicine)

Hypertension (HTN) is the leading risk factor of mortality worldwide. Additionally, HTN alters blood vessels' hemodynamics and biomechanics and may disrupt the homeostatic functions of perivascular adipose tissue (PVAT). In normotensive states, PVAT exerts anti-contractile and anti-inflammatory effects that help maintain vascular health. Like other adipose depots, PVAT stores lipids and releases free fatty acids and glycerol via adipose triglyceride lipase (ATGL)-driven basal lipolysis and hormone-sensitive lipase (HSL)-mediated stimulated lipolysis. Moreover, PVAT adipocytes express mechanosensitive ion channels, such as Piezo1, that enable cells to detect stretch and mechanical cues from the vascular wall, which is further heightened in HTN. It remains unclear how HTN alters PVAT lipolytic activity and whether this process is regulated by Piezo1-mediated mechanosensation. To test this, 14-week-old wild-type mice and Pdgfrα-lineage Piezo1 knockout mice are treated with angiotensin II (800ng/kg/min) for 2 weeks to induce HTN, or saline (vehicle). Blood pressure is measured by tail-cuff plethysmography. Basal and stimulated lipolysis in thoracic aortic PVAT were assessed by glycerol release using Glycerol-Glo. ATGL, p-ATGL Ser406, HSL, and p-HSL Ser660 were quantified by capillary electrophoresis (WES). RNA was extracted for transcriptomic analyses of PNPLA2 (encoding ATGL) and LIPE (encoding HSL). PVAT adipocyte morphology is assessed via confocal microscopy. Hypertensive wild-type PVAT is expected to show increased basal lipolysis, with increased ATGL and decreased HSL expression and activation. Piezo1 knockout PVAT should show no change in basal lipolysis between treatments. These findings may clarify how HTN-induced mechanical stress alters PVAT's vasoprotective functions and whether Piezo1 mediates this consequence.

SPATIAL EXPRESSION OF TBX18, TBX3A, AND TBX3B IN ZEBRAFISH VISUALIZED USING HYBRIDIZATION CHAIN REACTION.
Presenter(s): Treyton Grigg (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Tony Zhou (College of Natural Science)

The T-Box transcription factor family plays a crucial role in embryonic development of the limbs, heart, and other tissues. A common biomedical model species, zebrafish (Danio Rerio), shares about 70% of its genes with humans, including the T-Box transcription factor family. The zebrafish genome has undergone a whole-genome duplication event, leading to two copies of tbx3 (a,b), but only one copy of tbx18. Tbx18 is involved in fin expression, especially in the median fin, and previous unpublished studies from the Braasch Lab indicate that tbx3 and tbx18 have complementary expression patterns. In this study, we analyzed three T-Box genes, tbx18, tbx3a, and tbx3b in zebrafish embryos using Hybridized Chain Reaction, or HCR, to compare spatial expression between the three genes, mostly in regions of developing fins. HCR amplifies weak signals better than traditional in-situ hybridization, allowing more definitive results of gene expression location. Comparing the expression of closely related T-Box genes allows for the identification of shared and divergent roles in tissue expression during development. Zebrafish samples were analyzed at 2, 3, and 6 dpf, allowing us to confirm previous results at 3 dpf and to analyze a new time point after 6 days of development. This allowed us to track the expression of the T-Box genes through the progressing stages of development. Gene expression overlapped in some areas, while others showed distinct regions of gene-specific localization. Understanding these expression patterns leads to a broader knowledge of complex conserved genetic pathways that can show conserved expression and function between genes.

ASSAY VALIDATION OF NON-INVASIVE HEAT-SHOCK PROTEIN (HSP) MEASUREMENT IN MAMMALIAN FECES
Presenter(s): Lauren Koski Koski (Grand Valley State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Cynthia Thompson (Grand Valley State University)

Heat-shock proteins (HSP) are part of a physiological response to warm thermal stress. There are limited methods to measure HSP levels in wild animals non-invasively. Our goal was to validate assays of fecal HSP using four protein extraction protocols across four mammals. We measured spike recovery and parallelism to assess the reliability of extractions. HSP assay reliability varied across protocols for each species. For domestic cats, a single protocol utilizing lysis buffer had successful validations in both spike recovery and parallelism. European rabbits demonstrated the highest overall assay validations and achieved sufficient spike recovery under one protocol. Domestic horse and dog, however, resulted in unsuccessful validation outcomes in parallelism and spike recovery across all protocols. Given the inconsistency of the four protocols across species, a species-specific protein extraction protocol may be necessary for non-invasive fecal measurement of HSP.

LONGITUDINAL BIOMECHANICAL EVALUATION OF OVARIAN TISSUE USING BRILLOUIN MICROSCOPY
Presenter(s): Mankirat Singh (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Ping Wang (College of Human Medicine)

Ovarian follicle development is highly ordered beginning with primordial follicles characterized by an immature oocyte surrounded by a single layer of pregranulosa cells, followed by primary, secondary, all the way to pre-ovulatory where the follicle is mature and able to release the oocyte. This is further characterized by proliferation of granulosa cells and even recruitment of theca cells. Ovarian growth happens in a mechanically heterogenous microenvironment that can influence the behavior of the follicle; the ovary is a mechanosensitive organ. By understanding time-line based mechanical environmental changes seen during follicular maturation we can conclude how biomechanical cues help influence growth, development, and survival in addition to hormonal regulation and genetics. This understanding can also give us an insight into various clinical pathologies such as polycystic ovarian syndrome. This is done using Brillouin Microscopy, which provides a label-free and non-contact optical approach for depth-resolved mechanical imaging within samples. his non-invasive feature is particularly important for ovarian tissue, as mechanical properties are linked to delicate cellular organization and ECM interactions. Brillouin microscopy is based on the principle of spontaneous Brillouin scattering. When incident laser light interacts with the intrinsic acoustic waves within a material they scatter which gives us a frequency, this can be used to caluclate shift which quantifies stiffness.

INVESTIGATING THE ROLE OF ALKBH7 CANCER-ASSOCIATED MUTANTS IN MITOCHONDRIAL GENE REGULATION
Presenter(s): Charlotte Gullion (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Christina Fitzsimmons (College of Human Medicine)

Chemical modifications of RNA play a critical role in post-transcriptional gene regulation. To date, over 150 different modifications have been identified. Among these, methyl modifications account for 66% of the distinct modifications to coding and non-coding RNAs, and play important roles in splicing, stability, and translation. Critically, enzymes that modify RNA modifications are often dysregulated in cancer. Here, we chose to focus on Alkb homolog 7 (ALKBH7) which acts on N2,N2-dimethylguanosine (m2m2G) in mitochondrial tRNA. Single nucleotide polymorphisms (SNPs) in the ALKBH7 gene have been associated with breast, colon, gastric, pancreatic, and prostate cancers. Significant mutations were identified through analysis of publicly available datasets from cBioPortal and modeled in 3D with ESM and Alpha Missense software to determine pathogenicity. Selected variants were cloned into mammalian expression vectors and validated by sequencing. Current and future work will implement the use of CRISPR to establish ALKBH 7 knockouts in kidney (HEK 293) cells to observe how rescue with our variants affects phenotype, cloning variants into bacterial vectors to perform in vitro assays, as well as assess in vivo regulation through cancer phenotype assays. Taken together, these studies may ultimately inform novel targeted bio-therapeutic approaches.

OPTIMIZATION OF A HIGH-THROUGHPUT ASSAY TO SCREEN PENNYCRESS RESPONSE TO FUSARIUM VIRGULIFORME
Presenter(s): Natalie Pitts (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Bri Hashim (Graduate School Dean), Seung Rhee (College of Natural Science)

Fusarium virguliforme, the primary causal agent of sudden death syndrome (SDS) in soybean, caused the loss of over 49 million bushels in the United States in 2025, resulting in $500 million in losses. While soybean is the primary host for F. virguliforme, other species, including corn, have been identified as asymptomatic hosts for this pathogen. Preliminary unpublished work in our lab suggests that pennycress (Thlaspi arvense), a winter oilseed crop, may also be an asymptomatic host. Introducing pennycress into the corn-soybean rotation could increase soil inoculum and risk of soybean SDS infection. To investigate this, we aim to phenotype 405 pennycress ecotypes for sensitivity to F. virguliforme to enable a genome-wide association study (GWAS). This screening will identify tolerant and sensitive pennycress ecotypes, and loci associated with these traits. Our lab developed a high-throughput assay platform using custom 3D-printed parametric inserts to evaluate seedling response to F. virguliforme in a 48-well plate format. To optimize our screening, we sought to standardize germination timing by testing multiple stratification durations and pre-germination treatments with gibberellic acid (GA) and potassium nitrate (KNO_3) on high and low-germinating pennycress ecotypes. Treatments with 50 or 100 µM GA plus 10 mM KNO_3 increased overall germination, although low-germinating ecotypes remained developmentally delayed, indicating further optimization is needed. Once optimized, this high-throughput screening will phenotype pennycress ecotypes to identify genetic loci associated with differential responses to F. virguliforme. Additionally, the parametric insert design can be adapted for high-throughput plant phenotyping under various stressors, including nutrient deficiency and drought.

BLOOD CELL PRODUCTION FROM HUMAN EMBRYONIC STEM CELLS
Presenter(s): Tanisha Patel (Michigan State University)
Category: Cell Biology, Genetics, & Genomics
Mentors(s): Momoko Yoshimoto (Western Michigan University Homer Stryker MD School of Medicine)

Human embryonic stem cells (hESCs) are pluripotent stem cells capable of self-renewal and differentiating into all cell types of the body, making them a valuable tool for regenerative medicine. These cells have the potential to provide a renewable source of blood stem cells for patients with hematologic disorders requiring bone marrow transplantation. A limitation of bone marrow transplantation is the difficulty of finding major histocompatibility complex (MHC) compatible donors. This project investigates the differentiation of hESCs into the hematopoietic lineage using a 2D laminin-based differentiation method. Laminin is an extracellular matrix protein that provides a surface resembling the developing embryonic environment and promotes the formation of endothelial cells, which subsequently give rise to hematopoietic stem and progenitor cells (HSPCs). In this experiment, H9 hESCs were expanded to the appropriate confluency before differentiation using sequential addition of growth factors that mimic fetal blood development. Together, these conditions promote mesoderm formation and endothelial-to-hematopoietic transition, resulting in the generation of CD34+ cells, putative human HSPCs. CD34+ HSPCs were sorted and applied for colony forming assays using Methocult to quantify hematopoietic progenitor activity. Establishing efficient methods for generating hematopoietic stem cells (HSCs) from pluripotent stem cells will support the development of cell-based therapies for blood disorders. Although this study uses hESCs, these differentiation methods can translate to induced pluripotent stem cells (iPSCs), which can be generated from a patient's own cells, providing a patient-specific source for future therapies.

Chemical Engineering & Materials Science

SOLVING THE DIRAC EQUATION IN PERIODIC SYSTEMS WITH HIGH-FIDELITY QUANTUM CIRCUITS
Presenter(s): Fernando Velasquez (University of Illinois Chicago)
Category: Chemical Engineering & Materials Science
Mentors(s): Jose Mendoza Cortes (College of Engineering)

Simulating materials with relativistic effects and electron correlation accurately continues to be a challenge in computational material science. Solving the Dirac equation for complex systems with classical computational methods struggles with the exponential scaling of needed computation resources. Quantum computing's capabilities can possibly tackle these challenges by taking advantage of quantum parallelism and entanglement. By creating high-fidelity, quantum-enhanced circuits to solve the Dirac equation in simple periodic systems and using the capabilities of the AQT (Advanced Quantum Testbed), producing successful simulations can be then applied to more complex systems. Here, we mainly look to simulate a 2D grid of hydrogen atoms due to its compatibility to AQT's 8-12 qubit Noisy Intermediate-Scale Quantum (NISQ) devices. Hardware-Efficient Ansatz (HEA) will be used for the Dirac Hamiltonian, while Variational Quantum Eigensolvers (VQE) and Quantum Imaginary Time Evolution (QITE) will be applied to approximate the ground state of the hydrogen lattice. To mitigate errors, Dynamic Decoupling, Zero-Noise Extrapolation (ZNE), and Advanced Pulse Shaping will be incorporated. By achieving an accurate simulation of hydrogen, this method can then be built upon so as to simulate heavier material compounds.

UNDERSTANDING THE EFFECT OF ACOUSTOPLASTICITY ON THE MICROSTRUCTURAL EVOLUTION AND HARDNESS OF TITANIUM
Presenter(s): Quincy Scott (Prairie View A&M University)
Category: Chemical Engineering & Materials Science
Mentors(s): Carl Boehlert (College of Engineering), Sunil Kishore Chakrapani (College of Engineering), Teddy Mageto (College of Engineering)

Acoustoplasticity refers to the phenomenon in which the application of ultrasonic vibrations to a material, typically metals or polymers, temporarily enhances its plasticity, allowing it to deform more easily without changing external conditions such as temperature or applied force. These high-frequency vibrations interact with the material's internal deformation mechanisms, reducing resistance to plastic flow and improving formability. Because of these effects, acoustoplasticity has attracted significant interest as a potential method for improving manufacturing efficiency and reducing processing costs for difficult-to-form materials. In this study, we investigated the effects of varying ultrasonic processing parameters on the deformation behavior of commercially pure titanium. Specifically, ultrasonic power, downforce, and feed rate were systematically varied using an ultrasonic horn to determine how each parameter influences material response during deformation. Titanium was selected because of its excellent strength-to-weight ratio, corrosion resistance, and widespread use in aerospace, biomedical, and industrial applications; however, its relatively poor formability can increase manufacturing complexity and cost. Following ultrasonic treatment, the resulting samples were analyzed to identify trends in deformation behavior and determine the optimal processing conditions for enhanced formability. The collected data were used to evaluate the relationship between ultrasonic parameters and material performance, with particular emphasis on achieving consistent and uniform deformation. Our findings contribute to a deeper understanding of the process parameters governing acoustoplastic behavior and provide valuable insights for future research in precision forming and advanced manufacturing. Ultimately, this work may help enable the forming of materials that are traditionally difficult to bend, while reducing manufacturing costs and expanding the practical use of titanium in a wider range of commercial and engineering applications.

MICROWAVE-ASSISTED SYNTHESIS OF LOW-DIMENSIONAL MATERIALS
Presenter(s): Joe Margaret Claudio (City Colleges of Chicago)
Category: Chemical Engineering & Materials Science
Mentors(s): Dmitri Leo Mesoza Cordova (College of Engineering)

The precise control of the synthesis of advanced materials serves as a critical obstacle in modern chemistry and material science. More specifically, the control of crystal growth remains an especially ambitious endeavor. Effectively manipulating these materials means possessing control over how the crystal's atomic lattices assemble and thus encouraging applications in electrical and optoelectronics. A promising way of attaining effective manipulation through varying temperatures is through microwave-assisted synthesis. Microwave-assisted synthesis operates by leveraging electromagnetic radiation to induce volumetric heating through dielectric loss. Compared to conventional furnace resistance heating, microwave heating offers uniform temperature profiles and may reach higher temperatures at shorter reaction times, promoting the target product formation prior to the phase change and evaporation of highly volatile ingredients. Currently, microwave synthesis has been used for high-temperature synthesis (>1,000C). However, little is known about optimizing microwaves for low-temperature synthesis to more accurately control crystal growth of low-dimensional solids. This study seeks to optimize low-temperature (~400-600C) microwave heating through the active proportional balance of susceptor composition and microwave power to control time-dependent temperature profiles. Using an inverter microwave, we find that the maximum temperature is dictated by the microwave power and susceptor composition, with $SiC:Al_2O_3$ resulting in the most stable heating profile. At low microwave power, the pulse-width modulation of the power leads to temperature oscillations that can be leveraged to induce convection currents that enhance the homogeneity of the reactant mixture.

ANALYZING AND EVALUATING COMPUTATIONALLY PREDICTED PROTEIN-PROTEIN INTERACTIONS
Presenter(s): Connor Coombs (Michigan State University)
Category: Chemical Engineering & Materials Science
Mentors(s): Daniel Woldring (College of Engineering)

Testing bindings between protein pairs manually is time-consuming and expensive because of the many different sequences and arrangements that can come together to form a protein-protein interaction. With the use of AlphaFold (AF3), and its deep learning and diffusion models to computationally predict 3D structures, models and analysis of protein pair bindings can be generated. This project evaluates whether AF3 generates different protein-protein interaction predictions when provided with multiple conformations of the same proteins. Known protein complexes were obtained from the Research Collaboratory for Structural Bioinformatics Protein Data Bank (RCSB PDB) with attributes that would run well with AF3, such as being deposited after 2021, having only 2 distinct protein entities, having no non-polymer entities, and each protein in the pair having less than 500 amino acids. Sequences of the protein pairs were then extracted to run through AF3 for structure predictions. Predicted complexes were evaluated using interface predicted TM-score (ipTM) and Predicted Aligned Error (PAE). Specifically, ipTM measures confidence in the relative positioning of interacting proteins on a scale from 0 to 1 and PAE estimates AF3's uncertainty in the relative positions of residues, measured in angstroms. In this work, we evaluate the extent that using template structures - consisting of several unique conformations (structural variations) - can improve AF3's ability to produce accurate protein-protein binding interactions. This work has exciting applications in developing new protein therapeutics for human health as well as engineering novel proteins to protect crops against harmful pathogens.

COMPARING GENERATIVE MACHINE LEARNING MODEL'S ANALYSIS OF PROTEIN-PROTEIN INTERACTIONS
Presenter(s): Alexander LeRoy (Michigan State)
Category: Chemical Engineering & Materials Science
Mentors(s): Daniel Woldring (College of Engineering)

Understanding the interactions among proteins is incredibly important to many areas of biology and medicine. Designing drugs to destabilize an unknown and potentially harmful interaction can be done much more easily with a proper representation of the proteins' structure and interface. These models remain a challenge to create quickly and accurately, and in the past has required rigorous and expensive laboratory work to determine. However, recently with the help of generative AI, AlphaFold has made it possible to do exactly this, simulating a plausible structure of proteins and their interactions. Along with this AlphaFold has multiple metrics to gauge the probability of these structures existing naturally. However, despite AlphaFold's ability to map these structures much more quickly than inside a lab, AlphaFold's simulations are by nature unable to be perfect. On top of this, AlphaFold charges private pharmaceutical companies millions of dollars per year. This has made it worth looking into possible alternatives to AlphaFold for simulating protein-protein interactions. We will be comparing the performance of AlphaFold3 against two recent open source competitors: OpenFold3 and EsmFold2, which both aim to replicate the data AlphaFold creates. All 3 software will then be compared to results from existing databases whose structures have previously been tested using laboratory techniques. Knowing which software is most reliable in each area will make using these software much more practical in designing therapeutics for unknown protein interactions.

BIOSYNTHETIC ADDITIVE MANUFACTURING THROUGH MYCELIUM-BACTERIA CONSORTIA
Presenter(s): Grant Hubbard (Michigan State University)
Category: Chemical Engineering & Materials Science
Mentors(s): Hang Yuan (College of Engineering), Jinxing Li (College of Engineering)

Lignocellulosic biomass is the most abundant renewable raw material on Earth, yet its structural and carbon-storage potential remains unrealized: microbial decomposition returns stored carbon to the atmosphere before it can be harnessed as a durable material. Distinct microbial processes, such as biosynthesis and biomineralization, offer a natural counterpoint, converting organic carbon into mechanically robust, persistent materials such as polymers and minerals. Here, we establish a biosynthetic additive manufacturing strategy through mycelium-bacteria consortia, by coupling fungal self-assembly with bacterial biomineralization inside fabricated three-dimensional scaffolds derived from lignocellulosic biomass. Trametes versicolor forms a continuous living mycelial network that serves as both a structural template and a transport pathway, guiding the spatial colonization of Sporosarcina pasteurii and enabling volumetric calcium carbonate deposition throughout the scaffold interior, overcoming the surface-limited mineralization of conventional microbial systems. Integration with helicoidal Bouligand architectures translates microscale mineral reinforcement into macroscale performance, increasing compressive Young's modulus by 7-14-fold and ultimate strength by 5-fold relative to unmineralized conventional mycelium-based living composites. The living mycelial network also enables autonomous self-healing and modular self-assembly through hyphal bridging without external adhesives or energy input. This work establishes a scalable route for converting and upcycling transient biomass carbon into durable living structural materials for sustainable construction.

EVALUATING STRUCTURAL TEMPLATE INFLUENCE ON ALPHAFOLD3 PREDICTED CONFORMATIONAL ENSEMBLES ACROSS PROTEIN AND PROTEIN-LIGAND SYSTEMS
Presenter(s): Emma Renalds (Michigan State University)
Category: Chemical Engineering & Materials Science
Mentors(s): Annie Needs (College of Engineering), Daniel Woldring (College of Engineering)

Protein structure prediction tools like AlphaFold3 have transformed how researchers study proteins and develop new medical advances for human health, but questions remain about how input data shapes their outputs. This project studies whether providing AlphaFold3 with three-dimensional structural templates constrains or biases the structures it predicts. A structural template is a three-dimensional protein structure used as a reference input, giving AlphaFold3 a starting point when generating its predictions. Each set of templates is produced by aSAM (atomistic Structural Autoencoder Model), a deep learning model developed at Michigan State University that generates ten structures per protein representing its range of possible conformations. By running both templated and non-templated AlphaFold3 predictions across 15 different protein sequences, I compare how similar the predicted structures are to the input templates using Root Mean Square Deviation (RMSD), a standard measure of structural similarity. Analysis is performed at both the backbone ($C\alpha$) and all-atom levels, and statistical testing via Mantel tests is used to evaluate whether template identity correlates with prediction outcome. Current results show that 66% of templated predictions exhibit bias toward their template, based on statistically significant Mantel test result. Preliminary results suggest that templating bias is most evident in proteins with similar conformations across templates, while proteins with more geometrically distinct templates appear to resist this bias. Understanding this relationship could have real implications for protein engineering, like designing therapeutics that target specific protein conformations.

ELASTIC AND THERMAL PROPERTIES OF PYRITE SINGLE CRYSTALS
Presenter(s): Caleb Rogers (Carlow University)
Category: Chemical Engineering & Materials Science
Mentors(s): Alexandra Zevalkink (College of Engineering), Amir Sam Mohammadzadeh Shirazi (College of Engineering)

Thermoelectric materials enable the direct conversion of waste heat into electricity, with their performance evaluated by the dimensionless figure of merit, $zT=S^2\sigma T/\kappa$, where S is the Seebeck coefficient, σ is the electrical conductivity, and κ is the thermal conductivity. Pyrite (FeS_2) is an earth abundant, environmentally benign semiconductor with a band gap of approximately 0.95 eV, making it an attractive candidate for energy conversion applications. However, its thermoelectric performance is limited by its relatively high thermal conductivity (45 $W/m^{-1}K^{-1}$ at 300K). We investigate the relationship between thermal transport and elastic properties in single crystal and polycrystalline FeS_2. Natural single crystal from Navajún mine in Spain were used for this study. Polycrystalline pyrite samples were synthesized by crushing a piece of each single crystal and using spark plasma sintering. Single crystals were characterized using X-ray diffraction to confirm the cubic structure and chemical makeup of the sample. Thermal diffusivity measurements were performed on single and polycrystalline samples using light flash apparatus, and thermal conductivity was calculated from the measured diffusivity, density, and heat capacity. In parallel, elastic properties of single crystals were evaluated through temperature-dependent resonant ultrasound spectroscopy, allowing the determination of elastic moduli and sound velocities. The motivation for this study is to ultimately correlate thermal conductivity with elastic constants and microstructure in natural pyrite.

TRICHIMES: A GPU ACCELERATED MACHINE LEARNING INTERATOMIC POTENTIAL WITH TRITON KERNELS
Presenter(s): Philip Alcorn (Tarleton State University)
Category: Chemical Engineering & Materials Science
Mentors(s): Dylan Anstine (College of Engineering)

Traditional electronic structure calculations, particularly Density Functional Theory (DFT), offer an accurate description of molecular and material systems but their computational demands limit the system sizes and/or number of systems that can be simulated. Machine learned interatomic potentials (MLIPs) have been developed to overcome this unfavorable scaling, whereby the potential energy of a surface is approximated by training a data-driven model to reproduce the DFT reference data. In this work, we report a GPU optimized implementation of the Chebyshev Interaction Model for Efficient Simulation (ChIMES) MLIP which can perform molecular simulations several orders of magnitude faster than the reference CPU-based version. Kernels for neighbor list building as well as N-body order energy and force contributions have been efficiently implemented in the single-program multiple data (SPDM) Triton programming model. Our SPMD implementation takes a fused-kernel approach, simultaneously calculating energy, forces, and parameter gradients for training, minimizing costly host-device data transfers and the overall memory footprint by avoiding the need for storing intermediate results. The kernels exploit a blocked calculation design, where energy and force contributions from a central atom and all its local neighbors are calculated across single warp partitions in parallel. The set of TriCHIMES kernels have been integrated into a collection of custom automatic gradient (autograd) functions that support efficient MLIP training within the PyTorch ecosystem. We have trained a 1st generation TriCHIMES model on the ANI-1x training dataset (5M structures), which shows competitive accuracy with MLIP model of similar computational cost.

EXPLORING THE SULFURIZATION OF ALLOYED OXIDE PEROVSKITES
Presenter(s): Logan Lim (Swarthmore College)
Category: Chemical Engineering & Materials Science
Mentors(s): Jonathan Turnley (College of Engineering)

Chalcogenide perovskites are a promising class of material for photovoltaics and other semiconductor applications due to favorable band gaps, good stability, and the use of non-toxic and earth-abundant elements. While there are multiple high-temperature routes to the synthesis of these compounds, a particularly convenient synthesis involves the sulfurization of an oxide perovskite (for example, converting BaZrO3 into BaZrS3). Notably, BaZrS3 has been synthesized at moderate temperatures in the range of 500-600 °C. Additionally, attempts at sulfurizing SrZrO3 at similar moderate conditions produced SrS and ZrS3, rather than the targeted SrZrS3 perovskite. In the case of BaZrS3, a liquid barium polysulfide can form that acts as a flux, easing the reaction. However, the analogous strontium polysulfide does not form a liquid, which may explain the differences in synthesis outcomes.
We hypothesize that the presence of some Ba in an alloyed (Ba,Sr)ZrO3 oxide perovskite will allow for moderate temperature sulfurization. To test this idea, solution processing synthesis methods for the full range of (Ba,Sr)ZrO3 materials was developed based on spin coating of molecular precursor inks. We then studied how the quantity of barium in the oxide precursors impacted the sulfurization product, leading to a better understanding of the moderate temperature synthesis of chalcogenide perovskites.

FROM COPPER ORE TO SOLAR POWER: A COMPARATIVE LIFE CYCLE ASSESSMENT OF TELLURIUM SOURCING FOR CDTE PHOTOVOLTAIC MODULES
Presenter(s): Maria Cermeno (Fairleigh Dickinson University)
Category: Chemical Engineering & Materials Science
Mentors(s): Annick Anctil (College of Engineering), Jaewon Han (College of Engineering)

Cadmium telluride (CdTe) is a thin-film photovoltaic material that makes up 20-40% of the photovoltaic market in the US. These panels are made from tellurium, a metalloid recovered as a byproduct of copper refining, and Cadmium metal. Although CdTe modules reduce greenhouse gas emissions by displacing fossil-based electricity, it is also important to consider the environmental impacts associated with producing their materials. Tellurium production is identified as a major contributor to the global warming potential (GWP) of CdTe module manufacturing. As newer CdTe modules enter the market, evaluating domestic and international tellurium sourcing strategies remains important. This project evaluates the GWP of CdTe photovoltaic module manufacturing through life cycle assessment (LCA). The system boundary begins with copper ore being smelted into crude copper, then being electrorefined into solid copper and anode slime. Tellurium is recovered by Alkali leaching followed by electrowinning from the anode slime. Then synthesized into CdTe and sublimated into a photovoltaic module. Two supply chain scenarios are modeled: complete domestic production and international tellurium production followed by module manufacturing in the United States. A life cycle inventory is developed from the peer-reviewed literature and modeled in SimaPro 9.6.0.1 LCA software, using the Ecoinvent v3.10. The masses of materials and reagents are determined using stoichiometric calculations based on assumptions from peer-reviewed literature, and transportation of materials is considered. These results provide insight into tellurium sourcing strategies and support decision making for CdTe module manufacturing.

SYNTHESIS AND CHARACTERIZATION OF SMPTSB, SMPDSB, AND SMPDBI RARE-EARTH HALF- HEUSLER

Presenter(s): Safiye Baysal (Broward College)

Category: Chemical Engineering & Materials Science

Mentors(s): Jose Gonzalez Jimenez (College of Natural Science), Nafiseh Salimiyan Rizi (College of Natural Science)

Rare-earth half-Heusler compounds are of growing interest in research due to their diverse electronic and magnetic properties, making them promising candidates for studies of topological and semiconductor materials. Obtaining high-quality single crystals is essential to characterize these properties through magnetic, high-pressure synthesis, and structural measurements. This project focuses on the synthesis and crystal growth of the rare-earth half-Heusler compounds SmPtSb, SmPdBi, and SmPdSb, as well as the addition of a tin flux, SmPtSbSn. Polycrystalline precursor materials are prepared through solid-state synthesis from high-purity elements under controlled conditions. Crystal growth efforts are initiated to produce single crystals suitable for structural and physical characterization. Our current efforts are centered on refining the synthesis and growth conditions to improve purity and single-crystal size. The successful growth of high-quality single crystals will enable future research into the magnetic and electronic properties of Samarium-based half-Heuler compounds.

Communication Arts & Sciences

WHAT COMMUNITY ENGAGEMENT TAUGHT ME ABOUT STRATEGIC COMMUNICATION

Presenter(s): Alayla Milow (Michigan State University)

Category: Communication Arts & Sciences

Mentors(s): Kevin Brooks (University Outreach and Engagement)

My time as a research assistant at the Center for Community and Economic Development allowed me to reshape how I used my communication skills and gave me the opportunity to learn from hands-on experience. Working alongside graduate fellows from multiple disciplines, I partnered with the South Side Community Coalition on a range of initiatives including wrapping a community hoop house, leading a food pantry update, and helping coordinate the Health is Wealth community health event. Each project required a different kind of communication, from meeting directly with community members and organizations to building presentations and handling behind-the-scenes logistics that kept everything moving. Through it all, I found that the real work of community engagement lives in the in-between moments: the relationship-building, the follow-up emails, and the slide decks that have to translate complex ideas into something accessible and real for your audience. That's where my Communication background became most useful and most tested. This experience also deepened my understanding of asset-based community development (ABCD), the idea that communities already have strengths worth building on. Every conversation I had with South Side residents reinforced that. My job wasn't to bring solutions; it was to listen, communicate clearly, and help connect what was already there.

ACOUSTIC DATA QUALITY ASSESSMENT OF SIMULTANEOUSLY RECORDED AUDIO DURING LARYNGEAL HIGH-SPEED VIDEOENDOSCOPY

Presenter(s): Shri Keerthi Alla (Michigan State University)

Category: Communication Arts & Sciences

Mentors(s): Maryam Naghibolhosseini (College of Communication Arts & Sciences), Sardar Nafis Bin Ali (College of Communication Arts & Sciences), Trent Henry (College of Communication Arts & Sciences)

Laryngeal high-speed videoendoscopy (HSV) is becoming increasingly useful for studying vocal fold function in vocally normal speakers and those with voice disorders. Acquiring HSV simultaneously with acoustic signals enables concurrent analysis of laryngeal function and voice, making them critical for reliable data analysis. However, although acoustic assessment protocols outline specific requirements for clinical voice recordings, simultaneous acquisition during HSV presents unique challenges to signal integrity. Environmental and equipment-related noise sources, including the HSV camera cooling system, light source, and clinician's verbal instructions, degrade acoustic voice measurements in ways that vary with recording materials and environments. Furthermore, insertion of the flexible nasolaryngosocpe during the HSV recordings may impact a subject's true vocal output, compromising the validity of acoustic data. This descriptive study systematically categorized audio artifacts in simultaneously obtained HSV and audio data. A total of 157 recordings (95 normophonic recordings and 58 recordings from patients with voice disorders) were evaluated for audio quality, recurring artifacts, and channel patterns within audio channels. Findings revealed consistent and irregular patterns across recordings, highlighting the need for improved recording environments and standardized acoustic acquisition protocols. Potential mitigations include modifying clinician-participant interaction protocols, standardizing recording equipment and environment across participants, and minimizing the laryngoscope movements. Acknowledgment: We acknowledge support from NIH/NIDCD (K01DC017751, R21DC020003, R01DC019402), the Michigan State University Discretionary Funding Initiative and the Pathway to Research Program. We thank Drs. Dimitar D. Deliyski and Stephanie R.C. Zacharias, and Mayo Clinic, Scottsdale, AZ, for support with the data collection.

TESTING THE EFFECTIVENESS OF DEEPL AS A TRANSLATION TOOL
Presenter(s): Emma Steury (Michigan State University)
Category: Communication Arts & Sciences
Mentors(s): Sonja Fritzsche (College of Arts & Letters)

For this project, I assisted in the translation of "Das Erbe der Science-Fiction in der DDR" ("The Legacy of Science Fiction in East Germany") from German to English under Dr. Sonja Fritzsche using DeepL, a secure large language model (LLM) tool with the goal of translating the work for an American audience. "The Legacy of Science Fiction in East Germany" is the transcription of a round table discussion held at the German Hygiene Museum in Dresden in August 2023, a joint conference between the Science Fiction Research Association and the Society for the Study of the Fantastic in Germany. Held in German, the discussion featured panelists from Germany and the United States, including professors, art historians, authors, and publishers. In our research, we wanted to test the reliability of LLMs as a translation resource, using a case study approach to evaluate accuracy and ability to pick up on colloquialisms and nuances across languages. Throughout this project, I learned how to interact with an LLM as a translation source, as well as about professional translation, something I had not done prior to the project. This work also helped me to understand more about the restrictions on and ideals of East German science fiction in postwar Germany. I learned how to correspond internationally in a professional manner with people across multiple professions and languages, in addition to having the opportunity to experience the publication process for academic papers as we guide the paper from its early stages to its final polished result.

EXAMINING INTERGENERATIONAL FAMILY COMMUNICATION AND TECHNOLOGY USE
Presenter(s): Damian Rivera (Eastern Michigan University)
Category: Communication Arts & Sciences
Mentors(s): Brooke Wolfe (College of Communication Arts & Sciences)

Examining Intergenerational Family Communication and Technology Use Brooke Wolfe, Damian Rivera, and Cui Xiaohan. The communication patterns in family theory provide a framework for understanding how family communication shapes relationships, attitudes, and behavior across generations. The theory has two parts: Communication Orientation, which shapes the extent to which family members engage in open, frequent, and supportive communication, and Conformity Orientation, that mirror the extent to which families emphasize shared beliefs and values. As technology becomes more prevalent in everyday life, grandparents rely more on their grandchildren to help them learn how to use it. It's called digital backfeeding, which occurs when younger family members introduce, explain, and teach older family members how to use technology. While other researchers examine technology adaptation among older adults, less is known about how family communication environments actually influence these technology-related interactions. Addressing these gaps, this project investigates the research questions: how does family communication impact Intergenerational conversations about technology between grandchildren and grandparents? The data for this study will be collected through narrative, interviews, and survey responses from both grandchildren and grandparents. The research will use a mixed-methods approach, combining thematic analysis of interview data and statistical analysis of survey data to examine the relationships among family communication patterns and technology-related outcomes. The qualitative approach illustrates the quantitative methods. Although this project is ongoing and cannot claim that the adjectives were met or that the hypotheses were supported, the findings will provide insight into how family communication patterns shape technology learning across generations and may inform the design of future interventions to support technology adaptation among older adults.

MSU-UHAS COIL PROGRAM: CULTURAL HUMILITY AND PUBLIC HEALTH COMMUNICATION: VACCINATION IN GHANA AND THE UNITED STATES
Presenter(s): Sathwika Uttaradi (Michigan State University)
Category: Communication Arts & Sciences
Mentors(s): Constance Currier (College of Human Medicine)

This poster presents the outcomes of a Collaborative Online International Learning (COIL) program involving students from Michigan State University (MSU) and the University of Health and Allied Sciences (UHAS), Ghana. The project examined how culture shapes health beliefs, health behaviors, and public health communication in Ghana and the United States, with a particular focus on vaccinations. By comparing perspectives from both countries, the project highlights the role of culture in influencing vaccine attitudes and behaviors and demonstrates the importance of culturally responsive public health practice and communication. While Ghana and the United States share some common experiences regarding vaccinations, important cultural differences also shape public perceptions and decision-making.

UNDERSTANDING THE NEUROBIOLOGY OF STUTTERING: RECENT FINDINGS (2023-2026)
Presenter(s): Amelia Patten (Michigan State University)
Category: Communication Arts & Sciences
Mentors(s): Jia Bin (College of Communication Arts & Sciences)

This literature review examines studies published between 2023 and 2026 addressing the brain networks involved in stuttering, with a focus on functional connectivity and the neural circuits that support speech. By bringing together evidence across these studies, this review aims to clarify how brain network differences may contribute to stuttering and how these differences may change from childhood into adulthood.

Computer Science & Engineering

IMPLEMENTING AN ENHANCED SAMPLING QUANTUM CHEMISTRY SIMULATION PACKAGE: WEPYSCF
Presenter(s): Nathan Emeott (Michigan State University)
Category: Computer Science & Engineering
Mentors(s): Samik Bose (College of Natural Science)

Weighted ensemble (WE) methods are powerful enhanced sampling techniques that enable efficient exploration of rare events in classical molecular simulations. Quantum mechanics (QM), on the other hand, is uniquely suited to simulate electronic rearrangement, though at a significant computational cost. Our objective was to develop WePySCF, an extension that integrates the WE framework with PySCF, an electronic structure package to simulate chemical reactions and electronic rearrangements which were otherwise inaccessible in ab-initio molecular dynamics (MD). We built a PySCF runner that conforms to Wepy's interface, making adoption seamless for current users. However, before the runner could be functional, we needed to add stochastic integrators to PySCF to enable the path diversity that WE sampling requires. A CPU-only implementation was developed initially and later extended to support GPU acceleration via GPU4PySCF. This upgrade significantly improved runtime, as the parallel nature of QM calculations translates well to GPU architecture. To further improve performance, we implemented scanner caching, which preserves PySCF scanner objects across WE cycles. Without caching, scanners must be rebuilt from scratch after each resampling step, an overhead that increases with additional cycles. Multiple scanners are cached per worker, as workers are frequently reassigned GPUs during runtime. We also refactored Wepy's custom work mapper to eliminate busy waiting, substantially reducing idle CPU consumption. WePySCF combines two powerful simulation frameworks into a single package, presenting new possibilities for studying molecular transformations that classical MD cannot capture.

GEOMETRIC SPATIAL ENCODING
Presenter(s): Antonio Jun (Hunter College (CUNY)), Haoshui Yu (New York University)
Category: Computer Science & Engineering
Mentors(s): Cam Lu (Oakland University), Yao Qiang (Oakland University)

Large language models reason poorly about physical space because spatial structure stays implicit in pixels. We close this gap without training a spatial model by converting monocular RGB video into a structured spatial code: a compact, text-based scene description that writes each object as explicit variables, including metric position, a gravity-aligned 3D bounding box, and a semantic label. Exposing geometry as discrete, readable variables lets an LLM reason over space directly rather than infer it from raw frames. The code is produced by a training-free geometric engine that uses off-the-shelf perception backbones only as inputs and recovers every spatial variable through deterministic geometry. We pair this representation with an LLM and evaluate against the unaided model on VSI-Bench, isolating the contribution of explicit geometry to spatial reasoning.

A SYSTEMATIC REVIEW OF TEACHING PRACTICES FOR STUDENTS WITH DISABILITIES IN COMPUTER SCIENCE
Presenter(s): Salma Ibrahim (Eastern Michigan University)
Category: Computer Science & Engineering
Mentors(s): Siyuan Jiang (Eastern Michigan University)

The field of Computer Science (CS) education continues to expand, necessitating development of educational practices that are effective and inclusive of all students. Students with disabilities are increasingly attending higher education and engaging in computer science courses. Educators who aim to effectively teach CS skills to students with disabilities require an understanding of effective educational practices for this population. The purpose of this review is to identify existing research on effective practices, map the landscape of current research, and highlight key gaps to address in future studies. A rigorous systematic review procedure was conducted by searching [databases] for relevant literature. Data screening and extraction was conducted using Covidence software. Findings were summarized to identify pedagogical approaches, representation of disability types, and reported learning outcomes.This review provides a comprehensive evidence based for educators and researchers who aim to improved accessibility in CS education.

HIDDEN IN PLAIN SIGHT: HOW CODE OBFUSCATION BREAKS AI-BASED VULNERABILITY DETECTION
Presenter(s): Anmol Thapa (Oakland University), William Rebello (Robert Morris University)
Category: Computer Science & Engineering
Mentors(s): Mohammad Wardat (Oakland University), Niful Islam (Oakland University)

Security vulnerabilities in software are a primary vector for cyberattacks. Automated vulnerability detection tools powered by machine learning have shown promise, but real-world code is often obfuscated and deliberately transformed to obscure its structure while preserving behavior making detection significantly harder. This project investigates how well modern AI models detect security vulnerabilities in obfuscated C code, and whether structured reasoning can improve robustness. We investigate the impact of two parallel approaches: (1) a Graph Neural Network (GNN) trained on Code Property Graphs derived from the Devign dataset, and (2) an agentic AI pipeline that combines a Large Language Model (LLM) with static analysis tools, using a multi-step reasoning loop to reach a vulnerability verdict. To enable controlled evaluation, we built an obfuscation pipeline using Tigress, a widely used code obfuscater, applying three transformation types: symbol renaming, control flow flattening, and arithmetic encoding. This work opens a new direction for vulnerability detection in obfuscated code.

ULTRASOUND IMAGE CLASSIFICATION FOR RUSH TRAINING
Presenter(s): Nashitat Ahsan (Oakland University)
Category: Computer Science & Engineering
Mentors(s): Dirk Colbry (College of Natural Science)

The Rapid Ultrasound in Shock (RUSH) exam is a critical diagnostic tool used by medics and emergency healthcare providers to identify life-threatening causes of shock. Advanced RUSH training at Henry Ford Health (HFH) relies on instructor-reviewed videos, making evaluation time-consuming and difficult to scale. This project supports an HFH initiative to develop machine learning tools for automated assessment, student progress evaluation, and independent learning. A modular machine learning pipeline was developed to evaluate classification models, including K-Nearest Neighbors (KNN), Random Forests, Support Vector Machines (SVM), and Neural Networks. The pipeline also evaluated preprocessing methods, including histogram equalization, Gaussian filtering, and principal component analysis (PCA), to measure their impact on classification performance. Unfortunately, the RUSH image classification data are currently unavailable. To make progress, two public datasets were used for development and testing: the sklearn digits dataset and the Breast Ultrasound Images Dataset (BUSI). While these datasets are not expected to directly transfer to RUSH classification, the modular pipeline is being developed so RUSH data can be easily substituted when available. Preliminary results show that the best-performing model achieved 98.83% accuracy on the digits dataset. For the BUSI dataset, average accuracies ranged from 57% to 72%. Histogram equalization and PCA generally improved performance, while Gaussian filtering produced mixed results. The best results came from combined preprocessing, with Neural Networks reaching approximately 72% accuracy.
This work provides a reusable framework for ultrasound image analysis and model evaluation, supporting more objective, data-driven training and feedback as labeled RUSH imaging data become available.

CLASSICAL SIMULATION OF LARGE-SCALE UNITARY CLUSTER JASTROW (LUCJ) CIRCUITS
Presenter(s): Thomas Van Camp (University of Michigan -- Ann Arbor)
Category: Computer Science & Engineering
Mentors(s): Ryan LaRose (College of Engineering)

Quantum chemistry is a strong target for applications of near term quantum computers. However, typical state-vector simulations can become prohibitively expensive as the simulated molecules grow in size. The Local Unitary Cluster Jastrow (LUCJ) ansatz is a possible solution being a low depth quantum circuit architecture for electronic structure calculations, but it's performance can struggle in systems with noise. Thus, we have developed an efficient classical simulation framework for noisy LUCJ circuits using Majorana propagation of Heisenberg-picture observables. By propagating the observables backwards instead of quantum states forwards through our circuits, noise channels can be seamlessly integrated through channel evolution along with the observables. We also employ multiple Majorana monomial truncation strategies to control the computational complexity while preserving observable accuracy. Our simulations have shown LUCJ circuits can be simulated efficiently with over 80 qubits and thousands of operations, suggesting Majorana propagation can be a practical tool for validating actual quantum computations and benchmarking other quantum chemistry algorithms.

REAL-TIME CORRECTION OF SKIN COLOR BIAS IN PULSE OXIMETRY SPO2 ESTIMATION
Presenter(s): Carter Ostrowski (Michigan State University)
Category: Computer Science & Engineering
Mentors(s): Bige Unluturk (College of Engineering), Hakan Burak Karli (College of Engineering)

Pulse Oximetry is an essential part of healthcare due to its ability to detect blood oxygen saturation non-invasively and continuously. Pulse oximeters operate by shining light through the skin using red and near infrared light; the differential absorption of the wavelengths by oxygenated and deoxygenated hemoglobin and changes in blood volume creates a photoplethysmography (PPG) signal. SpO2 is the measure of blood oxygen concentration that pulse oximetry produces by leveraging the ratios of red and infrared light from the PPG signal. The goal for pulse oximetry is to align Spo2 as closely as possible with SaO2, the clinical gold standard, yet the presence of melanin in the body introduces bias that impacts the accuracy for individuals with darker skin tones. This bias occurs because melanin interferes with light absorption. Strategies for bias mitigation primarily focus on post-hoc correction of

SpO2 values already calculated by the device, which limits their usability for real-time correction. By leveraging machine learning and incorporating personal parameters, this work aims to use the ppg signal to identify and correct skin color related features for improved SpO2 estimation. The objective is to develop a robust model capable of real-time deployment on hardware that can be validated through future subject trials.

OATPFORMER: USING MACHINE LEARNING TO PREDICT DRUG-PROTEIN INTERACTIONS
Presenter(s): Ailin Patimar (Michigan State University)
Category: Computer Science & Engineering
Mentors(s): Daniel Woldring (College of Engineering), Logan Garland (College of Engineering)

How do medicines reach a damaged or diseased part of the body? Membrane transport proteins-Organic Anion Transporting Polypeptides (OATPs)-play a critical role in shuttling medicine into various regions, including the blood-brain barrier. Imagine if we could modify OATPs to enhance their ability to export therapeutic compounds into target sites while reducing transport of biowaste molecules, enabling improved delivery of diagnostic agents and treatments for neurodegenerative diseases. This research project develops a computational workflow for predicting OATP-ligand binding affinities and finetuning TopoFormer: a topology-based structure-to-sequence machine learning model for protein-ligand interaction predictions. I obtained structural models for 3 types of human OATPs using protein structure prediction methods, including AlphaFold3, Boltz-2, Protenix, and Chai-1. Multiple ligand-docking poses are generated for each protein-ligand pair, and binding affinities are predicted using ML-based scoring models such as OnionNet2 and TopoFormer. I then evaluated model performance against experimentally derived inhibition data to identify the most accurate prediction pipeline. We then feed results from each diffusion model into TopoFormer to generate an OATP-specific synthetic dataset for finetuning. Our enhanced affinity predictor-OATPFormer-will rapidly screen databases to identify promising protein-ligand complexes, guiding scientists in designing more effective drug transport proteins while minimizing affinity for waste molecules such as bilirubin and bile acids. This work demonstrates how integrating protein structure prediction, ligand docking, and machine learning models can accelerate the engineering of drug transport proteins and enable data-driven design of improved therapeutic delivery systems.

HOW CAN AGENTIC UAV DRONE SWARMS BENEFIT AIRPORT SECURITY: IMPLEMENTING AND BENCHMARKING EMBEDDED EDGE SLM-BASED AGENTS ON OFF-THE-SHELF UAV HARDWARE
Presenter(s): Devin Meyer (Oakland University), Joe Montroy (Loyola University Chicago)
Category: Computer Science & Engineering
Mentors(s): Darrin Hanna (Oakland University)

Autonomous UAV swarms are increasingly viable for the continuous surveillance of critical infrastructure, yet most agentic swarm designs still depend on a central LLM base station that reintroduces a single point of failure and a communication bottleneck. This research benchmarks a range of commercially available small language models (SLMs) as fully onboard agents within an airport-security UAV swarm, evaluating them across two complementary decision-making domains. The first examines visual threat reasoning: each drone's SLM receives semantic scene data from a lightweight onboard perception model, assesses potential security threats within its field of view, and communicates with peer drones to reach a well-informed collective decision. The second examines energy-resilient coordination: each drone's SLM tracks its own state-of-charge and, upon crossing a safe return threshold, opens a market-style auction for the area it can no longer cover, letting neighboring agents bid on the orphaned region based on state of charge, proximity, and orphans so that coverage degrades gracefully through local negotiation rather than central command. Both projects benchmark their SLMs across repeatable simulated scenario sets using similar metrics such as accuracy, alongside task-specific measures critical-reasoning and communication quality for threat detection, and auction latency and protocol violations for coordination. After benchmarking 10 different models, Granite4:3b performed the best in both tasks, achieving 75.6% accuracy for vulnerability detection and 58% accuracy for proper area auctioning.

ACCELERATING RESEARCH WITH EASYBUILD
Presenter(s): Connor Neiheisel (Michigan State University)
Category: Computer Science & Engineering
Mentors(s): Nicholas Panchy (Research & Innovation)

Through my research I created detailed documentation for using EasyBuild, a software installation framework used by researchers at Michigan State. This documentation allows researchers to download and install the software they need to be successful with their work.

AN EMPIRICAL STUDY OF GENERATIVE AI'S INFLUENCE ON USER STORY QUALITY ACROSS TWO HIGHER EDUCATION INSTITUTIONS
Presenter(s): Yasrib Yasir Farook (Eastern Michigan University)
Category: Computer Science & Engineering
Mentors(s): Siyuan Jiang (Eastern Michigan University)

As Generative AI (GenAI) increasingly reshapes software engineering practices, there is a growing need to evaluate how these tools can be integrated into the curriculum to support the development of requirements. In Agile software development, user stories describe functionality that is valuable to the user. We conducted a within-subjects study across two regional public universities involving 48 undergraduate students (406 user stories in total) to investigate the impact of GenAI on user story quality. Students completed equivalent user story writing tasks both without and with GenAI assistance, following guided instruction. The user stories were evaluated in terms of their structure and the INVEST framework, an industry standard assessing requirements across six criteria: Independent, Negotiable, Valuable, Estimable, Small, and Testable. Our results indicate that the impact of GenAI is substantial but selective. We observed universal, significant improvements in the Testable and Structure attributes (? < 0.001), regardless of initial student proficiency or the specific AI tool used. On the other hand, attributes such as Independence and Negotiability showed no significant change, likely due to high baseline performance. Furthermore, the effectiveness of GenAI assistance was inconsistent across institutional contexts, suggesting that instructional context and student background influence how effectively GenAI is used. At one site, the intervention acted as a leveling force, improving scores in weak areas like Valuable but causing a significant decline in the Small attribute. These findings suggest that while GenAI provides a robust scaffolding for structural and testable requirements, its success depends on the students' starting skill level and other institutional contexts.

EFFICIENT AI AND BACKDOOR ATTACKS
Presenter(s): Aliyah Montesdeoca (Loyola University Chicago), Bidisha Dalai (University of Texas - San Antonio), Pierce OKeefe (California State University - Sacramento)
Category: Computer Science & Engineering
Mentors(s): Huirong Fu (Oakland University), Lanyu Xu (Oakland University)

Large language models (LLMs) are becoming more common in everyday applications, but they are still vulnerable to backdoor attacks. These attacks hide malicious behavior inside a model so that it behaves normally until a specific trigger is given, causing it to produce attacker-controlled outputs. At the same time, model compression techniques such as pruning are widely used to reduce memory usage and improve efficiency, but it is still unclear how pruning affects these hidden backdoors. In this project, we investigate whether pruning can reduce the effectiveness of backdoor attacks while maintaining the model's performance on clean data. We evaluate three different backdoor attacks, Data Poisoning Attack (DPA), Weight Poisoning Attack (WPA), and Hidden State Attack (HSA), using the Qwen2.5-7B model and the SST-2 dataset. The models are pruned at multiple sparsity levels and evaluated using clean accuracy and attack success rate. This work aims to better understand how pruning impacts different backdoor attacks and whether it can serve as a potential defense for securing large language models.

PALLAS: AN AGENTIC AI FOR PHOEBUS OPERATOR INTERFACES
Presenter(s): Mihir Naik (Michigan State University)
Category: Computer Science & Engineering
Mentors(s): Tong Zhang (Facility for Rare Isotope Beams)

The rapid advancement of agentic AI workflows offers significant potential to accelerate system configuration and software development. We present Pallas, an agentic AI application for Control System Studio (CS-Studio) Phoebus OPI display generation and iteration. Traditionally, developing these operator interfaces requires substantial manual effort. To address this, Pallas leverages LangChain to orchestrate local large language models hosted on FRIB's A100 GPUs, integrating with the opi-generator tool to programmatically generate and refine display configurations. By translating high-level user requirements into functional Phoebus setups, the application significantly reduces development time and minimizes configuration errors. This project demonstrates the practical application of secure, local agentic AI in large-scale scientific facilities, ultimately enhancing control system efficiency at the Facility for Rare Isotope Beam

CONTEXT DRIVEN LARGE LANGUAGE MODELS FOR HIGH PERFORMANCE COMPUTING JOB ANALYSIS
Presenter(s): Adhvik Kolar (Michigan State University)
Category: Computer Science & Engineering
Mentors(s): Claire Kopenhafer (Research & Innovation)

High performance computing systems play an important role in scientific research by providing the computational resources needed for large and complex workloads. However, identifying the causes of failed or inefficient computing jobs often requires interpreting job logs, resource usage, system information, and technical documentation. This process can be time consuming and requires significant domain knowledge. This project investigates whether local large language models (LLMs) can help users interpret computing job information and generate clear, human like explanations of common job issues. A Python based workflow was developed to collect information about user accounts, resource usage, job execution, and system output. Relevant reference material was then provided to the language model to improve its understanding of the computing environment and common failure scenarios. The proposed approach was evaluated using representative job failures, including missing software packages, missing input files, memory related failures, exceeded time limits, library configuration errors, and inefficient processor utilization. Our work focuses on evaluating the quality and reliability of the model's responses across these scenarios and identifying the types of contextual information that most effectively improve job interpretation. This project serves as an initial step toward understanding how local large language models can support users in analyzing high performance computing jobs while maintaining a workflow grounded in structured system information.

Education

CREATING THE RIGHT CONDITIONS: UNDERSTANDING THE SUPPORTS THAT MATTER TO UNDERGRADUATE LEARNING ASSISTANTS
Presenter(s): Chanel Issa (Michigan State University)
Category: Education
Mentors(s): Rachel Barnard (Lyman Briggs College)

Undergraduate Learning Assistants (ULAs) are important help for faculty and students, but they need support to be effective in their work. LB 171L is Lyman Briggs College's introductory chemistry laboratory course that has 24 sections each fall, each supported by 2 ULAs. This course teaches first-year students safety, lab techniques, and inquiry-based exploration of lecture ideas into a chemistry lab environment. ULAs are students who did academically well in the courses they are assisting and are hired to elicit student thinking and learning about course material. ULAs in LB171L take attendance, start the lab, answer students' questions, ensure safety requirements are met, help professors give feedback to students, and hold office hours. Support structures specifically for the ULAs include a 20 minute pre-lab meeting, weekly 60 minute teaching team meetings, a post-lab conversation, and a library of curriculum resources. Broadly, this project explores how the ULAs perceive the supports - both relational and informational - impacting their sense of autonomy, competence, and relatedness (Ryan and Deci, 2000). In this poster, we explore the open-ended responses from the pre- and post-semester surveys of the seven ULAs who completed both surveys. Specifically, we examined whether the supports the ULAs identified in the post-survey appeared to address the hopes and concerns they expressed in the pre-survey. In doing so, we hope to better understand what sorts of supports help address the various priorities and concerns of ULAs.

IMPROVING HEALTH INSURANCE LITERACY AMONG COLLEGE STUDENTS: IDENTIFYING GAPS AND CAMPUS SOLUTIONS
Presenter(s): Grayson Rodgers (Grand Valley State University)
Category: Education
Mentors(s): Anna Hammersmith (Grand Valley State University)

This research examines health insurance literacy among college students, focusing on how demographic and socioeconomic factors influence students' understanding of health insurance and healthcare costs. The purpose of the study is to identify disparities in health insurance knowledge and explore strategies universities can use to improve students' ability to navigate healthcare systems. The primary research question asks: How do demographic characteristics, socioeconomic status, and health insurance coverage relate to college students' health insurance literacy and healthcare cost awareness? Examining these factors may provide insight into the underlying causes of disparities in health insurance literacy among college students. The current phase of the project consists of a systematic review of scholarly literature on health insurance literacy, healthcare access, and insurance-related disparities among college-aged populations. The review analyzes existing studies that examine differences in insurance knowledge by factors such as race, gender, sexual orientation, first-generation status, and socioeconomic background. A second phase, planned for Fall 2026, will involve administering a survey to students at Grand Valley State University to assess health insurance literacy, healthcare cost awareness, and experiences navigating healthcare systems. Ultimately, this research aims to reduce the burden of healthcare illiteracy on students and promote equitable access to information and care.

THE BIG PICTURE OF SMALL ATOMS: A YOUTUBE ANALYSIS OF ATOMIC RADIUS INSTRUCTION
Presenter(s): Addyson Walker (Michigan State University), Olivia Kollovozi (Michigan State University)
Category: Education
Mentors(s): Deborah Herrington (Grand Valley State University), Ryan Sweeder (Lyman Briggs College)

This project focuses on improving digital chemistry education through the analysis of YouTube videos on atomic radius. Using key search terms such as "atomic radius," "atomic radius periodic trends," and "atomic size explained," our team identified English-language videos under 15 minutes that were conceptually focused on atomic radius. Videos with substantial viewership were prioritized in our sample. A total of 28 videos were identified for in-depth coding by 2 faculty members and 3 undergraduate researchers. All team members contributed to the consensus coding process and final video selection. Our analysis revealed several notable trends. Nearly all videos incorporated symbolic representations (96%) and a majority included particulate representations (82%), while only 25% included macroscopic representations. Most videos were coded with core ideas (86%) with majority focus on electrostatic bonding and interactions, followed by atomic and molecular structure and properties. Within multimedia principles, coherence (50%), segmenting (50%), amount of text (68%) were the most common design features observed. Causal mechanistic reasoning(CMR) was present in 57% of videos, with explanations most commonly focusing on atomic radius trends across a period through electrostatic attraction and effective nuclear charge. Atomic radius videos demonstrated relatively high incorporation of Scientific Practices and three-dimensional learning elements compared with previously analyzed chemistry topics. Many videos connected atomic radius trends to broader concepts such as periodic trends and effective nuclear charge, although fewer videos explicitly defined atomic radius itself. Overall, this analysis provides insight into how atomic radius is represented in digital chemistry education and identifies opportunities to strengthen conceptual understanding through improved multimedia design and scientific explanations.

CHEMISTRY ON SCREEN: A SYSTEMIC ANALYSIS OF YOUTUBE VIDEOS ON TRENDS IN IONIZATION ENERGY
Presenter(s): Abigail Casey (Michigan State University), Jazmin Devereaux (Michigan State University)
Category: Education
Mentors(s): Deborah Herrington (Grand Valley State University), Ryan Sweeder (Lyman Briggs College)

YouTube analysis of videos involving ionization energy.

IMPACT OF MENSTRUAL CYCLE PHASE ON SKELETAL MUSCLE ACTIVATION AND FORCE PRODUCTION DURING EXERCISE IN HYPOXIA
Presenter(s): Anthony Diaz Ortega (University of South Florida)
Category: Education
Mentors(s): Chad Wiggins (College of Education)

Introduction: Women remain underrepresented in exercise physiology research, likely due to interactions between menstrual cycle hormones and physiological outcomes. Our study sought to evaluate forearm muscle electromyographic (EMG) activity during handgrip exercise in acute hypoxic environments to determine how different menstrual cycle phases influence neuromuscular responses at sea level and simulated altitude. Methods: Healthy females visited the lab four separate times across a single menstrual cycle and completed rhythmic handgrip exercise using a handheld dynamometer at different intensities (10%, and 20% of each participant's individual maximal voluntary contraction (MVC)) under normoxic (21% O2) and hypoxic conditions (16% O2, 12% O2). Surface electromyography (EMG) electrodes placed on the forearm recorded muscle activity during exercise across four visits. EMG responses were then compared across menstrual cycle phases to determine the effect of hormonal fluctuations on neuromuscular function. Results: EMGRMS was not different across menstrual cycle phases (EF vs. LF vs. LUT) at either handgrip intensity, regardless of inspirate. At 10% MVC, no phase effect was observed while breathing 21% O2 ($P=0.098$), 16% O2 ($P=0.766$), or 12% O2 ($P=0.557$). Similarly, at 20% MVC, EMGRMS did not differ across phases at 21% O2 ($P=0.617$), 16% O2 ($P=0.519$), or 12% O2 ($P=0.111$). Conclusion: Neuromuscular activity, during handgrip exercise, was/was not different across menstrual cycle phases under normoxic/hypoxic conditions. These findings suggest that hormonal fluctuations throughout the menstrual cycle do/ do not have and influence on forearm muscle activation during exercise. Further investigation with a larger sample size is needed to confirm these results.

FIGURING OUT THE FIGURES: HOW STUDENTS USE PRACTICAL RESOURCES TO INTERPRET NEUROSCIENCE GRAPHS
Presenter(s): Jordan Temple (Michigan State University)
Category: Education
Mentors(s): Aeryn VanDerSlik (College of Natural Science), Jennifer Doherty (Lyman Briggs College)

The ability to interpret graphs is critical to students studying neuroscience, however, a majority of students struggle with this skill. Examining how students draw on different cognitive reasoning skills when interpreting graphs can provide insight into how scientific reasoning develops across undergraduate courses. The goal of this study is to develop a better understanding of how students use practical resources to interpret neuroscience graphs throughout their undergraduate coursework. I analyzed 13 student interviews using Resource Theory. Resource Theory is the idea that a student's cognitive performance is dependent on a limited collection of resources, such as conceptual and practical knowledge that consists of small, context-dependent pieces that can be activated in different situations. The way students reason depends on which resources they activate in response to a task and how those resources are used to construct an explanation (Hammer & Elby 2002). During these interviews, students were asked to reason with three different types of neuroscience graphs: an action potential, a current graph, and an IV curve. I found that students further along in their coursework tended to begin with practical reasoning and then build toward conceptual reasoning when interpreting graphs. In contrast, students earlier in their coursework relied more heavily on conceptual reasoning and were less likely to use practical reasoning as part of their approach. Overall, students further in their coursework incorporated practical reasoning as a foundation for their conceptual explanations, whereas students earlier in their coursework primarily depended on conceptual reasoning.

ASPECTS OF COLLABORATIVE LEARNING THAT MATHEMATICS STUDENTS FIND CULTURALLY AFFIRMING
Presenter(s): Harjot Kaur (Michigan State University), Teegan McLeod (Michigan State University)
Category: Education
Mentors(s): Kristen Vroom (Lyman Briggs College), Reagin McNeill (Lyman Briggs College)

Collaborative learning can create mathematics classrooms where students feel a sense of belonging, encouraging them to remain motivated to learn at a deeper level while learning through their own perspectives and those of their peers. However, mathematics classrooms are often perceived as culturally neutral spaces, where students cannot bring their whole selves to their collaborations. To explore how mathematics classrooms can be a better holistic learning experience for students at Hispanic-Serving Institutions, we investigated what collaborative learning in a proof-based math course means to students at Hispanic-Serving Institutions and how it fostered a culturally affirming learning experience. Structured interviews were conducted with four students from three introduction-to-proofs courses at California bachelor's granting institutions whose instructors participated in interventions to promote culturally responsive teaching. The student interviews were transcribed and analyzed using open and axial coding methods. Data shows that students found collaborative learning culturally affirming when multiple ways of thinking were valued through activities that drew meaningful connections between mathematics and students' lives, creating opportunities for cultural identities to be recognized and celebrated. These findings can inform instruction that leverages diverse ways of thinking as an entry point for intercultural connection across STEM fields that can be otherwise seen as culturally devoid spaces.

Electrical & Computer Engineering

QUANTIFYING SOCIAL INTERACTION QUALITY: REAL-TIME SMILE DETECTION USING MACHINE LEARNING IN A RESOURCE CONSTRAINED ENVIRONMENT
Presenter(s): Kennedy Bailey (University of Michigan)
Category: Electrical & Computer Engineering
Mentors(s): Andrew Mason (College of Engineering), Angela Hall (College of Social Science)

Human social interactions are expressed through a diversity of signaling pathways including speech, facial expressions, and body movement. It is well established that non-verbal behaviors reflect cognitive, emotional, and relational states highly relevant to applications ranging from clinical health assessment to human-robot interaction. To advance these fields, new tools capable of quantifying behavioral mechanisms in real time and unobtrusively are greatly needed. However, existing monitoring systems typically analyze these behavioral signals in isolation and fail to capture the complexity and variability of human social dynamics. Machine learning (ML) combined with wearable sensing offers a solution by learning patterns across multiple data streams simultaneously, yet no unified framework currently exists for capturing and fusing multiple signal modalities to objectively quantify interaction quality. As part of a broader study to develop a multimodal ML system capable of tracking human social interaction parameters using audio, visual, and motion-based sensing, this project explores using camera data to identify specific facial expressions critical to interpreting underlying social behaviors. Specifically, this project aims to demonstrate that OpenFace, an open-source facial action unit extraction software tool, can be utilized to develop and train an ML model to identify smiles in real time. The work conducted includes extracting results from OpenFace, acquiring data sets containing labeled images, and training multiple ML models to predict facial expressions. By comparing accuracy and speed performance results across models, an optimal methodology for real-time analysis will be determined, ultimately contributing to deployable systems for wellness assessment and human-robot teaming.

CROSS-DEVICE GENERALIZATION OF SKIN PIGMENTATION-AWARE SPO2 CORRECTION MODELS VIA TRANSFER LEARNING
Presenter(s): Fadlulah Omitogun (University of Maryland Baltimore County)
Category: Electrical & Computer Engineering
Mentors(s): Bige Unluturk (College of Engineering)

Pulse oximeters are small, noninvasive devices widely used for measuring blood oxygen saturation (SaO2). However, they have been shown to have higher discrepancies between measured Saturation of Peripheral Oxygen (SpO2) and SaO2 with darker skin tones due to melanin absorbing the light used by the sensor, resulting in occult hypoxemia, a phenomenon where hidden low oxygen appears normal on the monitor. This issue disproportionately affects neonatal infants and could lead to them developing organ damage, neurodevelopmental issues, and higher mortality rates. Although there is existing work that implements machine learning to reduce the measurement errors, it lacks hardware transferability. This study aims to improve upon the existing machine learning model through the use of transfer learning across various devices in order to have the model adapt to the characteristics of novel hardware without having to fully retrain it. A custom pulse oximeter will be built around the AFE4400 analog front-end integrated circuit to explicitly show how device specific optical parameters contribute to skin pigmentation bias while serving as a reproducible research platform and alternative to standard commercial devices. A transfer learning framework will then be developed to adapt the existing XGBoost correction model to data collected from the custom AFE4400 platform to leverage the knowledge learned from large existing datasets while accommodating the signal characteristics of the different hardware. These contributions aim to establish a reproducible, hardware-transparent foundation for improving pulse oximetry accuracy in neonatal and other underserved populations.

ENHANCING A SOFT PERISTALTIC ROBOT FOR AGRICULTURAL DRAINAGE PIPE INSPECTION THROUGH RASPBERRY PI INTEGRATION AND VISUAL SENSING
Presenter(s): Keith Howerton (Southern Nazarene University)
Category: Electrical & Computer Engineering
Mentors(s): Christian Luedtke (College of Engineering)

Agricultural drainage systems are critical infrastructure for managing subsurface water in farming operations, yet inspection of small-diameter drainage pipes remains difficult because of their underground placement, limited access points, and often wet operating conditions. Traditional inspection methods may require excavation, increasing maintenance costs and delaying the identification of pipe failures. This research investigates whether integrating a Raspberry Pi-based control system and visual inspection hardware into an existing soft peristaltic drainage pipe robot can improve its functionality as an autonomous inspection platform. The research question guiding this work is: What hardware and software upgrades are needed to transform the existing locomotion robot developed by Luedtke et al. into a functional pipe inspection platform? The robot platform is based on a previously validated inchworm-inspired soft robot designed for locomotion in 4-inch agricultural drainage pipes. The original system utilized anisotropic thermoplastic polyurethane (TPU) fins to achieve directional movement. In this study, motor control is migrated from an Arduino microcontroller to a Raspberry Pi single-board computer, supporting simultaneous execution of motor control. Additionally, a waterproof camera module and LED ring light are incorporated to provide visual inspection capabilities. The hypothesis is that the Raspberry Pi-based system will maintain reliable robot locomotion while simultaneously supporting image capture and illumination functions necessary for drainage pipe inspection. System performance will be evaluated through motor control testing, camera functionality assessment, and inspection trials in representative wet environments. The resulting platform represents a step toward a minimally invasive and autonomous solution for monitoring agricultural drainage infrastructure.

A ROBUST VISION BASED TRAFFIC SIGN UNDERSTANDING AND BEHAVIOR EXECUTION FRAMEWORK FOR SMALL SCALE AUTONOMOUS VEHICLES.
Presenter(s): Chenxin Zhang (Michigan State University)
Category: Electrical & Computer Engineering
Mentors(s): Shaunak Bopardikar (College of Engineering)

Traffic signs provide important semantic cues for autonomous vehicles, but perception is only useful when detected signs are translated into correct real time driving behaviors. This paper presents a robust vision-based traffic sign classification and behavior execution framework for a one tenth scale autonomous vehicle platform. The system integrates lane following, custom YOLO based traffic sign detection, tiled inference for small-object recognition, temporal voting for detection stabilization, UDP communication between the vehicle and a remote computer, and an onboard finite state behavior controller.
A Quanser QCar is used as the experimental vehicle. Camera frames are streamed to an external computer for traffic sign inference, and sign-level commands are transmitted back to the vehicle for closed-loop execution. The framework supports multiple traffic behaviors, including stopping at stop signs, rerouting for Do Not Enter signs, slowing down for caution and yield scenarios, responding to traffic light states, and performing parking maneuvers such as parallel and reverse parking using blue line structure.
To improve robustness, a custom traffic sign dataset is collected from the QCar camera viewpoint under varied distance, angle, illumination, multi-sign, and physical perturbation conditions. The perception pipeline addresses practical failure cases such as small signs, simultaneous signs, stop and Do Not Enter confusion, partial occlusion, and sign deformation. Experiments evaluate both detection and behavior performance, including accuracy, confidence, multi-sign recognition, physical noise robustness, and closed-loop execution. The setup is also used to study cyber attacks against camera based autonomous systems.

INKJET PRINTING CARBON NANOTUBES TO FORM CONDUCTING MATERIALS WITH A CUSTOM LOW DPI SYSTEM
Presenter(s): Luca Sheridan (Cooper Union)
Category: Electrical & Computer Engineering
Mentors(s): James Siegenthaler (College of Engineering)

Carbon nanotubes (CNT) are currently being explored as a cheap material to create conductive inks for flexible electronics, transparent electrodes, electronic sensors, and many more electrical and chemistry applications. Many methods of CNT ink deposition are being explored, but one of the most promising is inkjet printing. Unlike many other deposition methods, it does not need a template to be made beforehand or any post processing afterwards. This, combined with the fact that inkjet printers are cheaply available consumer products, makes using inkjet printers with CNT inks very appealing for low-cost applications. Previous studies have used high dpi consumer printers (1200+ dpi) to deposit CNT inks with the goal of minimizing sheet resistance of the printed substrate. Our custom system uses a low dpi cartridge (96 dpi), but is still able to recreate similar sheet resistances to higher dpi models. This has been made possible by recent improvements to the system's software, specifically the addition of "density factor," which allows it to imitate higher dpi's. Using this density factor feature, we were able print a CNT substrate with a sheet resistance of 1200 Ω/□ with 13 layers on paper, comparable to the results of a separate group who achieved 1000 Ω/□ with 33 layers on paper using a 1200 dpi printer. Achieving comparable results with a much lower low dpi makes exploring this technology much more accessible, as lower dpi ink cartridges are easier to implement in custom systems, lowering the barrier of entry for future research groups.

HUMAN MOTION CAPTURE
Presenter(s): Aashika Mukarigari (Wayne State University), Ben Koenigbauer (Wayne State University)
Category: Electrical & Computer Engineering
Mentors(s): Brian Dean (Oakland University), Mrunalini Desai (Oakland University)

Human Motion Capture (HMC) is the process of tracking the movement of the human body. This movement can be recorded and digitized to effectively measure joint angles and analyze specific patterns of the body. Gathering accurate and reliable measurements of human motion is essential to help prevent future injuries and to improve physical therapy and rehabilitation. Most modern human motion wearable systems commonly utilize Inertial

Measurement Units (IMUs), which have increased in accuracy in recent years. However, measuring multiple joints with many IMUs can lead to an overly complex and substantially more expensive setup. The purpose of this study is to use sensor fusion to integrate three sensors: a bend sensor, a stretch sensor, and an analog hall effect proximity sensor to enhance the reliability and accuracy of the HMC data collected while keeping costs and complexity lower. The study focuses on the motion of the knee joint. All three sensors will be placed on a knee sleeve, allowing for non restricted movement and comfort during the natural motion of the knee. The data from our initial tests demonstrate that our proposed sensor fusion system can capture knee joint motion effectively with reduced noise and higher accuracy compared to previous data produced by IMUs. These results suggest that incorporating new types of sensor fusion is beneficial to improve the overall reliability of capturing human motion and can enhance wearable motion tracking systems in real world applications.

ASSESSING THE IMPACT OF RECEIVING ABSTRACTED INFORMATION IN EXTENDED REALITY
Presenter(s): Angel Garcia Vega (Eastern New Mexico University), Gabriella Thomas-Arbaje (Oakland University)
Category: Electrical & Computer Engineering
Mentors(s): Andrea Macklem-Zabel (Oakland University)

Previously, an extended reality (XR) system was created to explore the impact of information distribution over visual, auditory, and haptic channels. Our research extends this system to investigate the effectiveness of abstraction, focusing on its impact on accuracy and latency. Abstraction is defined as the generalization of key, specific details to simplify information. We are using a combination of literature and theories to inform the creation of low and high abstracted cues with the goal to incorporate them into our human-subject study design.

ADAPTIVE, RECONFIGURABLE, WIRELESS EEG SYSTEM DEVELOPMENT
Presenter(s): Cixian Yang (Oakland University), James Maurer (Wayne State University), Steven Garner (Oakland university)
Category: Electrical & Computer Engineering
Mentors(s): Jia Li (Oakland University)

Electroencephalography (EEG) is a non-invasive neurophysiological recording method for the diagnosis and study of epilepsy, traumatic brain injury, sleep disorders, and brain-computer interface applications. Although existing EEG systems have advanced in signal acquisition accuracy, wireless operation, and user-centered design, many remain limited by gel-based electrodes, bulky hardware, fixed functionality, or designs that are not optimized for lightweight modular sensing. This research project focuses on the design and implementation of a lightweight, modular, and energy-efficient EEG front-end system for continuous wireless brain monitoring. Adaptability is achieved through adaptive signal processing that responds to changing noise conditions, including motion artifacts and environmental interference, to preserve EEG signal integrity. Reconfigurability is provided through programmable firmware that enables the same hardware platform to support different acquisition parameters, communication modes, and future application-specific signal processing without requiring hardware modifications. The proposed system aims to improve usability by incorporating dry electrodes, adaptive filtering, and a modular four-electrode architecture. Dry electrodes reduce preparation time for long-term wearability. Adaptive filtering improves signal-to-noise ratio and reduces motion artifacts. The modular four-electrode sensing architecture provides area-specific brain monitoring. The system also integrates real-time WiFi/BLE communication for portable data streaming across different environments and reconfigurable control firmware to support future event-based monitoring. Methodology includes system-level architecture design, PSpice simulation, PCB schematic and layout, prototyping, testing, and evaluation. System performance will be assessed by comparing wireless EEG signal acquisition against commercial wired EEG devices and by verifying measurement quality relative to similar wireless EEG implementations reported in existing research.

CHARACTERIZING DEFECTS IN GAN HEMTS
Presenter(s): David Hutchinson (California State University Chico)
Category: Electrical & Computer Engineering
Mentors(s): Nicholas Miller (College of Engineering)

Gallium nitride (GaN) high electron mobility transistors (HEMTs) are semiconductor devices that are used in high power electronics and RF systems. GaN HEMTs are susceptible to localized energy states that capture and release charge carriers, caused by defects, called traps which lead to current collapse and poor device performance. Pulsed I-V (PIV) drain current transient (DCT) measurements were performed on GaN HEMTs. These measurements were used to replicate data showing Arrhenius or non-Arrhenius behavior in these devices dependent on the gate voltage pulse value. A need for thorough analysis of these DCT measurements led to the development of a custom program to better characterize the electron trapping effect signatures present in the DCT measurements. The program processes DCT measurement files and allows the user to define how the curve is fitted to the Kohlrausch-Williams-Watts (KWW) equation. Slight differences in the curve fit were shown to yield different Arrhenius analysis results. A more accurate analysis of the data leads to further insight of the trapping effects. A better understanding of these trapping effects can help to support the development of methods to mitigate trap related behavior in these devices, making GaN HEMTs more efficient overall. Robust testing also led to a better understanding of how to obtain consistent results for the saturated drain current values from the PIV DCT measurements, which is presented in this work.

ACCELERATING AND VALIDATING MATERIALS DISCOVERY: AUTOMATED CONVEX-HULL STABILITY SCREENING FOR THE SALSA PIPELINE
Presenter(s): Rohan Yarlagadda (Harvey Mudd College)
Category: Electrical & Computer Engineering
Mentors(s): Karina Shih (College of Natural Science), Marcus Djokic (College of Engineering)

The discovery of new earth-abundant semiconductors is essential for advancing clean-energy technologies, such as photocatalytic water splitting, which utilizes sunlight to convert water into hydrogen fuel. However, the vast number of potential compounds makes individual testing impractical. To address this challenge, the Mendoza-Cortes group at Michigan State University developed SALSA (Substitution, Approximation, evoLutionary Search, and Ab-initio calculations), a workflow that identifies new materials by intelligently recombining known compounds. My research extends SALSA in two significant ways. First, I incorporated a convex-hull stability analysis to determine whether a predicted compound would remain intact or decompose into other phases, a critical assessment since only stable materials are viable for application. Second, I restructured the disorganized scripts used in the pipeline's final stage into a cohesive set of Python tools that can retrieve data from materials databases, perform stability analyses, generate crystal structures, and automatically produce phase diagrams. These tools run on MSU's High Performance Computing Center, distributing the most demanding steps - density functional theory calculations performed with CRYSTAL23, a hybrid-DFT code that provides the accuracy needed for reliable stability predictions - across the cluster's compute nodes. This combination reduces manual effort from days to hours while producing results at a level of fidelity that would be impossible on a single workstation. Furthermore, the enhanced workflow will be made publicly available on the SALSA GitHub repository to support researchers interested in semiconductor discovery. Collectively, these improvements increase SALSA's reliability and efficiency, accelerating the search for novel semiconductor materials.

NON-EQUILIBRIUM CHEMICAL VAPOR DEPOSITION GROWTH OF 2D HYBRID CHIRAL PEROVSKITE
Presenter(s): Timothy Martinez (College of Southern Maryland)
Category: Electrical & Computer Engineering
Mentors(s): Ajay Sah (College of Natural Science)

2D hybrid perovskites have become an emerging semiconducting material due to their properties such as low dimensionality, hybrid composition, and softer mechanical rigidity compared to inorganic semiconductors. Interestingly, the introduction of chiral organic chains breaks inversion symmetry within the crystal, giving rise to chiroptical phenomena such as circular dichroism (CD) and circularly polarized photoluminescence. These unique optical and electronic properties make chiral 2D hybrid perovskites promising candidates for next-generation spintronic and optoelectronic applications. We employed non-equilibrium chemical vapor deposition (CVD) to synthesize R-methylbenzylammonium lead bromide, ((R-MBA)2PbBr4). Optical and electron microscopy revealed well-defined square nanoplatelet crystals with smooth surfaces and sharp edges, indicating uniform crystalline growth. Scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDS) measurements showed Br/Pb ratios of approximately 2.8 and 2.6. These values are close to the expected bromide-rich composition of layered lead bromide perovskites, suggesting consistent chemical composition across different crystals. Future work will include further structural and optical characterization of these crystals, such as powder/single-crystal X-ray diffraction and circular dichroism measurements.

EVALUATING WEARABLE SENSING TECHNOLOGIES FOR HUMAN SOCIAL INTERACTION MONITORING
Presenter(s): Chunxiao Liu (Michigan State University)
Category: Electrical & Computer Engineering
Mentors(s): Andrew Mason (College of Engineering)

This project focuses on wearable sensing technologies for human social interaction monitoring. Wearable devices can collect different types of information, including physiological signals, behaviors, emotions, and other data related to health and daily activities. Examples of these devices include Meta smart glasses, Oura Ring, Google Glass, and Muse headsets. However, each device has its own strengths and limitations. This project reviews and compares current wearable sensing products based on the types of information they can measure and their potential applications in social interaction monitoring. The goal is to better understand how different wearable technologies may complement each other and to provide ideas for the development of future wearable sensing systems.

TRANSFERABILITY OF INDOOR SCALE AUTONOMOUS VEHICLES TO REAL VEHICLE: A CASE STUDY USING VISION-BASED STOP SIGN DISTANCE ESTIMATION
Presenter(s): Keer Chen (Oakland University)
Category: Electrical & Computer Engineering
Mentors(s): Jun Chen (Oakland University)

Reliable stop sign perception is important for autonomous vehicles (AVs) operating in campus and urban driving environments. This project develops a vision-based stop sign distance estimation method and evaluates its transferability from a scale AV platform to real full-size vehicle. The distance model was trained using stop sign data collected from Quanser Self-Driving Car Studio with QCar 2. YOLO first detects stop signs from front-camera images, and the detected bounding box information is then used as input to a custom distance regression model to estimate the longitudinal distance between the vehicle and the stop sign. After training on the Quanser platform, the same detection and distance-estimation framework is implemented on a full scale AV platform, i.e., a Mach-E with Dataspeed by-wire system, front camera, Ouster-64 LiDAR, and RTK GPS with centimeter accuracy. For real-vehicle evaluation, front-camera video is processed frame by frame, and ground-truth distance is calculated using the vehicle GPS position and the stop sign GPS coordinates. The model achieves an RMSE of 0.026 m in the indoor-scale environment and 3.325 m on the full-scale AV platform with minimum recalibration. Numerical results also highlight the need for further improvement in model robustness under real-vehicle conditions. This work demonstrates the potential of lightweight vision-based distance estimation for AV perception.

3D RECONSTRUCTION OPTIMIZATION OF INDOOR DIGITAL TWINS
Presenter(s): Kevin Hartwell (Oakland University), Kevin Thompson (Oakland University)
Category: Electrical & Computer Engineering
Mentors(s): Mohammed Alzyout (Oakland University), Shadi Alawneh (Oakland University)

Digital Twins are computer representations of physical scenes or objects, allowing for simulations to occur without the necessity to be modeled in the physical world. Traditional modeling tools require many hours of labor and highly technical skillsets to create high-fidelity 3D representations of real environments. However, automated pipelines utilizing photogrammetry and Neural Radiance Field (NeRF) techniques have emerged to quickly extract

3D digital twins. These pipelines typically use hundreds of images to produce 3D models or meshes. We propose that providing these systems with exact camera pose data, recorded as 4 X 4 transformation matrices for camera extrinsics, alongside intrinsics such as focal length and distortion parameters, obtained from an autonomous image acquisition robot will improve the geometric quality and computation time of the resulting 3D meshes. Our research evaluates this hypothesis across two parallel tracks. Track 1 examines photogrammetric reconstruction using images and poses autonomously recorded by a Hello Robot Stretch 3. Software such as RealityScan and COLMAP are used to create and evaluate meshes, computing metrics like image alignment rate, mesh completeness, and processing time. Track 2 evaluates reconstruction and 3D mesh extraction using three scene-representation models - Nerfacto, Splatfacto, and Instant-NGP. Novel view synthesis metrics (PSNR, SSIM, LPIPS) measure rendering quality under hardware-tracked versus software-estimated camera poses. Meshes are then extracted from each model and evaluated for geometric accuracy by computing surface deviation against a high-fidelity photogrammetry reference.

PARALLEL SOFTWARE IMPLEMENTATIONS OF MEDIAN FILTERS
Presenter(s): Johnny Giang (University of Utah), Malainy Lambert (Utah Tech University)
Category: Electrical & Computer Engineering
Mentors(s): Daniel Llamocca (Oakland University)

Median filters are fundamental blocks in signal and image processing. These non-linear filters are excellent at noise reduction; however, they feature large computational overhead, which becomes problematic for large image/video sizes. The median filter slides a window of size k-by-k over every pixel of an image, where the output pixel is the median value of the pixels within the window. The increased computation time can become problematic for large image (or video) sizes. As a result, there is interest in speeding the median filter computation. Multiple methods exist, such as histogram-based and sorting-network-based. We selected a so-called separable sorting-networks-based filter. This algorithm divides the k-by-k window computation into row, column, and diagonal filtering. This exposes opportunities for parallelization and pipelining. In addition, parallelization can also be achieved at the image level: we can assign different image portions to different threads running in parallel. This project intends to take advantage of the parallelization opportunities using various tools such as multithreading libraries (pthreads, TBB) along with data-level parallelism (SIMD instructions). We present multiple speed-up results for different application sizes (e.g.: image sizes, window sizes from 3x3 to 9x9), algorithm parameters (e.g.: number of threads employed, parallel approaches), and devices (PCs, embedded kit).

MATHEMATICAL MODELING OF ALGAE MOLECULAR COMMUNICATION
Presenter(s): Anushka Nair (Michigan State University)
Category: Electrical & Computer Engineering
Mentors(s): Bige Unluturk (College of Engineering)

Algae are emerging as a biological platform due to their various signaling methods and significant ecological functions; these organisms are essential in the development of sustainable, bio-inspired technologies. Building on previous works that define algae as a molecular communication network, this paper develops a mathematical modeling framework for transmitter, channel, and receiver dynamics to characterize molecular signal propagation. By modeling the end-to-end communication process through closed-form concentration expressions, we investigate how different environmental conditions influence signal transport, attenuation, delay, and communication reliability. This mathematical framework works to enable the analysis of channel behavior and the impact of channel noise on signal-to-signal ratio (SNR) and communication capacity under realistic environmental conditions. Through mathematical modeling of algae-based communication systems, this work aims to advance environmentally sustainable bio-nano communication networks while contributing tools for ecological sensing, synthetic biology, and Internet of Bio-Nano Things applications.

Environmental Science & Natural Resources

GLWA RISK PERCEPTION OF UNREGULATED CONTAMINANTS
Presenter(s): Pleas Halsell (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Adam Zwickle (College of Agriculture & Natural Resources)

Risk perception is the study of how people understand and respond to potential dangers. Research has shown that people do not judge risks based only on scientific facts and statistics. Instead, emotions, personal experiences, trust, and values often influence how risks are perceived. Understanding risk perception is especially important in water management, where professionals must make decisions about environmental threats that may involve uncertainty.
This project examines how water professionals perceive and evaluate risks related to emerging contaminants and other water quality concerns. Through a review of risk perception literature and interviews with professionals from the Great Lakes Water Authority (GLWA), this study explores the factors that influence decision-making in water management. Particular attention is given to the roles of trust, uncertainty, experience, and decision-making processes. Findings from this research may help improve communication about water-related risks and provide insight into how environmental professionals make decisions when faced with complex and uncertain challenges.

THE POTENTIAL OF ENTOMOPATHOGENIC FUNGI IN PEST MANAGEMENT
Presenter(s): Vyanka Nunez Reyes (University of North Carolina - Pembroke)
Category: Environmental Science & Natural Resources
Mentors(s): Bryce Waller (College of Agriculture & Natural Resources)

Despite pesticides being a reputable way to quickly exterminate infestations, they cause significant environmental harm that depletes biodiversity. Within this realm, Reticulitermesflavipes is a common yet destructive termite, contributing to structural damage estimated at approximately $11 billion in the United States, and $40 billion globally. Consequently, entomopathogenic fungi, which naturally infect and kill insects, have emerged as promising biological control agents for sustainable termite management. The 3 main objectives of this study are to: assess the pathogenicity and dosage effects of fungal spores and toxins by exposing termites to varying concentrations to establish a dose-response curve and determine the lethal concentration (LC50); investigate the feasibility of incorporating entomopathogenic fungi into biomanufactured solid and pressed wood products; and evaluate the effectiveness of these products in resisting termite infestations as a sustainable alternative. Therefore, to conduct this experiment, we analyzed fungal isolates by inoculating plates, using media: Malt Extract Yeast Agar (MEYA) and Potato Dextrose Agar (PDA). Fungal growth was evaluated under varying temperature and light conditions to determine the most effective medium for culturing Metarhizium spp. and other fungal species. To assess pathogenicity, termites were inoculated by being dipped into fungal spore suspension prepared in Tween solution and monitored for mortality. We expect that the incorporation of entomopathogenic fungi into wood products will provide a first-line defense against termite infestations by reducing termite survival and wood damage. This research highlights fungal integration as a sustainable strategy to prevent ecosystem contamination and degradation.

EFFECTS OF DYNAMIC COMPRESSION ON MINERALOGY OF METEORITE CHONDRITES
Presenter(s): Maximiliano Marquez (University of Texas - El Paso)
Category: Environmental Science & Natural Resources
Mentors(s): Benjamin Brugman (College of Natural Science), Luisa Chavarria (College of Natural Science), Megan Elwood Madden (College of Natural Science), Susannah Dorfman (College of Natural Science)

How can we disrupt the trajectory of an asteroid that has Earth in its path? Collisions between rocky bodies are how our Earth formed and continue to pose a threat to life on Earth today. The vast majority of asteroids in the solar system have the same composition as chondrite meteorites, which are 88% percent of all meteorites that have landed on Earth. Previous studies of effects of planetary collisions and asteroid deflection and disruption protocols rely on experiments on single minerals. However, chondrites are complex rocks, composed of silicate minerals olivine, ortho/clinopyroxenes, and iron rich grains, which makes their physical properties more challenging to study and model. In addition, energetic enough impacts result in chemical reactions and changes in mineral crystal structure. In this study, we examine recovered samples from laser shock experiments on chondrite meteorites Tamdakht, Allen Hills 85069, and Miller Range 07052 to determine effects of dynamic compression on mineralogy. We identify the minerals in the unshocked meteorites by petrography of thin sections. Minerals inside and outside the shocked regions of samples are also analyzed by Raman spectroscopy. We expect to find olivine, pyroxene, and iron rich grains within the meteorites, but shocked regions may have high pressure forms of these minerals or evidence of melting. Our observations will allow us to relate the energy of the impact event to physical and chemical changes in the meteorite structure. The outcome of the project will help us better understand asteroids, as well as having an impact on society of sending explosives to the asteroids if Earth is on its pathway.

MODELING THE HIDDEN COSTS OF FAST FASHION: ENVIRONMENTAL AND SOCIAL TRADEOFFS IN GLOBAL SUPPLY CHAINS
Presenter(s): Badri Aiman Khan Badrul Zeman Khan (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Saroopa Taylor (College of Natural Science)

The global fast fashion industry has transformed clothing production and consumption through rapid manufacturing cycles and low cost garments, but these efficiencies often mask significant environmental and social consequences. This project presents a data driven analysis of fast fashion's environmental footprint and labor impacts by integrating publicly available datasets on carbon emissions, water consumption, textile waste, and labor conditions across major garment producing regions. Using exploratory data analysis and statistical visualization techniques, this research examines patterns linking production intensity with environmental degradation and socioeconomic disparities within global supply chains.
The analysis highlights how accelerated production cycles contribute to increased resource consumption and waste generation, while also disproportionately affecting regions with limited regulatory protections for workers and environmental standards. By synthesizing environmental indicators with labor related metrics, this study aims to move beyond isolated sustainability discussions and instead frame fast fashion as a complex system involving interconnected economic, environmental, and social tradeoffs. Visual and comparative analyses reveal trends not immediately visible through individual datasets alone, emphasizing the importance of interdisciplinary approaches in evaluating sustainability challenges.
This work contributes to ongoing discussions on sustainable development by demonstrating how data science methods can be applied to evaluate industry-level impacts and inform policy oriented conversations surrounding responsible production and consumption. The findings aim to support broader awareness of the hidden costs embedded within fast fashion systems and encourage data-informed approaches to sustainability research and decision making.

STEP ON A CRACK, BREAK A MITE'S BACK: SOIL MICROARTHROPOD COMMUNITIES OF SIDEWALK CRACKS
Presenter(s): Carson Binotto (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Max Helmberger (College of Agriculture & Natural Resources)

Urban ecosystems provide numerous habitats for soil microarthropods, tiny yet abundant organisms that are important for soil and ecosystem health. However, increased urbanization typically causes a decrease in soil biodiversity. Among the most constrained urban soil microhabitats are sidewalk and pavement cracks, an as yet uncharacterized habitat for soil microarthropods. The abundance and biodiversity of arthropods within such limited and disturbed spaces remains unknown, as well as how these communities may be affected by environmental and land use variables. We extracted soil samples from sidewalk cracks across the Michigan State University campus, counted the microarthropods within each, then compared how the abundance and diversity of key taxonomic groups varied based on characteristics of the crack and surrounding urban landscape. Understanding the biological makeup of these restricted habitats may prove important for future research on urban soil ecology, as their simplicity may allow them to be used as model ecosystems in future studies.

SHOULD NORTHERN VIETNAM BE RECONSIDERED AS TROPICAL?
Presenter(s): Michael Barry (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Ryan Shadbolt (College of Social Science)

Northern Vietnam, specifically in the Red River Delta (RRD), is a climate anomaly. This region is the only place on the planet where the region's classification is within a temperate category relative to its geographic characteristics. To examine this relations case further, we studied the region under two aspects: conditions on the local level, and comparisons with other environments on the global level. Primarily, 50 cities in the RRD were measured by the Koppen Standard (KS) and compared with an engineered temperature regime, which was called Thermal Build (TB), in order to stress test the industrial standard. Other environmental factors such as historical flooding, precipitation patterns, agriculture, and human-environment relationships were all tied in to possibly answer the question. For other environments in global regions, the matter was analyzing the strength in parallel between the specific cities sampled, which were 161 in total, to the RRD cities. The samples were again measured by the temperature regime TB in relation to static global variables that were also examined such as elevation and latitude, which the process was repeated with the KS regime. As a result, the data collected and analyzed would more clearly determine if the stress test was effective. Using this method to validate the KS in relation to characteristics in the 211 cities across both of the greater aspects would more clearly determine the plausibility of the RRD being switched to a tropical category under the Koppen classification.

INFLUENCE OF DIET TYPE ON GROWTH AND SURVIVAL OF LABORATORY-REARED LARVAL LAMPREY
Presenter(s): Eric Stapleton (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Tyler Buchinger (College of Agriculture & Natural Resources)

Research on several next-generation control tools for managing sea lamprey (Petromyzon marinus) populations in the Great Lakes relies on successfully rearing embryos to larvae in the laboratory. However, maintaining healthy growing larvae in captivity is difficult with many laboratories reporting substantial mortality and stagnated growth during the initial 3-6-month rearing period. This bottleneck may be linked to the frequent use of simple yeast diets which may leave larvae without the nutrition and bacteria needed to sustain growth development especially in relatively sterile laboratory environments. This study investigated how diet composition influences larval survival and growth using the chestnut lamprey (Ichthyomyzon castaneus) as a model species. We hypothesized that larvae receive greater and more complex nutrition from detrital diet analogues than from simple yeast diets. Starting at 20 days post-fertilization, laboratory-spawned larvae were raised in recirculating tanks with sand substrate and fed four diets over a three-month period. Feed treatments included: a fish meal and yeast mixture, commercial algae wafers, a probiotic-fortified fish meal and yeast mixture, and a yeast control. Each diet treatment was replicated 4 times at a density of 50 individuals per tank. We measured wet mass and length at monthly intervals and recorded survival curves. Our results assess whether larvae fed complex diets showed stronger growth and higher survival rates than those fed simpler yeast-only diets. Identifying a diet that maximizes growth and survival will provide a standardized protocol for laboratory aquaculture of lampreys, improving our ability to study critical life stages for population control of invasive sea lamprey as well as other research on an important model species.

QUANTIFYING SHIFTS IN ABIOTIC ENVELOPES TO UNDERSTAND POTENTIAL IMPACTS OF STRATOSPHERIC AEROSOL INJECTION ON ECOLOGY
Presenter(s): Ruoyu Chen (University of Pennsylvania)
Category: Environmental Science & Natural Resources
Mentors(s): Phoebe Zarnetske (College of Natural Science)

There is a lack of research on the potential effects of stratospheric aerosol injection (SAI) on ecological systems. SAI is a climate intervention method that aims to cool the Earth by dispersing reflective particles in the stratosphere to reflect a fraction of incoming sunlight back into space. However, rather than simply reducing temperature, SAI would also impact other abiotic variables that are important to organisms and ecosystems, including spatiotemporal changes to incoming solar radiation, UV, ozone, and precipitation, among others. As a result, SAI has the potential to effectively shift entire climate envelopes. To evaluate the effects of SAI on ecological communities, we will apply a space-for-time substitution technique that identifies analog locations with existing abiotic conditions similar to the projected future conditions of a focal location based on relevant abiotic variables. We consider three future scenarios: 1) SSP2-4.5, a "middle of the road" realistic climate change scenario, 2) SAI-1.5 and 3) SAI-1.0, SAI scenarios that maintains the global mean surface air temperature near 1.5°C and 1.0°C above pre-industrial levels, respectively. For each scenario, we average climate values globally from 2015 to 2034 as the present period, and average climate values under the three scenarios from 2050 to 2069 as the future period. Then we apply climate analog calculations to find abiotic analogs in the present period for several locations in North America. With these results, we will assess ecological pressures by comparing biodiversity between focal regions and their SAI-analog counterparts.

THE NOT SO BORING BILLION: TONIAN MICROFOSSILS IN THE YUKON
Presenter(s): Abbie Burkman (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Katie Maloney (College of Natural Science)

The Neoproterozoic is famous for its extreme glaciations in the Cryogenian, but before the glaciers, life was beginning to colonize marine environments. During this time, the planet's landmasses were concentrated into one supercontinent known as Rodinia. The geologic record of Rodinia is lacking due to erosion over the last ~ billion years and limited preserved strata, so we must rely on a sparse fossil record for clues on the location of the modern continents and climate of the planet during this time.
The Tonian Period's fossil record is characterized by extremely rare, macroalgae and microscopic acritarch's (organic walled organisms of uncertain biological affinity). Acritarchs include both prokaryotes and eukaryotes, making them key to understanding the expansion of eukaryotes. Here we report the first microfossils from the ca. 950 Ma Dolores Creek Formation of the Mackenzie Mountain Supergroup, Yukon, Canada. Shale samples were sent to an external lab for thin section preparation. Residues mounted on slides were then analyzed in the MSU Paleontology laboratory using transmitted light microscopy. Interesting morphologies and their measurements are recorded in a spreadsheet to identify different taxa. I will highlight the similarities and distribution of acritarchs and possible microalgae across two sites. These results will provide insight into both prokaryotes and eukaryotes during the proposed Neoproterozoic algae diversification event. This research will provide insight into the presence and distribution of eukaryotic and prokaryotic life in the Yukon during the Tonian Period, making the results key to understanding the how and when of Neoproterozoic algae diversification.

INTERPRETING THE PALEOCLIMATE OF LAKE ERIE'S CENTRAL BASIN USING MICROFOSSILS
Presenter(s): Dallas Storey (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Dalton Hardisty (College of Natural Science), Katie Maloney (College of Natural Science), Paige Kohler (College of Natural Science)

The Great Lakes are one of the most hydrologically unique and complex lacustrine systems in the world, supporting the economic and ecological foundation of the surrounding states. The Great Lakes formed 14,000 years ago with their geologic record representing a large period of environmental development prior to European settlement and significant industrial impact. Research has been conducted on the ecology of the Great Lakes following industrialization, particularly around Lake Erie; however, examination of environmental development prior to industrialization has been limited. Here, I developed a method of isolating and preserving diatom microfossils from sediment cores of Lake Erie's Central Basin to record abundance and biodiversity. These results will then be used to interpret the paleoenvironment of Lake Erie when paired with radiocarbon dating of these cores. Due to the cores being comprised of dense clays, the main goal of this method was to find a way to break down and remove clays effectively without damaging the delicate silica structures of the diatoms. Experimentation with chemical and heat digestion, sonication, and manual sieving led to the development of a procedure that both preserves these fragile microfossils and isolates material that can be utilized in radiocarbon dating. By developing a method tuned to the unique nature of the sediments of the Great Lakes, further data on diatom biodiversity and evolution over time can be derived to develop a fuller understanding of the paleoclimate of the Great Lakes prior to European settlement.

ISOLATION OF BIOFILM-FORMING ALKALIPHILIC MICROORGANISMS FROM CROMO WATER AND ROCK SAMPLES
Presenter(s): Jack Marean (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Matthew Schrenk (College of Natural Science), Sarah Gonzalez Henao (College of Natural Science)

Serpentinizing environments provide highly alkaline, low nutrient conditions that can support specialized microbial communities adapted to extreme geochemical gradients. The Coast Range Ophiolite Microbial Observatory (CROMO) in California represents an important terrestrial analog for studying microorganisms associated with alkaline waters and ultramafic rock hosted systems. In this study, water and rock samples from CROMO are being used to isolate alkaliphilic and biofilm forming microorganisms under laboratory culture conditions. Samples are incubated using three media types, Horikoshi medium, TSB medium, and Prony low Salt (PLS) medium, adjusted to pH 10 and pH 11.5 to target microorganisms capable of growth under alkaline conditions. The isolation strategy focuses on recovering colony forming bacteria with distinct morphologies and potential biofilm forming phenotypes. Colonies will be purified through repeated streaking, grown in liquid media, and screened for biofilm formation and extracellular polymeric substance production. This work aims to build a culture collection of alkaliphilic microorganisms from CROMO and identify isolates that may contribute to mineral colonization, biofilm development, and microbial survival in serpentinizing environments. These isolates will provide a foundation for future studies on microbe mineral interactions, EPS production, and the role of biofilms in habitability and biosignature preservation in alkaline systems.

ADVANCING COORDINATION OF DRINKING WATER AND ELECTRIC POWER SYSTEMS FOR SUSTAINABILITY IN MICHIGAN
Presenter(s): Quentin Logee (Michigan State University)
Category: Environmental Science & Natural Resources
Mentors(s): Annick Anctil (College of Engineering), Md Shariful Islam (College of Engineering)

Throughout Michigan, and the world as a whole, there is an increasing demand on both power and water systems. This carries with it an increasing pressure and reliance on these infrastructure systems, which may soon struggle to meet demand. This project aims to address these issues by investigating how drinking water distribution systems can be used as flexible electric loads, which would shift some power demand to off-peak times, and identifying barriers and opportunities that might arise when implementing this concept. The project is a scoping study that will evaluate implementation options for flexible pumping considering current operational practices and other constraints. It is done in collaboration with researchers from Michigan Technological University, the University of Michigan, Wayne State University, and Michigan State University. In addition to discovering conditions where drinking water pumps can reliably be used as flexible loads, the study also aims to evaluate the technical, economic, and environmental impacts of flexible pumping. To achieve these goals, the project will include a literature review of existing or related technology, data collection, interviews with several water utility managers, and a life cycle assessment using preliminary data from Lansing's Board of Water and Light.

Health Sciences

ASSOCIATIONS BETWEEN A 10-DAY HIGH-FIBER DIET AND SKIN CAROTENOIDS, DIETARY INTAKE, AND GUT MICROBIOTA COMPOSITION IN THE PREGNANCY GUT MICROBIOME
Presenter(s): Alexander Boville (Michigan State University)
Category: Health Sciences
Mentors(s): Sarah Comstock (College of Agriculture & Natural Resources)

Carotenoids, micronutrients found in fruits and vegetables, are important for vision, immune health, cardiovascular health. Serum carotenoid concentrations are associated with colonic mucosal bacteria, and considering evidence linking higher quality diet and optimal perinatal outcome, it is important to investigate the effects of increasing carotenoid intake during pregnancy, and its effects on the composition of the pregnancy gut microbiome. The Pregnancy Eating and Postpartum Diapers study (PEAPOD-2) builds upon the pilot PEAPOD study, in which the feasibility of a food provision trial in a rural US setting was demonstrated. This diet intervention study collected diet survey info, non-invasive skin carotenoid measurements (as opposed to invasive serum carotenoid concentrations), provided a 10-day diet intervention, and collected stool samples from the participants both baseline and post-intervention. gDNA was extracted from stool samples for targeted PCR and 16S rRNA gene sequencing to describe the gut microbiota. After analysis, we found skin carotenoids and meta-vegetable intake increased from baseline to post-intervention, and taxa differences between baseline and intervention were confirmed. By investigating the associations between these skin carotenoid measurements and the gut microbiota and dietary intake, we are expanding upon the available literature of the effectiveness of a diet-intervention study for pregnant women, improving the diets of our population through our food intervention, and identifying associations between participant characteristics and gut microbiota composition that could be used to improve the diet or health of an individual with a food intervention.

CELLULAR MESOTHELIAL TO MESENCHYMAL TRANSITION IN MESOTHELIUM FOUND IN CARDIOVASCULAR ORGANS DURING HYPERTENSION AS A NOVEL SITE OF TISSUE FIBROSIS
Presenter(s): Mankirat Singh (Michigan State University)
Category: Health Sciences
Mentors(s): Stephanie Watts (College of Osteopathic Medicine)

The mesothelium/serosa (mes/ser) is a tissue that surrounds various cardiovascular organs. Functionally, this has been established as a passive barrier that aids in lubrication. However, further exploration supports cardiovascular mes/er being a multicellular tissue that contains mesothelial cells, fibroblasts, immune cells, and even rich extracellular matrix and therefore can be targeted for fibrosis. Hypertension has historically been associated with tissue fibrosis; however, the role of the mes/ser in this pathological cascade is unknown. We hypothesize that hypertension induces mesothelial-to-mesenchymal transition (MMT) within the mes/ser which will likely promote fibrosis in tissues. Mes/ser is collected from two rat groups (Dahl and stroke prone) including hypertensive and normotensive to be used as experimental and control. The collection comes from kidney, aorta, and mesenteric organs. RNA is isolated and reverse transcribed into complementary DNA. Polymerase chain reaction (qPCR) is utilized to assess the abundance of various genes such as (Col1a1, Col3a1, Acta2, Cdh1, Vim, TGM2, TGFBR1, TGFBR3, AND TGB1). The relative gene expression between the two groups is then compared. The mes/ser is seen as a target organ of hypertension. As can be derived from the data, there is evidence of MMT associated gene expression in the pathological tissue seen in the hypertensive rodents.

LOW DOSE RADIATION THERAPY AS AN EFFECTIVE TREATMENT OPTION FOR POST-TRAUMATIC OSTEOARTHRITIS
Presenter(s): Natalie Neubecker (University of Michigan)
Category: Health Sciences
Mentors(s): Dipankar Ray (University of Michigan)

Post-traumatic osteoarthritis (PTOA) is a leading cause of disability, affecting over 5 million people in the United States and causing chronic pain. Low-dose radiation therapy (LDRT) has been used to reduce PTOA-associated pain in Germany for over 100 years using 6 treatments of 0.5 Gy/frac, though this dosage lacks supporting data. Prior literature characterizes the anti-inflammatory effects of LDRT at the cellular level, though the fundamental molecular mechanisms are underresearched. This study sets out to optimize the dose of radiation given and reveal the biological mechanism behind this treatment, primarily by assessing the function of protein phosphatase 2A (PP2A), an anti-inflammatory enzyme. Both LDRT and DT-061, an agonist of PP2A, are hypothesized to activate PP2A, which in turn dephosphorylates tristetraprolin (TTP), an anti-inflammatory regulator protein. By reducing inflammation, the effects of PTOA, including pain, can be minimized or eliminated. This research will be accomplished by culturing h-FLS and h-MLS cells, treating them with TNF-α both with and without LDRT and DT-061, extracting proteins from these cells, including PP2A, and analyzing them through immunoblotting. The PTOA mouse model created by anterior cruciate ligament reconstruction (ACLR) will also be used to evaluate the therapeutic efficacy of LDRT and DT-061, both as single agents or in combination, in suppressing synovial inflammation.

ARE MEN AND WOMEN COMPETING UNDER THE SAME CONDITIONS? EXAMINING HEAT-RISK EXPOSURE THROUGH OLYMPIC EVENT SCHEDULING

Presenter(s): Zashu Allen (Morehouse College)
Category: Health Sciences
Mentors(s): William Adams (College of Education)

Large-scale events such as the Summer Olympic Games have the potential to predispose athletes to increased heat-related illness risk due to a combination of environmental conditions and scheduling events during high heat times of the day (i.e., 1300 - 1700h). However, there is no known knowledge as to whether the scheduling of male and female Summer Olympic sporting events predisposes either sex to a greater degree of environmental heat stress. Purpose: This study explores sex differences in environmental heat exposure across moderate- to extreme-heat-related illness risk sports during the Summer Olympic Games. Methods: Summer Olympic sport event schedules and event start time environmental conditions were assessed during each Summer Olympic Games from 1984 (Los Angeles, USA) to 2024 (Paris, France). Historical environmental data were exported from both the weather station closest to the central geographic point of the Summer Olympic Games events and the weather stations closest to each geographic coordinate for each event location. Moderate to extreme heat risk sport schedules for all male and female events were captured using historical scheduling data by the International Olympic Committee. Sex differences in WBGT (primary outcome), ambient temperature, relative humidity, and heat index were examined using linear mixed-effects models with random intercepts nested within disciplines, sports, and Olympic Games editions. Covariates included start time, Olympic year, hemisphere, and sport. Causal mediation analysis quantified start time as a potential scheduling mechanism. Logistic mixed models estimated odds of exceeding established high-risk (≥28°C) and extreme-risk (≥32°C) WBGT thresholds. Sex × year and sex × hemisphere interactions, quantile mixed models (75th, 90th percentiles), and venue- versus centroid-level sensitivity analyses were performed.

CONTRASTING DISPARITIES BETWEEN DESI POPULATIONS AND THE MICHIGAN HEALTHCARE SYSTEM IN THE METRO DETROIT AREA

Presenter(s): Ramin Areeb (Eastern Michigan University)
Category: Health Sciences
Mentors(s): Jeffrey Schulz (Eastern Michigan University)

This study investigated the healthcare disparities experienced by the Desi population (Indian, Pakistani, Bangladeshi, Sri Lankan, Nepali, etc.), ages 18 and higher, in the Metro Detroit area. Despite the ever-growing population of South Asian communities in the United States, research on their interactions with Michigan healthcare remained very limited. The lack of consistent reports, population-specific studies, and overall popularity of the discussion proves this. Using a survey-based methodology, this study collected accounts from participants regarding their healthcare experiences, perceived inequities, and barriers to accessing high-quality medical services. The data then underwent a thematic review to identify recurring patterns, including issues related to affordability, insurance coverage, cultural or linguistic barriers, and provider biases. Along with this, a systematic review of existing literature was conducted to provide additional insights. The results revealed significant healthcare gaps, including underrepresentation in medical research, a lack of culturally competent care, and disparities in preventive health measures. By researching these challenges, this study aimed to add to the lack of data on healthcare equity and inform policy improvements that improve access and quality of care for the Desi community. Future research could expand on these findings by integrating deeper qualitative interviews, community-based interventions, or policy reevaluation to develop targeted solutions for reducing disparities in healthcare access and outcomes.

PARENTAL PERCEPTIONS OF THEIR CHILDREN'S PARTICIPATION IN A POWER WHEELCHAIR SKILLS RESEARCH STUDY.
Presenter(s): Andrew Clarent (Grand Valley State University)
Category: Health Sciences
Mentors(s): Lisa Kenyon (Grand Valley State University)

While children with severe cerebral palsy often need a power wheelchair for functional mobility and independence, showing the proficiency needed to gain access to this device can be exceedingly difficult for many children. To achieve this level of proficiency, training and practice are necessary. To address this barrier, a NIH-funded, single-site, 2-arm, parallel group, single-blinded, pre-test-post-test randomized controlled trial (RCT) was conducted to evaluate the effects of an eight-week power wheelchair skills training intervention on children's power wheelchair skills. In parallel, we also carried out a qualitative interview study to quantify and explore parental perceptions of their children's participation in both the power wheelchair skills training intervention and in the RCT. Data were gathered via parental interviews at pre- and post-intervention. These interviews focused on gaining insights into their child's mobility, independence, and participation in the RCT, as well as parents' general experiences and expectations. The audio recorded interviews were transcribed verbatim, deidentified, and prepared for analysis using the Linguistic Inquiry and Word Count program (LIWC). LIWC, a computerized text analysis program, analyzes text by comparing words within a transcript to an internal dictionary and provides scores for four summary variables: Analytical Thinking, Clout, Authenticity, and Emotional Tone. Pre- and post-intervention scores were evaluated for changes in parental language and perceptions throughout the wheelchair skills training program. By looking at these parental perceptions objectively, the findings can be used to improve future power wheelchair skills training interventions and give better insight into changes in parental perceptions pre- and post-intervention.

Integrative & Organismal Biology

CONSERVATION GENETICS IN THE MICHIGAN MONKEYFLOWER (MIMULUS MICHIGANENSIS)
Presenter(s): Emma Haller (Central Michigan University)
Category: Integrative & Organismal Biology
Mentors(s): Lauren Stanley (Central Michigan University)

Michigan monkeyflower (Mimulus michiganensis, syn. Erythranthe michiganensis) is a yellow-flowered perennial plant endemic to the Mackinac Straits of Lake Michigan. The species is currently listed as endangered and is at risk of extinction due to habitat loss and sterility in most populations. This could potentially lead to a loss of genetic diversity and accumulation of mutations. It has been twenty years since genetic data for the Michigan monkeyflower has been analyzed, and methods for sequencing have greatly advanced in that time. My project aims to analyze the genetic diversity of the Michigan monkeyflower and construct a phylogenetic tree to describe relationships between populations for use in conserving the species. We extracted DNA from individuals from each population, amplified various single copy genes, and Sanger sequenced them in search of informative SNPs and indels. Because no reference genome currently exists for Michigan monkeyflower, we also extracted high molecular weight genomic DNA for whole genome Illumina sequencing, which could help to pinpoint the unknown origin of the species. Determining the relationships between populations of the Michigan monkeyflower will further aid in efforts to conserve the species by guiding potential hybridization or relocation efforts.

GLOBAL CHANGE IMPACTS ON AVIAN DISTRIBUTION AND COMPETITIVE INTERACTIONS OVER SPACE AND TIME
Presenter(s): Liz Bauer (Michigan State University)
Category: Integrative & Organismal Biology
Mentors(s): Phoebe Zarnetske (College of Natural Science)

Global change factors, like climate change and human modification, are influencing the geographic distributions of avian species across the world. How these factors affect the interactions between avian species is not well understood. Ecosystems that once supported a variety of species may no longer have the resources they once did.

To find more habitable environments, avian species may have to shift their distributions (elevational, latitudinal, or otherwise). Human modification of the environment exacerbates ecosystem degradation, potentially forcing species to increase competition over resources (e.g., space, food). Here we address this knowledge gap for competitive interactions involving two or more avian species. We use the Avian MetaNetwork, which includes 25,948 interactions among species in North America, to identify competing species whose geographic distributions have changed since in recent decades. North American Breeding Bird Survey data from 1970-2024 are used to quantify changes in avian species ranges over space and time. Human Modification data, from 1990-2020, and annual ERA5 climate data are used to quantify the influence of human presence, and climate, on changes in avian distributions in North America. Regression analysis identifies which global change factors have the most influence on geographic shifts among the competitive avian species. The results of this study help fill gaps in knowledge of species interaction responses to global changes and help inform conservation prioritization for species threatened by both global changes and increased intraspecific competition.

TWO DISTINCT LINEAGES OF SAPROLEGNIA AUSTRALIS IDENTIFIED IN THE GREAT LAKES REGION
Presenter(s): Suhaylah Ahmad Ali (Michigan State University)
Category: Integrative & Organismal Biology
Mentors(s): Bartolomeo Gorgoglione (College of Veterinary Medicine)

Saprolegnia species are important oomycete pathogens of freshwater fish and aquatic animals' eggs, causing saprolegniosis in aquaculture facilities and wild fish populations. Although S. parasitica is widely recognized as the most common cause of saprolegniosis, the diversity and distribution of Saprolegnia species throughout the Great Lakes region remain poorly characterized. We hypothesize that S. parasitica would be the predominant species recovered from symptomatic salmonids and environmental samples. To evaluate Saprolegnia diversity, samples were collected from riverine environments and fish hatchery systems across Michigan, including mucus swabs from skin lesions of symptomatic fish and water samples processed through micropore filtration or hemp seed baiting. Samples were cultured on glucose-yeast agar supplemented with penicillin and streptomycin, subcultured to obtain pure isolates, and characterized using PCR amplification followed by sequencing of the internal transcribed spacer (ITS) region. Thirty-seven isolates from seven locations were successfully cultured, with most originating from swabs of fish lesions. Contrary to expectations, no S. parasitica isolates were detected, and all sequenced isolates were identified as Saprolegnia australis. Phylogenetic analyses further revealed two distinct ITS lineages within S. australis, suggesting previously unrecognized genetic diversity in the species and within the Great Lakes watershed. These findings challenge assumptions regarding the dominant Saprolegnia species associated with symptomatic fish in the region and highlight the need for further investigation into the ecology, distribution, and pathogenic potential of genetically distinct S. australis lineages.

PHYSIOLOGICAL CORRELATES OF BODY CONDITION IN HOUSE SPARROWS (PASSER DOMESTICUS) ACROSS AGRICULTURAL LANDSCAPES
Presenter(s): Daniela Vargas Carrion (Michigan State University), Lorelei Bearss (Michigan State University), Madison Godfrey (Michigan State University)
Category: Integrative & Organismal Biology
Mentors(s): Kevin McGraw (College of Natural Science), Victor Aguiar de Souza Penha (College of Natural Science)

Agricultural environments impact the health of wild birds through altered diets and exposure to stressors. Although body condition is commonly used to assess bird health, its relationship with physiological markers is not fully understood. We studied house sparrows (Passer domesticus), a wild bird species on farms, and hypothesized that body condition was (a) positively associated with circulating carotenoid, vitamin, and glucose levels; (b) negatively associated with ketones and parasitemia; (c) higher in males; and (d) lower during peak breeding season. Using mist nets, we captured sparrows (n = 106) at four Michigan State University livestock farms from May-August 2025. We banded, aged, and sexed sparrows, and used residuals from a body mass-tarsus length regression to quantify body condition. We measured blood parasite load by microscopy; glucose and ketones with point-of-care devices; and carotenoid and vitamin concentrations using high-performance liquid chromatography. We found body condition declined through the breeding season; males were in better condition than females. Sparrows from the sheep farm were in better condition than those from an adjacent beef farm. Body condition was strongly positively and weakly negatively correlated with plasma vitamin A and vitamin E concentrations, respectively, while carotenoid levels were unrelated. These patterns likely reflect seasonal reproductive effort, greater energetic investment by females, and farm-specific differences in resource availability and disturbance, with sheep pastures potentially greater access to high-quality forage and invertebrate prey than adjacent beef operations. Future study will use hematology and PCR to quantify parasitic and bacterial infections in P. domesticus and further investigate drivers of passerine health.

CONNECTING THE PIECES: A MODULAR INTERCONNECTED POT SYSTEM (MIPS) FOR INVESTIGATING PLANT-MYCORRHIZAL FUNGI SYMBIOSES
Presenter(s): Karissa Johnson (Michigan State University)
Category: Integrative & Organismal Biology
Mentors(s): James Moran (College of Natural Science)

Healthy soils contain extensive fungal hyphal networks that facilitate nutrient exchange between plants, representing a belowground symbiosis that has existed for millions of years. Obligate biotrophic arbuscular mycorrhizal fungi (AMF) colonize plant roots, exchange soil-derived nutrients for plant-derived carbon, and can connect multiple plants via a common mycorrhizal network. Understanding the complexities of plant-AMF interactions and nutrient exchange dynamics are limited by the challenges of distinguishing hyphal-mediated nutrient acquisition from direct root uptake. To address key knowledge gaps on the controls and mechanisms of plant-AMF nutrient exchange, we developed a Modular Interconnected Pot System (MIPS) for tractable greenhouse experimentation. This design incorporates reusable, spatially segregated plant and nutrient chambers, connected by AMF-accessible tunnels capped with root-exclusion mesh, and provides an experimental construct for quantifying the proportion of plant nutrient sourcing through hyphal transfer. We are using isotopically labeled (15N) fertilizer to trace nitrogen movement from root-free nutrient zones through AMF, and into a host plant. Switchgrass (Panicum virgatum Var. Cave-in-Rock) was used as the model plant species due to its strong AMF associations, and soil from switchgrass field plots provided a naturally derived microbial inoculum containing native AMF. Soil and plant biomass samples were analyzed using Elemental Analyzer-Isotope Ratio Mass Spectrometry (EA-IRMS) to quantify nitrogen presence throughout the chambers and plant tissues. Here, I will discuss MIPS functionality, nutrient leaching, and future design modifications. Optimizing this system will provide a versatile mesocosm to advance research on plant-AMF symbioses with implications for agricultural ecosystems, land restoration, and nutrient cycling.

ANALYSIS OF VENDOTAENID FOSSILS FROM THE EDIACARAN NAMA GROUP OF NAMIBIA
Presenter(s): Gabriel Carcereri (Michigan State University)
Category: Integrative & Organismal Biology
Mentors(s): Katie Maloney (College of Natural Science)

The 550 to 539 Ma Nama Group in Namibia (Southwest Africa) is known for its exceptionally preserved fossils across the Ediacaran-Cambrian boundary, a crucial time in the evolution of animal life. One of the most common macroscopic fossils found in Precambrian rocks, not just in Namibia, but in other formations globally, are tubular fossils (possibly algae) named Vendotaenids. Despite their abundance and probable importance to the Ediacaran ecosystems as photosynthesizers, Vendotaenids are still not clearly understood, with ongoing debates as to what type of algae they might be, or if they are algae at all. Here, I analyzed images of fossil slabs from the Feldschuhhorn Member of the Schwarzrand Subgroup, Nama Group to better understand the fossils present, especially those that display complex morphologies such as branching. Using an image analysis software (ImageJ) I identified and measured hundreds of specimens to identify trends amongst the fossils and between the different slabs. Specimens with branches were further analyzed for branching type and order. Though not all specimens have been analyzed yet, preliminary results show that there are fossils in the Upper Ediacaran which do not conform to the taxonomic description for Vendotaenids, typically tubular fossils without branching. Several specimens show not just consistent branching, but different types of branching suggesting different morphogroups are present. These findings add to the argument that Vendotaenid dominated ecosystems may be more complex than previously understood at the dawn of animal life.

Mechanical Engineering

RADIATIVE HEAT TRANSFER IN NON-RECIPROCAL MEDIA
Presenter(s): Kai Fukumoto (Michigan State University)
Category: Mechanical Engineering
Mentors(s): Yoichiro Tsurimaki (College of Engineering)

Heat normally flows from a region of higher temperature to lower temperature. In non-reciprocal media, however, radiative heat transfer can exhibit unconventional behavior, including heat flow transverse to the temperature gradient, known as thermal photon Hall effect. In addition, persistent heat current can exist even at thermal equilibrium without violating the laws of thermodynamics. While these effects have been extensively studied in nanoscale heat transfer, their behavior in a bulk participating medium remains to be investigated. In this work, we develop theoretical formulations to describe these phenomena using the framework of the radiative transfer equation (RTE). The RTE models angular energy transport by electromagnetic radiation in a participating medium, where radiation is emitted, absorbed, and scattered. In non-reciprocal systems, optical properties such as the scattering phase function, emission coefficient, and extinction coefficient can contain anisotropic, odd components. We show that the thermal photon Hall effects arise from broken system symmetries, particularly broken reciprocity, which is associated with the time-reversal symmetry of the Green's function. Since the RTE is an integro-differential equation that cannot be solved analytically, we derive approximate solutions using the Rosseland diffusion approximation and the P1 approximation. The resulting analytical formulas are validated through Monte Carlo simulations. This work extends the understanding of non-reciprocal radiative heat transfer beyond nanoscale systems and provides a foundation for analyzing heat transport in bulk non-reciprocal materials.

PATIENT-SPECIFIC QUANTIFICATION OF LONGITUDINAL CARDIAC CHANGES FOLLOWING LVAD SUPPORT
Presenter(s): Prathima Nagasai Krothapalli (Michigan State University)
Category: Mechanical Engineering
Mentors(s): Lik-Chuan Lee (College of Engineering), Sandra Hager (College of Engineering)

Left ventricular assist devices, also known as LVADs, are used to support patients with advanced heart failure by helping the heart pump blood to the body. Although LVAD therapy reduces the workload of the left ventricle, each patient's heart may respond differently after implantation. Understanding these changes is important because remodeling of the heart can affect recovery, right ventricular function, and long term outcomes. In this study, we use patient specific cardiac image segmentation obtained before and after LVAD implantation to measure geometrical changes in the heart over time. Specifically, we quantify changes in left ventricular cavity size, right ventricular cavity size, septal wall thickness, left ventricular free wall thickness, and right ventricular free wall thickness. These measurements allow us to compare how the heart changes after mechanical circulatory support and to identify patterns of cardiac remodeling in individual patients. Changes in the septum and right ventricle are especially important because the right side of the heart may become strained after LVAD implantation. By combining pre- and post-LVAD image based measurements, this work provides a quantitative framework for studying patient specific cardiac remodeling. Ultimately, this approach may help improve understanding of how patients respond to LVAD therapy and support future efforts to personalize treatment planning and risk assessment for patients with advanced heart failure.

LINKING EXPERIMENTAL MEASUREMENTS AND NUMERICAL MODELING IN SUCTION-BASED ASPIRATION OF THROMBUS-LIKE MATERIALS
Presenter(s): Syhming Vong (Grand Valley State University)
Category: Mechanical Engineering
Mentors(s): Ali Olcay (Grand Valley State University)

Background: It is not easily determined how much suction force is required to remove a blood clot from a stroke patient undergoing aspiration thrombectomy. Being able to determine the range of suction pressures for the type of clot will allow clinicians to more efficiently and safely remove clots from patients. Methods: Thrombus-like sample material was formulated using sodium alginate (NaAlg) and cross-linked using calcium chloride ($CaCl_2$) at 1-5% and 25 mMol and 75 mMol, respectively. The samples were set in the cross-linking solution for 3, 5, and 7 minutes. Ultimate tensile stress (UTS) testing was done on a Mark-10 tensile testing machine. A testing rig was constructed to emulate aspirated thrombectomy using a vacuum pump with pressure sensors near the vacuum pump and after the clot. Results: Ultimate tensile stress ranged from 151 kPa to 2,991 kPa based on initial testing results. Samples with 75 mMol $CaCl_2$ concentrations had higher UTS compared to samples containing 25 mMol. Similarly, samples containing higher NaAlg % had higher UTS compared to samples containing lower percentages. Conclusions: Findings for UTS corroborated the variability found in the literature. Ultimate tensile stress scaled linearly with percent NaAlg and $CaCl_2$ concentration.

DEVELOPMENT OF A REAL-TIME HARDWARE-IN-THE-LOOP SIMULATION PLATFORM FOR CONTROL AND DIAGNOSTIC RESEARCH USING MATLAB/SIMSCAPE MULTIBODY AND RASPBERRY PI
Presenter(s): Bambie Johnson (Oakland University)
Category: Mechanical Engineering
Mentors(s): Weichen Chen (Oakland University)

This research presents the development of a real-time three-dimensional (3D) simulation environment for an electrified hydraulic excavator to support advanced control and fault diagnostics research. The framework integrates multi-physics models developed in MATLAB/Simulink, Simscape Fluids with a high-fidelity 3D multibody model created using CATIA and Onshape. The integrated model is deployed on a Raspberry Pi 5 embedded system, enabling real-time execution of closed-loop pump and valve control algorithms. The virtual excavator accurately reproduces the hydraulic, mechanical, and kinematic behavior of the physical system while providing synchronized 3D visualization and real-time simulation data for controller development and performance evaluation. The proposed simulation environment provides a safe, cost-effective, and scalable framework for developing, testing, and validating advanced control and diagnostic algorithms, bridging physics-based multi-domain modeling with embedded real-time implementation. The developed framework supports future research on electrified off-road vehicles and other intelligent mechatronic hydraulic systems.

REAL-TIME HIL SIMULATION OF ELECTRIC-HYDRAULIC HYBRID VEHICLES ON RASPBERRY PI
Presenter(s): Parth Pachore (Michigan State University)
Category: Mechanical Engineering
Mentors(s): Amirhossein Taaghi (Oakland University)

Electric-Hydraulic Hybrid vehicles combine electric drive systems with hydraulic components to improve system-level energy efficiency and power density in transportation systems. The development and validation of advanced control strategies for these vehicles require real-time simulation environments that accurately capture the coupled dynamics of electrical, hydraulic, and mechanical subsystems while supporting real-time execution. This research presents the development of a real-time Hardware-in-the-Loop (HIL) simulation platform for an electric-hydraulic hybrid vehicle using a Raspberry Pi single-board computer. The multi-physics vehicle model is developed in MATLAB/Simulink and Simscape and integrates three major subsystems: an electric motor drive, a hydro-pneumatic accumulator as a secondary energy storage system, a variable displacement hydraulic pump and motor, and a longitudinal vehicle dynamic model. Together, these subsystems provide an end-to-end representation of vehicle operation and energy flow. The integrated model is deployed on a Raspberry Pi for real-time execution, enabling rapid testing and validation of control algorithms in a hardware-based environment. Compared with conventional commercial HIL platforms, the proposed approach offers a low-cost and accessible solution while maintaining sufficient fidelity for control development and system evaluation. This work demonstrates the feasibility of Raspberry Pi-based real-time simulation for electric-hydraulic hybrid vehicles and provides a modular testbed for future research on advanced hybrid powertrain control and energy management strategies.

EFFECT OF HELIUM PLASMA ON PLASMA CONSTRICTION AND SILICON NANOCRYSTAL SYNTHESIS

Presenter(s): Anastasia Metz (Beloit College)
Category: Mechanical Engineering
Mentors(s): Rebecca Anthony (College of Engineering)

Silicon nanocrystals have gained significant interest in recent decades due to their unique optical properties. A popular synthesis method for these particles is low pressure plasmas. This pressure regime provides improved power coupling for nanoparticle growth. Alternatively, little work has been done in the field of silicon nanocrystal synthesis using atmospheric pressure reactors. While these reactors have lower power coupling, they excel over their low pressure counterparts in their ability to be integrated in other manufacturing processes, such as additive manufacturing. In previous experiments with an atmospheric pressure silane/argon plasma, we discovered that at higher silane concentrations, a constriction formed in the plasma. We determined that this constriction was required in order to synthesize crystalline material due to the increased ion density that it exhibited. One variable that could have a role in this phenomenon is the background gas. In order to test the effect of the background gas, the gas flow was changed to silane/helium/argon, with the majority of the flow being helium. Helium was chosen due to its high ionization potential and heat capacity compared to argon. While the silane/argon plasma showed two plasma formations (diffuse and constricted), the silane/helium/argon plasma showed an array of plasma formations based on increasing silane/argon concentration. In this study we characterized the plasma and nanoparticles at four plasma formations in order to identify the relationship between background gas and plasma constriction, and the overarching effect it has on nanoparticle crystallinity.

ACOUSTIC MODULATION OF NANOPARTICLE TRANSPORT SELECTIVITY IN HYDROGEL MATRICES

Presenter(s): Ruihao Lu (Michigan State University)
Category: Mechanical Engineering
Mentors(s): Shaoting Lin (College of Engineering)

Selective particle transport is critical across medical and biological technologies, yet distinguishing particles with similar size, chemistry, or geometry remains difficult-their diffusion governed by nearly identical thermodynamic and kinetic conditions. Current selectivity strategies, whether mesh-based size filtration or dynamic chemical bonding, require substantial differences in particle size or affinity to function. This study introduces ultrasound excitation as a new engineering lever, enabling nanoparticle selectivity through dynamic mechanical control of diffusion in polymer networks.

ENGINEERING AND DESIGN OF A COMPACT MULTI REFLECTION-TIME OF FLIGHT MASS SEPARATOR FOR NUCLEAR STUDIES AT FRIB

Presenter(s): Austin Sjaarda (Michigan State University)
Category: Mechanical Engineering
Mentors(s): Franziska Maria Maier (Facility for Rare Isotope Beams)

The Facility for Rare Isotope Beams (FRIB) delivers a wide range of rare isotopes for nuclear science experiments, where rapid beam characterization is essential for efficient operation. The mass of a nucleus provides a unique fingerprint, enabling an unambiguous identification of an ion species when determined with sufficient precision when compared to a known isotope. Multi-reflection time-of-flight (MR-ToF) devices have emerged as powerful tools for high-precision mass spectrometry, beam diagnostics, and mass separation. In these devices, ions are confined in a closed loop between two electrostatic mirrors and separate in time-of-flight according to their mass-to-charge ratio. This enables the mass measurement of ions with very small mass differences benefiting a fast identification of the ion species within the delivered ion beam, simultaneous observation of multiple ion species, and relative intensity measurements. This provides critical feedback for beam identification, beam tuning, and optimization. This work discusses the design of a compact MR-ToF device which is foreseen to be installed at the LEBIT facility of FRIB. Due to space constraints, the MR-ToF device will only be 543mm, significantly smaller than existing devices. Our simulations show that high mass resolving power can be achieved in a very compact geometry compatible with existing infrastructure. The poster details the design and simulated performance characteristics of the Mini-MR-ToF device, which manufacturing process will soon be started.

Microbiology, Immunology, & Infectious Disease

THE IMPACT OF CLIMATE CHANGE ON SYMBIOSIS BETWEEN HAWAII BOBTAIL SQUID AND V. FISCHERI.
Presenter(s): Malaiyah Shaw (Louisiana State University - New Orleans)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Elizabeth Heath-Heckman (College of Natural Science), Lacey Bishop-Schouster (College of Natural Science)

Host-microbe associations are fundamental to global ecosystems, yet climate change threatens to disrupt these relationships in poorly understood ways. To investigate how temperature stress affects host-microbe dynamics, we used the Hawaiian bobtail squid (Euprymna scolopes) and its bioluminescent symbiont Vibrio fischeri as a model system. This system is particularly advantageous because colonization can be experimentally controlled, allowing precise manipulation of host-microbe interactions under defined conditions. The squid horizontally acquires bioluminescent bacteria from the ocean, which are housed in its light organ, providing counter-illumination for predator avoidance while the bacteria gain nutrients and a protected environment. Preliminary data indicate that elevated temperatures negatively impact symbiont retention. We hypothesize that elevated temperatures will lower symbiont survival rates and disrupt retention within the light organ. To determine the underlying mechanism, we exposed squid to three temperatures (23°C as the ambient, 27.5°C as the summer median, and 30°C as the elevated temperature) and performed micro-dissections to isolate the light organ. To quantify the bacterial load specifically with temperature, we will employ CFU plating. To quantify protein oxidation as a marker of reactive oxygen species (ROS) accumulation specifically with temperature, we will perform OxyBlot analysis. Future work will visualize and quantify ROS distribution to further validate these stress pathways. This research addresses a critical gap in understanding how rising ocean temperatures may destabilize critical symbiotic relationships, with broader ecological consequences such as the disruption of marine food webs.

WHSC1 REGULATES MACROPHAGE CD274 IN DIABETIC WOUNDS
Presenter(s): Yug Patel (University of Michigan)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Jorge Reyes-Arbujas (University of Michigan)

Non-healing wounds in patients with Type 2 Diabetes (T2D) are a major cause of morbidity and mortality and are increasing at a concerning rate. Non-healing wounds that result in lower limb amputation are among the most common complications associated with T2D and account for more than 200 billion USD annually in healthcare costs. The injury response is a complex process that must proceed in an orderly and organized manner to restore homeostatic tissue function. Although many structural and immune cells are involved in this process, macrophages are a key immune cell critical for normal tissue regeneration. Macrophages are highly plastic in tissue and are recruited in wounds following injury. In vivo, macrophages exist along a continuum where they initially exist in a pro-inflammatory state and then transition to an anti-inflammatory state to promote proliferation and remodeling phases of healing. In T2D, this does not occur, and macrophages remain in an inflammatory state and serve to promote chronic inflammation. Recent literature has identified WHSC1 as a key epigenetic regulator in highly immunosuppressive tumors. Given that macrophages in T2D wounds fail to transition to an immunosuppressive and that our preliminary data demonstrate WHSC1 is significantly decreased in human diabetic wound macrophages, we investigated WHSC1 as a novel regulator of immunosuppression in diabetic wounds. The histone methyltransferase WHSC1 is a transcriptionally activating chromatin-modifying enzyme (CME), and our data identify that TGFβ-mediated signaling can increase Whsc1 in macrophages and serves to promote wound healing in diabetic wounds.

CHARACTERIZING THE ROLE OF CYTOSKELETON REMODELING IN LANGERHANS CELL ACTIVATION AND MIGRATION TOWARD LYMPHATIC VESSELS IN VIVO.
Presenter(s): Carlos González (University of Puerto Rico, Rio Piedras Campus)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Axel Schmitter (College of Human Medicine), Sangbum Park (College of Human Medicine), Sudhanshu Mishra (College of Natural Science)

The skin is the body's first line of defense against external threats. The outermost layer of the skin, the epidermis, contains a network of tissue-resident immune cells called Langerhans cells (LCs), which constantly survey the epidermis for injury, infection, and inflammatory signals and function as phagocytic antigen-presenting cells. When the skin is wounded or exposed to a threat, LCs become activated. Activated LCs internalize antigens, detach from surrounding keratinocytes, and migrate toward lymphatic vessels (LVs) before traveling to draining lymph nodes to initiate adaptive immune responses. During this process, LCs undergo major changes in cell shape, dendrite dynamics, adhesion, and motility, which likely depend on cytoskeletal remodeling. However, how the cytoskeleton regulates LC activation and migration in vivo remains poorly understood. A major challenge is that LC activation and migration occur within the complex structure of living epidermal tissue, which cannot be fully reproduced in vitro. To address this challenge, we used intravital two-photon microscopy to visualize LC behavior in living skin. We used fluorescent reporter mice in which epithelial cell nuclei were labeled with mCherry, LCs with EGFP, and lymphatic vessels with tdTomato, allowing simultaneous visualization of these structures in vivo. We investigated cytoskeletal inhibitors targeting actin, microtubules, and vimentin and quantified LC roundness, aggregation, and cell number. We also visualized LC migration toward lymphatic vessels.Together, these experiments provide insight into how LCs migrate toward lymphatic vessels and how cytoskeletal remodeling contributes to LC activation and migration, informing our understanding of inflammatory and autoimmune skin responses.

REGULATION OF CBASS IN VIBRIO CHOLERAE
Presenter(s): Jack Marsh (Michigan State University)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Christopher Waters (College of Osteopathic Medicine)

In microbiology there are organisms known as phages; they are viruses that only infect bacteria and take control of a specific bacterial species to reproduce, kill the host bacterial cell, and then infect other cells. Phages are often extremely different from one another and can only infect a specific species. Bacteria survive phage infections using phage defense systems, which allow them to survive when infected with their specific phage. Our lab researches Vibrio cholerae and its phage defense system called the cyclic oligonucleotide-based antiphage signaling systems (CBASS) However, not much is known about CBASS regulation in V. cholerae or any other bacterial species.The purpose of my summer research is to determine how Quorum sensing and the crbS gene pathway regulate CBASS in V. cholerae. We are investigating this pathway by using Gibson cloning to create new mNeonGreen transcriptional fusions of V. cholerae acetate metabolism genes. I will measure the fluorescence of different strains to determine if the acetate metabolism genes are being transcribed when CBASS is activated or repressed.We are investigating Quorum Sensing by measuring mNeonGreen Fluorescence and Optical Density of Mutant V.cholerae as the cells multiply in culture. This research will lead to a better understanding of how CBASS drives phage defense in V. cholerae. Ultimately, understanding how phage defense systems are regulated will help to drive phage therapy, which is an alternative method to treat bacterial infections by retaining activity against those that are antibiotic resistant.

INVESTIGATING A NOVEL PUNITIVE PHAGE DEFENSE SYSTEM FROM VIBRIO CHOLERAE
Presenter(s): Ariana Straus (Michigan State University)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Christopher Waters (College of Osteopathic Medicine)

Phage therapy, or the use of bacterial-specific viruses to treat infectious disease, has been studied as an alternative to antibiotics for centuries and has renewed interest as an effective treatment due to their ability to infect and lyse specific bacterial species. Bacteria, however, have evolved various phage defense systems to protect themselves from phage infection. To develop phage therapies, we must understand the mechanisms of phage defense systems. To identify new phage defense systems, we are using Vibrio cholerae as a model as it has evolved several phage defense systems due to its constant predation by phages in its environment. A previous screen of a V. cholerae cosmid library within Escherichia coli found a 25kb fragment that provides protection against T2 coliphage. Using a transposon mutant library, we identified that the gene vca0483 was both necessary and sufficient to protect against T2, T4 and T6 phage infection. Expression of vca0483 both from its native promoter and an inducible promoter in E. coli was sufficient for protection against T2, T4, and T6. Overexpression of vca0483 inhibits cell growth, suggesting the protein it produces is toxic. A colony forming survival count shows overexpression of vca0483 inhibits cell growth without decreasing the viable cell count. Alpha fold predicts the protein vca0483 encodes as a transmembrane protein. My model for how vca0483 functions which I am testing is that vca0483 is expressed during phage infection as a transmembrane protein that induces cell stasis, and inhibits the phage replication cycle.

PHENOTYPIC VARIATION AND ROS TOLERANCE IN PAENIBACILLUS ISOLATES WITH CONTRASTING HOST OUTCOMES
Presenter(s): Eli Collinsworth (Southern Illinois University - Carbondale)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Alexander Demetros (Research & Innovation)

Plant-associated microbiomes play critical roles in host health and resilience, motivating the development of bacterial bioproducts for agricultural applications. Paenibacillus is a genus of particular interest due to its ability to promote plant growth through nitrogen fixation and antimicrobial activity; however, other strains within the same genus have been implicated in plant disease. The genomic and phenotypic factors underlying these divergent outcomes remain poorly understood. Here, we characterize Paenibacillus isolates recovered from Arabidopsis thaliana and Panicum virgatum, alongside morphological variants derived from select isolates, to evaluate phenotypic diversity associated with host interactions. Previous findings that ROS-deficient rbohD mutants exhibit increased susceptibility to MF181 infection motivated investigation of ROS tolerance as a potential virulence-associated trait. Each isolate was screened for ROS tolerance and motility in vitro, and host outcomes were assessed through in planta monoassociation assays. Isolates PVR133 and MF181 caused A. thaliana mortality despite their close phylogenetic relationship to growth-promoting strains of P. polymyxa, suggesting that phylogenetic relatedness alone does not predict host outcome. Morphological variants of MF181 displayed differential virulence in in planta assays, indicating that phenotypic variation within isolates can influence pathogenicity. However, morphological variants showed comparable ROS susceptibility, suggesting that differences in ROS tolerance do not account for variation in pathogenicity. The PVR133 morphological variant retained pathogenicity, demonstrating isolate-specific effects of morphological variation on host interactions. Together, these results characterize phenotypic variation among Paenibacillus isolates with contrasting host outcomes and provide a foundation for future genomic analyses to identify mechanisms underlying beneficial and disease-associated plant interactions.

FROM ISOLATION TO CHARACTERIZATION: BACTERIOPHAGES THAT INFECT CITROBACTER
Presenter(s): Grace Palazzolo (Aquinas College)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Natalia Hubbs (Aquinas College)

Bacteriophages, or phages for short, are viruses that use a bacterial host. In this work, we focused on the isolation and characterization of Citrophages, phages that infect Citrobacter. In healthy individuals, Citrobacter is commonly found in gut flora, but an overgrowth can cause issues such as gastrointestinal symptoms and other invasive infections including: urinary tract infections, sepsis, and respiratory and wound infections. The decline in the effectiveness of antibiotics has become a greater issue in recent years and has become a focus in modern research. Phages can potentially be utilized in the treatment of these infections where antibiotics fall short. The Citrophages described in this work were isolated from Lake Iola, raw sewage, and hospital sink sludge. After purification, we characterized the phage in many ways, including determining the efficiency of plating (EOP) at different temperatures, determining host ranges, and determining temperature and pH stability. Preliminary results show that the host range for these phages is narrow. In addition, the EOP across temperatures (24-42° C) general remains consistent. Our stability assays indicate that extreme temperatures and pH values lead to a decline in phage stability. Future work includes testing the stability of the phage at more diverse temperatures and pH values, imaging the phage, and sequencing their genomes. Overall, these experiments provide new insights into novel Citrophages, a group of largely unexplored phage, and provide crucial information should these phages ever be used for phage therapy.

EFFECTS OF MULTI-BACTERIAL INFECTION ON GUILLAIN-BARRÉ SYNDROME NEUROPATHY
Presenter(s): Siara Nason (Howard University)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Linda Mansfield (College of Veterinary Medicine)

Guillain-Barré syndrome (GBS) is an autoimmune disease that primarily affects the peripheral nervous system. It can be triggered by many pathogens, but the most common is Campylobacter jejuni. The body is typically able to eliminate the bacterial infection. However, the bacteria has a molecular mimicry mechanism; the lipooligosaccharides on its surface resemble the gangliosides on the surface of peripheral nerves. This triggers the GBS post-infectious autoimmune response as the body begins to mistake the healthy nerves for a recurrence of the pathogen. The myelin sheath coats the nerve and allows action potentials to quickly travel along the nerve pathway by skipping along at gaps in the sheath called the Nodes of Ranvier. The GBS response will cause the membrane attack complex and macrophages to punch holes in the myelin sheath and damage the motor axon. This causes the muscle weakness and symmetrical segmental ascending paralysis associated with GBS. While we know many pathogens can trigger GBS, we do not know if the presence of multiple pathogens can have a synergistic effect. Enterococcus faecalis is a bacteria with ganglioside-mimic structures that has been found in the gut microbiomes of many GBS patients. The hypothesis of this experiment is that other bacteria in the gut microbiome of GBS patients increases patient susceptibility to autoimmune peripheral neuropathy. The specific objective of my research project is to assess whether inflammation and lesions in the neurons has a correlation to the presence of multiple pathogens and the progression of the disease.

GENETIC ANALYSIS OF SMALL COLONY VARIANTS OF THE XEN36 STRAIN OF STAPHYLOCOCCUS AUREUS
Presenter(s): Analise Lang (University of North Carolina - Pembroke)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Jonathan Hardy (College of Human Medicine), Scott Sherrill-Mix (College of Veterinary Medicine)

Staphylococcus aureus (staph) is a common bacterium that colonizes the skin of approximately 30% of the population and is one of the leading causes of bacterial blood infections. Treatment typically involves antibiotics, with the choice depending on strain susceptibility. Staph is highly adaptive, especially during prolonged or high-dose antibiotic exposure. One such adaption is the development of small colony variants (SCVs), which exhibit slower growth rates and smaller sizes, allowing them to evade detection and later cause chronic infections. Several genes contribute to the formation of SCVs, including the rplF gene, which is essential for building secondary structures of the ribosome. Following whole genome sequencing it was noted that several rplF SCV isolates contained odd mutations, including a 29 base pair repeat frameshift mutation. To confirm whether these mutations were consistent, all SCV isolates were struck out repeatedly, primers were developed to highlight the entire rplF gene, and several colony PCRs were performed. The PCRs visually confirmed the presence of the 29 base pair mutation in one of the isolates. Amplicon sequencing confirmed the presence of all mutations first noted in whole genome sequencing. This validation demonstrates that the lab successfully developed a reliable PCR assay for detecting rplF-associated mutations in the Xen36 strain of staph.

ASSOCIATIONS BETWEEN FECAL CALPROTECTIN AND THE COMPOSITION AND DIVERSITY OF THE PEDIATRIC GUT MICROBIOTA
Presenter(s): Hannah Cook (Michigan State University)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Sarah Comstock (College of Agriculture & Natural Resources)

Calprotectin, an inflammatory biomarker found in stool, will be used as a quantitative continuous measure of inflammation in the intestines for this project. The aim is to measure the association between fecal calprotectin levels and the composition and diversity of the gut microbiota in healthy children and adolescents. Stool samples were collected at home by the child's caregiver and mailed to the lab. Genomic DNA (gDNA) was extracted from the stool. For each sample, the 16S rRNA gene was amplified by PCR using primers specific to the V4 region of the gene. PCR products were cleaned and pooled. The MSU genomics core sequenced the amplicons using short read sequencing on the Aviti (Element Biosciences). Resulting sequences were processed with mothur, and data was visualized with R Studio. Fecal calprotectin was also extracted from stool samples. Total protein was quantified using a Bradford Assay. Calprotectin levels were quantified using ELISA. 97 stool samples from 77 unique participants (2021-Present) were analyzed. Early childhood (EC; n=66) is defined as ages 4-7 years, and middle childhood (MC; n=31) is defined as ages 9-13 years. Due to an incomplete overlap between the study population with samples collected during EC and MC, the data is analyzed cross-sectionally. Because calprotectin is used as a biomarker of inflammation, lower microbial diversity and evenness is a hypothesized outcome. If this is observed, it may prompt future studies on the effect of probiotics to increase microbial diversity in the guts of children with high calprotectin levels.

NEUTROPHILS RESOLVE ACUTE POSTOPERATIVE PAIN BY SUPPRESSING MAST CELL ACTIVITY
Presenter(s): Tyler Thomas (Cornell University)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Geoffroy Laumet (College of Natural Science)

Approximately 10% of Americans undergoing surgery procedures annually develop chronic postoperative pain. Surgical incisions triggers immune cell activation and inflammation, which has been shown to be critical for the developmentof pain. Neutrophils are the first responders to a skin injury, but their contribution to postoperative pain is not completely understood. Previous data from our lab show neutrophil-depleted mice exhibit prolonged postoperative pain after surgical injury and increased mast cell activity. We hypothesize that neutrophils release lactoferrin, which inhibits mast cell activity, preventing the transition from acute to chronic postoperative pain. Postoperative pain was induced by a surgical plantar incision and assessed by using a 0-2 guarding behavior metric. To investigate the role of neutrophils in pain, we depleted neutrophils by injecting anti-Ly6G antibodies. The neutrophils count was examined by flow cytometry. Mast cell activity was assessed by histology and an Enzyme-Linked Immunosorbent Assay (ELISA) to measure levels of IL-6, a key cytokine released by mast cells. Paw thickness was also measured to assess inflammation-induced edema. Lactoferrin was administered into the injured paw. Our data showed that surgical incision increases the number of neutrophils in the injured skin. Depletion of neutrophils prolonged postoperative pain, indicating that neutrophils are necessary to resolve acute postoperative pain. As lactoferrin is specifically release by neutrophils, we expect that administration of lactoferrin will reduce mast cell activation and shorten postoperative pain. Better understanding of this molecular pathway may pave the road for the development of novel therapies that prevent postoperative pain from transitioning to chronic pain.

LIPOSOMAL AZITHROMYCIN THERAPY POST-MYOCARDIAL INFARCTION: OPTIMIZING ADMINISTRATION TIMING AND DOSAGE TO MAXIMIZE ANTI-INFLAMMATORY EFFICACY AND LIMIT ADVERSE CARDIAC REMODELING
Presenter(s): Komal Patel (University of Michigan - Ann Arbor)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Afnan Alzamrooni (University of Michigan)

Previous research and animal models have demonstrated that azithromycin (AZM) therapy following myocardial infarction (MI) reduces infarct scar size and promotes recovery of cardiac function through its anti-inflammatory properties. This effect is achieved through polarization of macrophages, a key component of post-MI regeneration, toward a reparative, anti-inflammatory phenotype. To further enhance drug efficacy, a liposomal azithromycin formulation (L-AZM) was developed and evaluated alongside free azithromycin (F-AZM), utilizing the known immunomodulatory properties of liposomes. Mice receiving L-AZM treatment immediately post-MI, resulted in reduced cardiotoxicity, a 50% lower mortality rate, and a significantly greater shift toward the anti-inflammatory macrophage phenotype compared to F-AZM-treated animals, while also limiting off-target effects. The liposomal formulation upregulated anti-inflammatory gene expression in cardiac macrophages, neutrophils, and monocytes, while simultaneously downregulating pro-inflammatory genes, reducing cardiomyocyte death, decreasing scar size, and promoting angiogenesis. In continuation to these studies, which establish that L-AZM enhances both the efficacy and safety of azithromycin in promoting cardiac recovery, current studies investigates two critical parameters: the optimal post-MI administration timepoint (30, 60, or 90 minutes post-MI) and the optimal dosage (1, 10, or 25 mg/kg). Cardiac function and infarct region fibrosis will be assessed and compared across all experimental groups to determine future directions.

EXPLORATION OF NEWLY DISCOVERED ENVIRONMENTAL PHAGES
Presenter(s): Dylan Madsen (Michigan State University)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Kristin Parent (College of Natural Science)

The continued discovery and propagation of new phages is important for their continued use. New phages bring potentially new interactions between them and their host bacteria. These new interactions could be used to improve the use of phages overall. The primary application of these new phages is combating antibiotic-resistant bacteria. My research aims to continue to discover and categorize new phages for future use in research.

WASTEWATER MONITORING OF NOROVIRUS GI AND GII IN MICHIGAN
Presenter(s): Gessica Portice (Michigan State University)
Category: Microbiology, Immunology, & Infectious Disease
Mentors(s): Nishita D'Souza (College of Agriculture & Natural Resources)

The COVID-19 wastewater surveillance (WS) program in Michigan enabled the development of complementary public health approaches for monitoring viral infections at the community level. By leveraging existing infrastructure, this framework can be expanded to other pathogens of public health concern, particularly in regions with limited clinical surveillance capacity. The Centers for Disease Control estimate that Norovirus causes approximately 58% of foodborne illness and is associated with about 2,500 outbreaks annually in the United States alone. As clinical Norovirus data is limited, this study evaluates WS as a tool for monitoring Norovirus prevalence in Michigan communities. Composite 24-hour influent wastewater samples (n = 335) were collected from eleven wastewater treatment plants across Michigan between October 2023 and February 2026. Virus concentration was performed using PEG precipitation and centrifugation to recover viral pellets, followed by RNA extraction. Norovirus GI and GII targets were quantified using GT-ddPCR Wastewater Test Kits (GT Molecular). Droplet digital PCR was conducted with a one-step RT-ddPCR Advanced Kit on a QX200/600 system (Bio-Rad). Norovirus GI and GII positivity rates were 95.54% (321/336) and 100% (336/336). Mean concentrations were 6.30 x 10^4 gene copies (GC)/100 mL for GI and 3.21 x 10^5 GC/100 mL for GII. Norovirus GI concentrations peaked in January and February, while GII was most prevalent in March and April. These findings demonstrate that WS is a cost effective and non-invasive tool for tracking Norovirus trends, identifying hotspots, and supporting public health interventions, providing data that enables timely and targeted mitigation when clinical surveillance is limited.

Neuroscience

COMPUTER VISION-BASED ANALYSIS OF COCAINE-INDUCED BEHAVIORAL SENSITIZATION IN MALE SPRAGUE-DAWLEY RATS
Presenter(s): Landon Palmer (Western Michigan University)
Category: Neuroscience
Mentors(s): Lisa Baker (Western Michigan University)

Substance Use Disorder (SUD) remains a major public health crisis, with limited treatment efficacy and incompletely understood neurobiological mechanisms. Activator of G-protein Signaling 3 (AGS3) is a promising molecular target implicated in drug-induced neuroplasticity, neuroadaptation, and relapse-relevant behavior. Previous studies have reported increased AGS3 expression in the prefrontal cortex (PFC) and nucleus accumbens core (NAcc) following repeated exposure to certain drugs, including cocaine and heroin. This study investigates behavioral sensitization to cocaine as part of a broader effort to characterize AGS3-associated neuroadaptations. Male Sprague-Dawley rats underwent repeated cocaine or saline administration followed by a withdrawal period and a cocaine or saline challenge. Behavioral responses were quantified using both traditional locomotor activity measurements (Accuscan Versamax system) and a DeepLabCut-based computer vision pipeline. Pose estimation data were used to quantify locomotion and derive additional behavioral features associated with stimulant-induced stereotypy, including head-movement dynamics, spatial confinement, and repetitive movement patterns. DeepLabCut-derived locomotor measures showed strong agreement with automated chamber recordings, validating the tracking approach. Behavioral analyses revealed robust locomotor sensitization following repeated cocaine exposure and identified significant cocaine-induced stereotypic behaviors. Stereotypy was strongly associated with acute cocaine challenge and positively correlated with locomotor activity. Ongoing work will examine AGS3 protein expression in the PFC and NAcc using quantitative Western blotting and assess relationships between molecular and behavioral measures. Together, these findings serve to further characterize cocaine-induced behavioral plasticity and establish a framework for linking behavioral adaptations to AGS3-associated neurobiological changes.

A HYBRID COMPUTER VISION PIPELINE FOR ROBUST PUPIL TRACKING IN AWAKE BEHAVING MICE
Presenter(s): Jaini Gandhi (Michigan State University)
Category: Neuroscience
Mentors(s): Qingguang Zhang (College of Human Medicine)

Pupil diameter is widely used as a non-invasive indicator of internal brain state and reflects neural processes associated with arousal, attention, cognitive effort, and sensory processing. In head-fixed mouse imaging experiments, a widely used model in modern neuroscience, pupil size is typically recorded using a camera while animals perform behavioral tasks. However, reliably extracting pupil size from these recordings remains challenging due to factors such as lighting variability, shadows, reflections, motion blur, and partial eyelid occlusion. Here, we conducted a comparative analysis of multiple classical computer vision approaches used for pupil tracking, including threshold-based segmentation, edge-based ellipse fitting, and symmetry-based detection methods. Each method was assessed based on its ability to accurately determine the pupil location and the pupil size across frames in varying conditions. Building on the observed limitations of individual methods, we further explored a hybrid approach that combines radial symmetry transforms with region-growing segmentation to improve robustness to noise and partial eye occlusion. This work provides a systematic framework for evaluating pupil tracking methods and will inform the development of more reliable pupil tracking pipelines for neuroscience experiments involving both head-fixed and free-behaving mice. Supported by Honors College Hymen and Miriam Stein Scholarship and College of Natural Science Undergraduate Research Scholarship to J.G.

MAPPING THE EXPANSION OF DEEP BRAIN STIMULATION: A BIBLIOMETRIC ANALYSIS OF CLINICAL INDICATIONS
Presenter(s): Lauren Proper (Michigan State University)
Category: Neuroscience
Mentors(s): Kevin Chen (University of Michigan)

Deep Brain Stimulation (DBS) is an established neurosurgical therapy used in treating movement disorders such as Parkinson's disease, essential tremor, and dystonia. However, in recent years of research, neuroscientific advances have expanded the interest in DBS as a potential treatment for a variety of neurological and psychiatric disorders, including epilepsy, depression, obsessive-compulsive disorder, Alzheimer's disease, and addiction. Understanding current research trends and priorities provides strong indicators of future directions in DBS and functional neurosurgery. This study is designed to characterize trends in Deep Brain Stimulus research from 1990 to 2026 through a bibliometric analysis of published scientific literature. Publications will be targeted using PubMed and categorized by publication year, clinical indication, and other relevant bibliographic characteristics. Publication volume trends will be analyzed to identify shifts in research focus over time and to evaluate rapidly growing areas of investigation. The goal of studying the evolution of DBS research is to illustrate the transition of DBS from a treatment focused on improving movement disorders to a wider scope for neural circuit modulation. The findings may reveal emerging clinical applications and provide insight into future directions in functional neurosurgery.

VALIDATING A DREADDS VIRAL VECTOR IN AVP-IRES-CRE RATS: FIRST STEPS IN INVESTIGATING THE ROLE OF VASOPRESSIN NEURONS IN SOCIAL PLAY
Presenter(s): Alye Perryman (Albion College)
Category: Neuroscience
Mentors(s): Alexa Veenema (College of Social Science), Evan Wilson (College of Agriculture & Natural Resources), Samantha Bowden (College of Social Science)

Exposure to social play, a behavior displayed by both children and juvenile rats, is critical to the development of social skills. However, engagement in social play is impaired in many children with Autism Spectrum Disorder (ASD), hampering the development of social skills. The neuropeptide arginine vasopressin (AVP) regulates various social behaviors, and shows potential for treating social deficits in ASD children. Yet, little is known about AVP's role in social play. We will address this gap by infusing an inhibitory Cre-dependent DREADD (Designer Receptors Activated Exclusively by Designer Drugs) viral vector in the hypothalamic paraventricular nucleus (PVN) of juvenile AVP-IRES-Cre rats, and testing the effects on social play behavior. To do this, we first validated that the viral vector is working as intended. Following viral transfection and collection of coronal PVN brain sections, we performed fluorescent immunohistochemistry followed by cell counting to determine viral specificity (i.e. how well the virus transfects AVP-producing neurons) and changes in activation patterns of transfected neurons upon infusion of clozapine-N-oxide (CNO), the ligand that activates the inhibitory DREADDs. We found the virus shows high specificity as defined by high rates of co-labeled of DREADDs-positive and AVP-positive neurons. We further expect a CNO-induced decrease in activation of transfected AVP neurons as defined by a lower EGR1 presence; these results are in progress. By showing high specificity of this DREADDs viral construct, we can now confidently determine the effect of AVP neuronal inhibition on social play, further informing the development of AVP-based therapeutics for ASD children.

NEUROINFLAMMATION AND COGNITIVE FUNCTIONING IN HIGH-FAT DIET-FED DIVERSITY OUTBRED MICE
Presenter(s): Gregory Guantos (St. Mary's University)
Category: Neuroscience
Mentors(s): Jordan Kreger (College of Human Medicine), Sarah Elzinga (College of Natural Science)

Metabolic stressors, such as obesity and prediabetes, along with cognitive impairment (CI) have seen increased prevalence in adult populations worldwide. Recent studies, often utilizing inbred mice strains, have found that metabolic stress is a major preliminary indicator in the development of CI. While these studies provide sufficient evidence regarding the relationship between the presence of metabolic stressors and the development of CI, due in part to their use of genetically invariant mice, the results are not always easily translated to humans. To provide a more clinically relevant model, this study used a genetically diverse strain of mice known as Diversity Outbred (DO) mice. Additionally, to mimic the conditions of metabolic stress that result from obesity and prediabetes, the study observed two groups of female DO mice; one fed a high-fat diet (HFD) and the other fed a standard diet (SD). After the mice were on diet for 14 weeks, executive functioning, hippocampal dependent spatial learning, and memory were assessed using the puzzle box test (PB), Morris Water Maze (MWM), and fear conditioning test (FC). To further correlate the impact of metabolic stressors on the development of CI, this study also examined possible neuroinflammatory changes that may occur by measuring the expression of inflammatory markers by quantitative polymerase chain reaction (qPCR). The results of this study will provide exploratory evidence to support the incorporation of DO mice in future studies involving the development of CI in relation to chronic metabolic stress.

PREGNANCY INDUCED CHANGES IN THE MATERNAL SUPRACHIASMATIC NUCLEUS AND ITS IMPACT TO LIGHT SENSITIVITY

Presenter(s): Naomi Cintron (Pontifical Catholic University of Puerto Rico)
Category: Neuroscience
Mentors(s): Hanne Hoffmann (College of Agriculture & Natural Resources)

The suprachiasmatic nucleus (SCN) is the circadian pacemaker (24h) of the brain, coordinating daily rhythms in behavior, hormone secretion and physiological processes. Localized in the hypothalamus, the SCN receives light information from the retina and uses these environmental cues to synchronize circadian rhythms throughout the body. Circadian rhythms play a critical role in reproductive physiology, which are particularly important during pregnancy which requires extensive neuroendocrine adaptations to support fetal development and maternal health. Within the SCN, the vasoactive intestinal peptide (VIP) expressing neurons coordinate circadian timing and transmit light related signals to the rest of the body. Despite this knowledge, and well established changes in sleep-wake and activity patterns during pregnancy, how the SCN adapts to pregnancy, is unknown. Using SCN tissue collected from pregnant and non-pregnant female mice, we will evaluate the distribution and expression of VIP neurons within SCN through histological analysis. This study aims to improve our understanding of how the maternal brain adapts during pregnancy and how these changes influence SCN function. The findings may provide valuable insight into the relationship between circadian rhythms, reproductive function, and maternal health.

CHARACTERIZATION OF SEX DIFFERENCES IN COCAINE SELF-ADMINISTRATION IN ADULT MICE

Presenter(s): Victoria Alderete (The University of Texas - El Paso)
Category: Neuroscience
Mentors(s): Alfred Robison (College of Natural Science)

Cocaine intravenous self-administration (IVSA) is a gold-standard preclinical model used to study the behavioral effects of cocaine in rodents. It allows volitional drug intake and measurement of translationally relevant outcomes, such as drug seeking and relapse after abstinence. While this paradigm has been widely used to study sex differences in rat behavior, these distinctions remain largely unexplored in mice, despite their advantages in genetic tractability and high throughput. Therefore, we utilized IVSA to model cocaine use disorder in adult C57BL/6 male and female mice. Eight-week-old mice received jugular vein catheter implantations followed by a 3-day recovery period. Then, during a 14-day acquisition phase, mice learned to nose-poke in association with a light cue to receive a 0.75 mg/kg infusion of cocaine or saline. On day 15, motivation was assessed using a progressive ratio test. After 7 days of abstinence in the home cage, relapse-like behavior was assessed by measuring unrewarded nose pokes upon return to the test chamber. In a preceding study, experimental groups self-administered infusions of 0.5 mg/kg, and female mice demonstrated greater acquisition and maintenance of cocaine intake. We expect that the higher cocaine dose used here (0.75 mg/kg) will elicit faster acquisition, greater motivation, and increased drug-seeking behavior in males, such that there is no longer a sex difference. Collectively, these findings may reveal dose-dependent sex differences in seeking and taking while providing a foundation for future inquiry into hormone signaling and neural circuits underlying sex differences in addiction.

ENHANCING THE SENSITIVITY AND STABILITY OF BORON-DOPED DIAMOND MICROELECTRODES FOR NEUROCHEMICAL SENSING AND STIMULATION USING PEDOT/MWCNT-SDS COMPOSITE COATINGS
Presenter(s): Ariel Block (Michigan State University)
Category: Neuroscience
Mentors(s): James Siegenthaler (College of Engineering)

The measurement of neurotransmitters in the brain is crucial for the early detection of neurodegenerative diseases such as Parkinson's or Alzheimer's disease but poses a significant challenge due to neurotransmitters' rapid oxidation and reduction rates tied with the requirement of subcellular electrodes for in vivo/vitro measurements. Boron-Doped Diamond Microelectrodes (BDDMEs) offer exceptional electrochemical stability, biocompatibility, and a wide potential window but often suffer from reduced sensitivity due to their low density of SP2 electroactive surface states. On the other hand, Carbon Fiber Microelectrodes offer excellent sensitivity electrochemically but degrade incredibly fast due to their surface full of loosely folded SP2 carbon molecules. In this work, conductive polymer nanocomposite coatings were developed for the electrochemical enhancement of BDDMEs and CFMEs to increase stability and sensitivity through adsorption modification for neurotransmitters such as Dopamine and Serotonin. Poly(3,4-ethylenedioxythiophene) (PEDOT) and Carboxyl functionalized Multi-walled Carbon nanotubes (COOH-MWCNT) were electrochemically deposited to form a higher-surface-area, redox-active interface designed to improve charge transfer and analyte interaction at the electrode's surface. Carbon fiber microelectrodes (CFMEs) were initially used as a disposable model system to optimize deposition parameters, film thickness, and stability prior to application on BDDMEs. Electrochemical characterization using cyclic voltammetry, electrochemical impedance spectroscopy (EIS) and fast-scan cyclic voltammetry (FSCV) demonstrated increased background current, altered redox behavior, and enhanced analyte-evoked responses following coating, consistent with increased electroactive surface area and improved electron transport. This work aims to bridge the gap between the robustness of diamond-based electrodes and the sensitivity required for high-performance neurochemical sensing.

EFFECTS OF CESAREAN BIRTH ON THE MOUSE VENTRAL TEGMENTAL AREA
Presenter(s): Zoey Bennett (Albion College)
Category: Neuroscience
Mentors(s): Alexandra Castillo-Ruiz (College of Social Science)

Cesarean birth is a widespread practice across the world, yet the consequences for brain development remain obscure. Epidemiological studies in humans suggest that Cesarean-born individuals are at a higher risk of being diagnosed with disorders characterized by altered reward behavior, such as attention-deficit hyperactivity disorder. Remarkably, Cesarean-born rodents exhibit altered reward-system neurocircuitry, as evidenced by reduced dopamine projections to the prefrontal cortex and nucleus accumbens. Since the primary source of dopamine for the reward system is the ventral tegmental area, we hypothesize that Cesarean birth disrupts neurodevelopment of this region. To test this, we investigated neuronal cell death (a key neurodevelopmental event that shapes the brain during the perinatal period) in the VTA of Cesarean and vaginally born male and female mice. Brains were harvested prenatally on the day of expected delivery and then postnatally at 3 hours, one, and three days after birth, and then immunohistochemically stained for activated caspase-3, a marker of cell death. Aperio ImageScope software was used to quantify dying cells in the VTA. We found that Cesarean-born mice had higher cell death across all postnatal timepoints, indicating that birth mode alters cell death in the VTA. To test whether this effect translates into lasting reductions in dopaminergic neurons in the VTA, we next harvested adult mouse brains and immunohistochemically stained them for tyrosine hydroxylase (TH), a marker of dopamine. We are currently quantifying TH+ neurons in the VTA.

ASSESSING THE BORON-DOPED DIAMOND MICROELECTRODE- BRAIN INTERFACE USING QUANTITATIVE IMMUNOFLUORESCENCE
Presenter(s): Sarah Ward (University of Maryland - Baltimore County)
Category: Neuroscience
Mentors(s): Erin Purcell (College of Engineering)

Implanted electrodes in the brain have been used to study and treat neurological conditions. These devices record electrical and/or chemical signals from the brain, relying on the detection of stable and accurate signals over time. However, upon insertion, a series of tissue responses are triggered that can impact stable signal detection and overall device performance. This initiates protein adsorption upon the foreign device. The tissue inflammatory response activates microglia and astrocytes, causing these cells to move toward the device. Over subsequent weeks, reactive astrocytes and microglia encapsulate the device, forming a glial scar. Previous studies have assessed different electrode types and materials to mitigate the tissue response to implanted devices. A promising choice is the boron doped diamond microelectrode (BDDME) due to its large working window potential, background stability and decreased biofouling effects. Histological assessments of the BDDME device-tissue interface can provide valuable cellular and molecular information concerning the tissue response to the electrodes. In this study, brain tissue was collected from rates implanted with BDDME devices in the striatum (n=3 rats) for one week. Tissue was sectioned using a cryostat, and immunohistochemistry was performed to stain for glial fibrillary acidic protein (GFAP, astrocyte marker), neuronal nuclei (NeuN, neuron marker), and Hoechst (counterstain). Quantitative analysis was done using MATLAB to assess protein intensity levels, and measure GFAP and NeuN surrounding the device. These results provide information on the tissue response elicited in rat brains implanted with BDDMEs, providing novel cellular and molecular insight into this device-tissue interface.

SHINING A LIGHT ON PHOTOPHOBIA: VALIDATION OF THE LIGHT SENSITIVITY ASSAY (LSA) IN MOUSE MODELS OF MIGRAINE
Presenter(s): Frances Michelly Señeriz Padró (University of Puerto Rico - Humacao)
Category: Neuroscience
Mentors(s): Geoffroy Laumet (College of Natural Science)

Migraine is a chronic neurological disorder characterized by headaches and often accompanied by heightened sensitivity to light (photophobia) and sound. Despite the prevalence of light sensitivity as a symptom in migraine, there is a lack of adequate behavioral assays to measure it in mice, preventing the understanding of the neurobiology underlying light sensitivity associated with migraine. I will use two mouse models of migraine induced by clinically relevant migraine triggers: repeated restraint stress and administration of Calcitonin Gene-Related Peptide (CGRP), a neuropeptide that is upregulated during migraine episodes. In our lab, a behavioral assay has been developed to measure light sensitivity in these models. Grimacing is a validated measure of spontaneous pain in rodents, making it suitable for detecting light- evoked discomfort. My project will examine and extend the Light Sensitivity Assay by analyzing grimacing responses to CGRP or repeated stress under three different light conditions (dark, ambient, and bright). We hypothesize that light exposure in mice will increase grimacing and that this effect will be more significant in mice that receive a CGRP injection or experience repeated stress compared to their vehicle and non-stress controls. Validation and better definition of the light sensitivity assay will allow more precise investigation of mechanisms underlying photophobia.

GLIAL COX2, NEUROPLASTICITY, AND FIBROSIS IN THE POST INFLAMED GUT
Presenter(s): Liana Salazar (Michigan State University)
Category: Neuroscience
Mentors(s): Brian Gulbransen (College of Natural Science)

The main goal of this project is to understand how manipulating glial COX2 could be used to provide therapeutic benefit for colon dysfunction in the resolution phase of colitis in inflammatory bowel disease (IBD). We aim to determine how glial COX2 regulates enteric nervous system (ENS) hyperexcitability and stromal remodeling in the colonic muscularis through PGE2 signaling following acute colitis. We hypothesize that inflammation-driven glial COX2 activity is required to correct ENS maladaptive neuroplasticity and to constrain fibroblast activity. To test this, we will combine conditional, cell-specific transgenic mice to delete the COX2 gene (Ptgs2) in enteric glia following an acute inflammatory event induced by DNBS colitis. This approach allows temporal control of glial COX2 during colitis and enables us to assess its effects on both the ENS and fibroblasts. Outcome measures will include disease activity indices, immunolabeling to assess ENS structure, and calcium imaging to record ENS function. In parallel, we will evaluate the impact of glial COX2 on collagen remodeling through histological staining and RNAscope to detect fibroblast activation. Overall, this work will provide insight into the mechanisms that drive neuroplasticity and fibrosis through COX2-PGE2 signaling in the post-inflamed gut. Understanding enteric glial activity during disease, resolution, and remodeling may help explain symptom persistence despite mucosal healing and clarify why some IBD patients develop fibrotic complications. In the long term, defining these pathways could guide new therapeutic strategies aimed at improving functional recovery and preventing maladaptive remodeling in IBD.

TEMPORAL CHANGES IN COMPLEMENT SYSTEM ACTIVATION DURING ALPHA SYNUCLEIN-INDUCED NEURODEGENERATION
Presenter(s): Kelleany Santana (University of Puerto Rico - Humacao)
Category: Neuroscience
Mentors(s): Matthew Benskey (College of Human Medicine)

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by the death of nigrostriatal dopaminergic neurons and accumulation of aggregated alpha-synuclein (α-syn). Neuroinflammation is a central feature of PD and likely contributes to disease progression; however, mechanisms by which immune activation promote neurodegeneration are not yet fully understood. The complement system is a branch of the innate immune system that acts as a first line of defense against infection and cellular damage. Complement is activated in the PD brain and a-syn based models of PD. For instance, in the a-syn preformed fibril (PFF) model, complement is robsutly activated during the peak of α-syn aggregation, but prior to neurodegeneration; however, whether complement activation changes during the degeneration of the nigrostriatal pathway is unknown. To investigate whether complement activation changes over the pathological time course of the a-syn PFF model, we will quantify expression of complement C3, the central component of the complement system, in substantia nigra pars compacta (SNc) glia using immunofluorescence and image analysis. Preliminary data indicate that complement activation occurs in response to α-syn aggregates; therefore, we hypothesize that complement C3 expression in SNc glia will decrease as nigrostriatal degeneration precedes. However, we observed an increase in both C3 and pSyn intensity in the PFF-injected animals, indicating sustained innate immune activation. Monomeric α-syn did not differ from PBS controls, suggesting that pathological α-syn aggregates, rather than α-syn alone, drive complement activation. Our findings demonstrate that complement activation persists during neurodegeneration and associate with pathological α-syn aggregation.

ASSESSMENT OF THE MHC-II MICROGLIAL RESPONSE IN A COMBINED TYPE 2 DIABETES AND SYNUCLEINOPATHY RODENT MODEL
Presenter(s): Elena Mares (St. Mary's University)
Category: Neuroscience
Mentors(s): Joseph Patterson (College of Human Medicine)

Parkinson's Disease (PD) is a progressive motor disorder characterized by the accumulation of alpha-synuclein (a-syn) containing Lewy pathology and loss of the nigrostriatal dopamine neurons. More recently, neuroinflammation has also been appreciated as a feature and potential driver of PD progression. Several factors can influence PD, recently type 2 diabetes (T2D) has been implicated as a comorbidity which can accelerate PD symptoms. To better understand the links between T2D and PD, we combined rat models which possess features of T2D (hyperglycemia and insulin resistance) with a fibril induced model of synucleinopathy (a-syn aggregation and subsequent nigrostriatal neurodegeneration). Two-month-old rats were fed a high-fat diet for two months, followed by stereotactic intrastriatal injections of a-syn preformed fibrils (PFFs). After recovery from surgery, rats received an injection of streptozotocin (20 mg/kg i.p.) to induce hyperglycemia. At two months post-surgery, rats were for assessed for motor impairment and brains collected for biochemical and histological analysis. In this phase of the study, we sought to assess the impact of the diabetic state on microglial activation based on the presence of Major Histocompatibility Complex Class II (MHC-II) immunoreactive microglia adjacent to a-syn pathology. As T2D is associated with chronic inflammation, we hypothesize the diabetic state will increase the immune response associated with a-syn pathology. Quantification of MHC-II positive microglia in the substantia nigra pars compacta is ongoing. Our results will contribute to our understanding of the role of T2D associated inflammation as a potential contributor to PD progression.

BLOOD-BASED PROTEOMIC SIGNATURES OF COGNITIVE DECLINE: VALIDATION IN HUMAN TEMPORAL CORTEX TISSUE
Presenter(s): Génesis Suárez Rentas (Pontifical Catholic University of Puerto Rico)
Category: Neuroscience
Mentors(s): Andrew Umstead (College of Human Medicine), Irving Vega (College of Human Medicine)

Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the leading cause of dementia worldwide. Aggregation of Amyloid Beta and aberrantly posttranslationally modified tau proteins are well-established hallmarks of AD pathology detected in both brain tissue and plasma. However, individualized, person-level biomarkers of cognitive decline are needed to track the transition from cognitively unimpaired status to cognitive impairment. Previous longitudinal plasma proteomic analyses identified candidate proteins that were differentially expressed in association with cognitive impairment. Whether these peripheral protein changes reflect similar alterations in disease-relevant brain regions remains unclear. This study aims to validate plasma-derived proteomic findings in human temporal cortex tissue, a region vulnerable to AD-related pathology. Utilizing western blot analysis, selected candidate proteins will be measured in temporal cortex samples from pathologically confirmed brain tissue with Braak stage ranging from 0 to VI. The validation of the selected plasma proteome changes in brain tissue will lead to assert that changes detected in peripheral blood reflect molecular changes occurring in the brain during cognitive decline. This work may support the identification of blood-based biomarkers for early AD risk assessment and disease monitoring.

PROGESTERONE RECEPTOR EXPRESSION IN THE DORSAL ROOT GANGLIA ACROSS REPRODUCTION OF FEMALE LABORATORY RATS
Presenter(s): Emma Schrum (Michigan State University), Sarah Pasko (Michigan State University)
Category: Neuroscience
Mentors(s): Joseph Lonstein (College of Social Science)

The hormones of pregnancy and parturition underlie dramatic neurobehavioral changes that compel females to care for their young. Progesterone is a neuroactive steroid hormone that rises dramatically across pregnancy and acts on the central and peripheral nervous systems through two isoforms of its receptor- PR-A and PR-B. During late pregnancy, expression of PR-A and PR-B increases in peripheral tissues, such as the uterus, and in brain regions, including the hypothalamus. Whether similar changes occur in the peripheral nervous system (PNS) has yet to be investigated. Dorsal root ganglia (DRG) are groups of neuronal cell bodies in the PNS that transmit sensory information from the periphery to the spinal cord, where it is then relayed up to the brain. PR-A and PR-B have been identified in dorsal root ganglion neurons, but little is known about the abundance of these receptors across female reproduction. Such changes in PR-A and PR-B expression in the DRG could indicate a role for progesterone in altering peripartum sensory signaling. To investigate this, DRG were collected from the cervical, thoracic, and lumbar spinal regions from rats sacrificed as either diestrus virgins, at the end of pregnancy on day 21 (P21), or on postpartum day 2 (PP2). PR-A and PR-B mRNA expression levels are being quantified using real-time quantitative polymerase chain reaction (RT-qPCR). Our findings will have important implications for further research into sensory processing during motherhood, as well as the role of progesterone receptors in DRG and sensory processing more broadly.

ELUCIDATING MECHANISTIC CANDIDATES THAT REGULATE GABAERGIC NEURON DEVELOPMENT IN A HYPERACTIVE MAPK MODEL
Presenter(s): Xaymarie Serrano (University of Puerto Rico - Cayey)
Category: Neuroscience
Mentors(s): Daniel Vogt (College of Human Medicine), Dariangelly Pacheco Cruz (College of Natural Science)

The RAS/MAPK pathway is composed of genes that, when mutated, underlie neurodevelopmental syndromes with high rates of autism and attention deficit hyperactivity disorder (ADHD). This pathway is both necessary and sufficient for GABAergic interneuron development. It has been demonstrated that GABAergic neuron dysfunction is implicated in cognitive changes associated with RAS/MAPK disorders. However, the mechanism by which the cognitive impairments commonly observed in RASopathies arise and can be treated remains unknown. Previous data showed that the hyperactivation of the RAS/MAPK pathway impairs the development of GABAergic cortical interneurons (CINs). Importantly, elevated RAS/MAPK activity increases the expression of somatostatin (SST) expressing GABAergic neurons, at the expense of other GABAergic neuron subtypes. I hypothesize that altered ratios of GABAergic neuron subtypes could underlie the cognitive changes due to altered RAS/MAPK signaling. Here, I will investigate the role of novel RNA-sequencing targets on the role of SST expressing GABAergic neurons during brain development. To accomplish this, I will normalize or mimic the expression of these targets in GABAergic neuron progenitors and assess their impact on SST expression in these cells as they mature. Overall, these experiments will identify new molecular candidates that regulate GABAergic neuron cell fate and function that could contribute to the frequent co-occurrence of autism and ADHD associated with RAS/MAPK dysfunction.

LIGHTING EFFECTS ON BLOOD GLUCOSE LEVELS IN A DIURNAL RODENT MODEL
Presenter(s): Neha Jampana (Michigan State University)
Category: Neuroscience
Mentors(s): Lili Yan (College of Education)

The circadian system evolved under natural light-dark cycles, while modern humans spend considerable time indoors under electric lighting. How such lighting environments influence physiology remains unclear. In this study, we used the diurnal Nile grass rat (Arvicanthis niloticus) to assess the impact of indoor vs. outdoor lighting on nonfasting random blood glucose (RBG). We hypothesized that animals housed in outdoor light conditions would exhibit lower RBG than those housed in indoor light conditions. Male and female grass rats (3-6 months old) were housed under simulated daylight (Day-L, ~5000 lux) or fluorescent light (Flu-L, 150 lux) conditions. In cohort one (n = 10/condition), RBG was measured after 6 weeks from right atrial blood following CO_2 euthanasia. In cohort two (n = 7-8/condition), RBG was measured after 4 weeks from tail vein blood under 5% isoflurane, then 2 weeks later, following CO_2 euthanasia as in cohort one. In cohort one, mean RBG was 143.9 vs. 252.4 mg/dL in Day-L and Flu-L, respectively ($p = 0.1488$). In cohort two, mean RBG was 171.0 vs. 227.8 mg/dL after 4 weeks under 5% isoflurane, and 162.3 vs. 210.1 mg/dL in Day-L vs. Flu-L ($p = 0.3384$) after CO_2 euthanasia. Under Day-L conditions, 1 out of 10 or 1 out of 7 in each cohort had hyperglycemia (RBG > 200 mg/dL), while under Flu-L, 4 out of 10 or 4 out of 8 had hyperglycemia. These findings suggest that insufficient exposure to outdoor light, or spending excessive time indoors, may increase the risk of developing diabetes.

REPRODUCTIVE IMPAIRMENTS IN RAI1+/- NILE GRASS RAT, A DIURNAL RODENT MODEL OF SMITH MAGENIS SYNDROME
Presenter(s): Nathan Koviack (Michigan State University)
Category: Neuroscience
Mentors(s): Lili Yan (College of Social Science)

Smith-Magenis syndrome (SMS) is a rare neurodevelopmentaldisorder caused by haploinsufficiency of the retinoic acid-induced 1(Rai1) gene. SMS is characterized by a low intellectual quotient, obesity, behavioral problems, and disrupted circadian rhythms in sleep and melatonin secretion. Our lab have developed a diurnal rodent model of SMS usingCRISPR-based targeting of Rai1 gene in the Nile grass rat, Arvicanthis niloticus. Preliminary data characterizing the phenotype of Nile grass ratSMS model (Rai1+/-) revealed disturbed daily rhythms inlocomotor activities and sleep, altered melatonin rhythm, obesityand hyperphagia, low fertility (particularly in males), and impairments in object and spatial memory. The primary goal of the present study is to determine their productive impairments in Rai1+/- grass rats. We analyzed breeding records of Rai1, wild-type (WT), and another mutant line (Dec2) generated by CRISPR as controls. In both Rai1 and Dec2 breeding pairs, the mutant was paired with a WT mate. The % of successful pregnancy, latency from pairing to thebirth of first litter, and litter size were compared betweenthe 3 lines. Our results show that Rai1+/- animals have lower pregnancy rate, longer latency to produce their first litter, compared to WT animals and another CRISPR edited line. These results indicate reproductive impairments in the grass rat model of SMS.

POTENTIAL PROTECTIVE EFFECTS OF THE INDIVIDUAL AND COMBINED EFFECTS OF EICOSANOYL-5-HYDROXYTRYPTAMIDE (EHT) AND CAFFEINE ON PARKINSON'S DISEASE
Presenter(s): Jazmyne Rees (Grand Valley State Unversity)
Category: Neuroscience
Mentors(s): Natashia Swalve (Grand Valley State University)

Parkinson's disease (PD) is one of the fastest-growing neurodegenerative disorders today, characterized by the gradual deterioration of dopaminergic neurons, leading to tremors, stiffness, and slow and unbalanced movement. While the progression of the disease is slow-moving, there are currently no cures, and the effects can be permanently disabling to patients. The need for effective treatments that can slow or prevent the disorder is thus clear. Coffee consumption has demonstrated a strong association with reduced risk of developing PD. Though coffee's neuroprotective potential has typically been attributed to caffeine, emerging evidence suggests eicosanoyl-5-hydroxytryptamide (EHT), another component of coffee, may work synergistically to protect against PD. However, the mechanisms underlying this effect are not well understood. This study seeks to contribute to the existing literature on the individual and combined neuroprotective effects of caffeine and EHT on treating Parkinson's disease. Forty-nine rats were exposed to the rotenone model of Parkinson's disease for 35 days. Groups were divided based on treatments: caffeine (25mg/kg/day) in water, EHT (12mg/kg/day) in their feed, both caffeine and EHT, or neither. They were then assessed using behavioral paradigms such as a fixed-ratio model of motivation and rotarod for motor impairment. The results of this experiment will have significant implications for future research into caffeine and EHT as effective prevention and treatments against Parkinson's disease.

EFFECTS OF CESAREAN BIRTH ON ACTIVATION OF BRAIN REGIONS THAT REGULATE SOCIAL BEHAVIOR
Presenter(s): Keeley Stankus (Michigan State University)
Category: Neuroscience
Mentors(s): Alexandra Castillo-Ruiz (College of Social Science)

The brain undergoes immense reorganization around the time of birth. Therefore, divergence from the natural birthing process could alter neurodevelopment. Indeed, we previously reported that newborn Cesarean-born mice have fewer vasopressin (VP) neurons in the hypothalamic paraventricular nucleus (PVN) than their vaginally-born counterparts. A similar but more modest effect was seen in oxytocin (OT) neurons of the PVN. Since the VP and OT systems of the PVN regulate sociality, here we tested whether Cesarean birth affects social behaviors as well as the PVN's overall responsiveness to social stimulation. To this aim, we recorded the behavior of adult, vaginally and Cesarean-born mice of both sexes exposed to the reciprocal social interaction test. Specifically, during this test, an experimental mouse was habituated for 5 minutes to a neutral arena. Then, a same-sex, unfamiliar mouse was placed in the arena for 5 minutes. Experimental mice were then returned to their home cages and, 90 minutes later, their brains were collected for the immunohistochemical detection of the neuronal activation marker, Fos, in the PVN. Behavioral results showed a reduction in affiliative push-crawl behavior in Cesarean-born mice, supporting the hypothesis that Cesarean birth alters social behavior. Immunohistochemical results showed no effect of birth mode on the number of Fos+ cells in the PVN. We are currently honing in on the response of VP and OT neurons of the PVN to social stimulation by colabeling them with Fos.

MIDBRAIN CIRCUIT DIFFERENCES IN BINGE EATING PRONE AND RESISTANT RATS REVEALED THROUGH MRI
Presenter(s): Keaton Hill (Michigan State University), Marina Ramiro de Assis Sousa Santos (Michigan State University)
Category: Neuroscience
Mentors(s): Alexander Johnson (College of Social Science)

In the current food landscape, many questions still arise on the mechanisms and causes for binge eating behavior. This is especially true within environments that promote foods that are high in enjoyability and low in nutrients. Our research set out to find specific brain regions that may play a role in whether a person is binge eating prone or binge eating resistant. To do this, we provided 20 rats with a dish of frosting for a controlled period of time over the span of two weeks. After the two weeks were concluded, the rats were separated into two groups. The binge eating prone group contained rats that consistently ate over the amount of frosting considered to be prone, but never resistant. The opposite goes for rats in the binge eating resistant group. An MRI was then used to determine any differences between the two groups. A significant change in synaptic connections was found between a brain region known as the red nucleus, located in the anterior midbrain. This research is important because it helps uncover some of the brain regions that may play a role in binge eating behavior, and could provide a new understanding of a biological role involved, opening new doors for future research in the field. Overall, our presentation will cover our findings of the red nucleus and how it may contribute to binge eating behavior.

UNCOVERING TRANSCRIPTOME-WIDE RESPONSES ACROSS THE BRAIN IN COCAINE USE DISORDER
Presenter(s): Sophie Grover (Michigan State University)
Category: Neuroscience
Mentors(s): Alfred Robison (College of Natural Science), Dimitri Joseph (Graduate School Dean)

The cellular and molecular mechanisms of cocaine use disorder are not fully understood, limiting the development of novel treatments. Cocaine use drives gene expression changes across the brain's reward circuitry, with the nucleus accumbens (NAc) as a central focus because it mediates the rewarding effects of the drug. Whether the NAc transcriptional response to cocaine is region-specific or shared across similar brain regions remains unclear, and comparisons between regions are confounded by differences in cell-type composition. A rank-based approach was used to compare cocaine-associated gene expression across brain regions which contain differing cell composition and behavioral roles. We first explored transcriptomic responses using two publicly available RNA-seq datasets (GSE158588, GSE110344) from mouse models which employed acute experimenter-administered cocaine or intravenous self administration including withdrawal. In each study, DESeq 2 was utilized to enumerate the genes in each brain region, then compare across the NAc and dorsal striatum (DS), a neighboring brain region with similar cell composition but a very different role in the behavioral effects of cocaine. A stratified Rank-Rank Hypergeometric Overlap ranked meta analysis was then used to compare whole transcriptome effects across these brain regions in independent studies. Our meta analysis uncovered a common cocaine-associated gene expression signature across the NAc and DS. Our future work will extend this analysis to more studies, generating a more comprehensive and generalizable gene expression signature. This gene expression signature can then be applied to medicinal compounds, determining potential candidates that could reverse these gene expression changes and potentially prevent cocaine-use disorder.

Pharmacology & Toxicology

IMPACT OF FACTOR-13B DEFICIENCY ON ACETAMINOPHEN CYTOTOXICITY IN PRIMARY MOUSE HEPATOCYTES
Presenter(s): Vanessa Agyei (Columbia University)
Category: Pharmacology & Toxicology
Mentors(s): Caitlin Schneider (College of Osteopathic Medicine)

Coagulation factor 13 (FX-III) is a coagulation enzyme that crosslinks fibrin clots formed by the blood coagulation cascade. FXIII is composed of two catalytic A subunit (FXIII-A) and a regulatory (FXIII-B) subunit, which are produced by different cell types. FXIII-B's only known function is to stabilize FXIII-A. Preliminary data from our lab suggest that FXIII-B deficiency increases liver injury which is unexplainable by its role in stabilizing FXIII-A and independent of crosslinking fibrin(ogen). We hypothesize that FXIII-B deficiency increases Acetaminophen (APAP)-induced hepatotoxicity in-vitro, independent of stabilizing FXIII-A and fibrin crosslinking. Primary hepatocytes were isolated from wild-type mice using perfusion and collagenase digestion and APAP (0, 1.25, 2.5, and 5 mM). Cells were plated at 500k, 400k, and 300k cells/ well and cytotoxicity evaluated by supernatant collected at the 18hr-timepoint post-treatment for alanine aminotransferase (ALT) - a biomarker of cellular necrosis and an enzyme in primary hepatocytes- activity using a Tecan microplate reader. We found that APAP cytotoxicity was influenced by plating density. Cells plated at 500k and 400k cells/well did not exhibit a concentration-response relationship between APAP and ALT release. We found that hepatocytes plated at 300k exhibit a concentration-response relationship with an increase in. ALT at the 5 mM concentration. We expect that the addition of recombinant FXIII-B will reduce ALT levels similar to what is present in wildtype, and knockout cells with the FXIII-A2B2 complex. The results suggest that plating density influenced cytotoxicity in C57BL/6J WT cells.

A PLASMA DILUTION-CURVE APPROACH FOR THROMBIN GENERATION ASSAYS

Presenter(s): Adam Goudreau (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Adam Lauver (College of Veterinary Medicine), Caitlin Schneider (College of Osteopathic Medicine), James Luyendyk (College of Veterinary Medicine)

Thrombin generation assays (TGAs) are used to assess coagulation potential, but are performed at a single plasma concentration. Plasma dilution alters the balance of pro- and anticoagulant factors, allowing a view of hemostatic regulation. This study introduces a plasma dilution-curve approach to determine whether thrombin generation across plasma dilutions reveals alterations in coagulation not detected by conventional thrombin generation assays. This approach examines thrombin generation across a dilution range, revealing shifts in functional response curves. Whole blood was collected from mice into sodium citrate tubes, then double centrifuged to yield platelet-poor plasma (PPP). PPP samples were serially diluted and analyzed using Technothrombin TGA reagents. Lag time, peak thrombin generation, and effective thrombin potential were measured at each dilution and plotted to generate plasma dilution curves. Preliminary data demonstrate a reproducible inverted U-shaped relationship between plasma dilution and peak thrombin generation, with highest thrombin generation observed at approximately a 1:4 dilution in normal animals. In a mouse model of acetaminophen-induced acute liver injury (300 mg/kg, 6 hours post-dose), peak thrombin generation shifted toward a lower plasma concentration (1:16 dilution), lag times were prolonged, and peak thrombin generation and effective thrombin potential were reduced, indicating altered coagulation dynamics. Current work focuses on investigating time-dependent changes following acetaminophen administration. Future studies will investigate the specific coagulation factors altered in the acute liver injury model. These studies will determine how alterations in coagulation pathways contribute to changes in thrombin generation and improve understanding of hemostatic regulation during acetaminophen-induced liver injury.

ELUCIDATING HOW ADIPOCYTE-DERIVED FACTORS MODULATE ANGPTL4 EXPRESSION IN A CELLULAR MODEL OF NON-MELANOMA SKIN CANCER

Presenter(s): Afraz Yousuf (State University of New York - Buffalo)
Category: Pharmacology & Toxicology
Mentors(s): Jamie Bernard (College of Human Medicine)

Non-Melanoma Skin Cancer (NMSC) is the most common type of cancer with 5.4 million cases in the United States annually. Primarily caused by overexposure to UV radiation, NMSC is highly curable if caught in the early stages with existing interventions like Mohs surgery leading to a survival rate of over 95%. Despite this, NMSC causes more deaths annually than melanoma if left unchecked. Bariatric surgery has been shown to reduce skin cancer risk, indicating adipose tissue may impact tumor progression. Previous Bernard lab research has shown that expression of ANGPTL4 increases as Cutaneous Squamous Cell Carcinoma (cSCC), a form of NMSC, progresses in patients yet it is absent in invasive cSCC. ANGPTL4 is a glycoprotein which endogenously inhibits lipoprotein lipase, an enzyme that breaks down triglycerides into free fatty acids for delivery to adipose tissue. To better understand the role of ANGPTL4 in NMSC, we commercially purchased human subcutaneous preadipocytes and using a differentiation medium cocktail preadipocytes were differentiated into adipocytes over 11 days. Adipocyte differentiation was confirmed using microscopy to detect lipid droplet accumulation. Both undifferentiated preadipocytes and differentiated adipocytes were then indirectly co-cultured with human keratinocyte (HaCat) cells for 72 hours to evaluate changes in ANGPTL4 expression. We used CRISPR-Cas9 mediated lentiviral knockout of ANGPTL4 in HaCats to study impacts on growth and invasion. We hypothesize that ANGPTL4 is induced by adipocytes and increases the growth of HaCats. ANGPTL4 may serve as a therapeutic target for halting the progression of precancerous lesions and NMSC into invasive skin cancers.

THE EFFECTS OF SOLUBLE EPOXIDE HYDROLASE INHIBITION ON BLOOD-BRAIN BARRIER INTEGRITY IN HYPERTENSIVE RATS
Presenter(s): Sushmita Emani (University of Massachusetts - Amherst)
Category: Pharmacology & Toxicology
Mentors(s): Anne Dorrance (College of Osteopathic Medicine)

Vascular contributions to cognitive impairment and dementia (VCID) is the second most common form of dementia and encompasses a spectrum of cognitive deficits resulting from cerebrovascular dysfunction, often in association with comorbidities such as hypertension. Soluble epoxide hydrolase (sEH) metabolizes epoxyeicosatrienoic acids (EETs), endothelium-derived hyperpolarizing factors that induce vasodilation and increase cerebral perfusion. Therefore, inhibition of sEH could enhance cerebral blood flow and reduce cognitive deficits in VCID models. We hypothesize that sEH inhibition with trifluoromethoxyphenyl-3-(1-propionylpiperidin-4-yl) urea (TPPU) improves cognitive dysfunction and blood-brain barrier (BBB) integrity in a hypertensive model. For this study, twenty-week-old male and female stroke-prone spontaneously hypertensive rats (SHRSP), a model of human hypertension, from a colony housed at Michigan State University, were randomized into two groups. Animals received TPPU (3mg/kg/day) or vehicle (1% PEG400) in their drinking water for 8 weeks before euthanasia. BBB integrity was detected through immunofluorescence staining with Claudin-5 and histological staining with Luxol Fast Blue (LFB). Data were analyzed using FIJI/ImageJ for fluorescence intensity (Claudin-5) or cell counting and hippocampal area (LFB). Preliminary results show no significant differences between cell count of LFB-stained male and female vehicle- and TPPU-dosed rats. Our study will further characterize the effects of sEH inhibition as a potential treatment strategy for cerebrovascular disease and cognitive decline associated with VCID.

EFFECT OF MACROPHAGE EXTRACELLULAR VESICLES ON MECHANICAL SKIN WOUND CLOSURE AND ON CHEMICAL-INDUCED EPIDERMAL CELL INJURY IN HUMAN HACAT CELLS
Presenter(s): Rafaella Holler Santoro (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Neera Tewari-Singh (College of Osteopathic Medicine)

Skin wound healing is a complex process involving coordinated cell migration, proliferation, and tissue remodeling. M2 macrophage-derived extracellular vesicles (M2-EVs) have emerged as promising cell-free therapeutics due to their regenerative and anti-inflammatory properties. This study evaluated the effects of M2-EVs on wound healing using an in vitro scratch assay in HaCaT skin keratinocytes and their ability to reduce vesicating agent nitrogen mustard (NM)-induced skin toxicity and inflammation. For the scratch assay, a mechanical wound was created in confluent cell monolayers, followed by treatment with M2-EVs (0.5x10^8 and 1x1018 EVs) or untreated. Wound closure was monitored by bright-field microscopy at 0, 4, 8, 18, 24 and 30 hours after treatment. M2-EV treatment accelerated wound closure compared with untreated cells, suggesting enhanced keratinocyte migration and tissue repair. We further investigated their effect on NM induced toxicity in HaCaT cells in our ongoing studies. We exposed cells to 40 uM NM for 2 hours, followed 1x10^8 M2-EVs treatment. Cells death was analyzed by MTT assay and cells were collected at 24 hours after treatment for quantitative polymerase chain reaction (qPCR) analysis of cell death and inflammatory gene expression. These studies will determine whether M2-EVs can attenuate NM-induced toxic effects while supporting tissue regeneration, providing insight into their potential as a novel therapeutic for vesicant-induced skin injury and wound repair. These studies will also provide supporting data for further in vivo studies to translate the therapeutic potential M2-EVs in ameliorating vesicant and other chemical exposures induced long-term skin inflammation and chronic wounding.

ZEBRAFISH (DANIO RERIO) AS A SCREENING TOOL FOR SMALL MOLECULE-INDUCED PANCREATIC TOXICITY VIA IRE1α-MEDIATED ENDOPLASMIC RETICULUM STRESS

Presenter(s): Nana Essel (Grambling State University)
Category: Pharmacology & Toxicology
Mentors(s): Karilyn Sant (College of Veterinary Medicine)

The endoplasmic reticulum (ER) plays a critical role in the secretory function of the pancreas, particularly within the exocrine compartment responsible for producing and releasing digestive enzymes. Disruption of ER homeostasis activates the unfolded protein response, of which Inositol-requiring enzyme type 1 alpha (IRE1α) is a key mediator. Small molecules targeting IRE1α have emerged as potential therapeutic and research tools; however, their effects on pancreatic morphology and function remain poorly understood. Therefore, this study aimed to determine the applicability of zebrafish as a model for pancreatic toxicity by testing the hypothesis that compounds targeting IRE1α alter pancreatic morphology and function. Transgenic Tg(ptf1a::GFP) zebrafish embryos were collected at 3 hours post fertilization (hpf) and screened at 24 hpf. At 96 hpf, larvae were individually housed in 24-well plates and exposed to 0, 0.1% v/v DMSO (vehicle control), or 0.2, 2, or 20 µM of an IRE1α-targeting small molecule. Exposures were refreshed daily until 168 hpf, after which larvae were rinsed and imaged using brightfield and fluorescence microscopy. Exposure did not affect larval survival or gross morphology, and no significant differences in exocrine pancreatic length were observed. However, the highest treatment group showed an increased frequency of pancreatic lengths below the 10th percentile of controls. These findings suggest that although IRE1α perturbation does not alter overall pancreatic growth or morphology, it may increase the incidence of congenitally shortened pancreata. Further studies are needed to determine whether pancreatic function is also affected.

INCREASED THORACIC AORTIC MESOTHELIUM THICKNESS IN MALE "PVAT-LESS" MOUSE

Presenter(s): Lydia Elbert (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Stephanie Watts (College of Osteopathic Medicine)

Perivascular adipose tissue (PVAT), arguably the 4th blood vessel layer, serves as a mechanotransducer, a source of vasoactive molecules, and remodels with hypertension. The mesothelium serosa (mes/ser) lines PVAT, a proverbial 5th layer speculated to allow communication of the vessel with its external world. Here, we test whether PVAT acts as a buffer to protect the mes/ser from the pressure of the aorta through a PVATless mouse model. The smooth muscle specific peroxisome proliferator gamma (PPARg) knockout mouse (PVATless mouse) loses substantial PVAT around the thoracic aorta while retaining the mes/ser. PVATless mice were bred from heterozygous pairs from the University of Missouri, where the PPARg gene silencing is driven by Cre recombinase. Comparing Cre+ (PVATless) and Cre- (PVAT) male mice, body weights did not differ at 6 months of age (g; Cre- = 34±1; Cre+ = 40±0.3). Nighttime mean arterial blood pressures (measured via radiotelemetry) did not differ (~125 mmHg). Cre+ mice displayed a ~10 mmHg lower diastolic pressure during the day. In a separate cohort, male Cre- and Cre+ (N=4) 58-61 weeks of age had thoracic aorta removed for Masson's Trichrome staining. Images were analyzed in OlyVIA by three independent observers blinded to the experimental group. At least six measures were taken and averaged by each observer per aorta, given the recognized heterogeneity of the mes/ser. Mes/ser of the Cre+ mouse was thicker (43.9±10 µm) than Cre- age-matched control (25.9±6.8 µm; p<0.05). These findings provide additional support for PVAT's role as a buffer for absorbing pressure.

THE N-TERMINAL REGION OF IL-10 ORCHESTRATES INTRACELLULAR TRAFFICKING AND LOADING INTO EXTRACELLULAR VESICLES

Presenter(s): Sadhana Kilangodi (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Masamitsu Kanada (College of Human Medicine)

Extracellular vesicles (EVs) serve as natural carriers for therapeutic biomolecules, including proteins, RNA, and DNA. Our recent studies show that the anti-inflammatory cytokine IL10 can be efficiently loaded into EVs and delivered to proinflammatory macrophages, effectively suppressing their activation. However, the mechanism by which IL10 associates with EV membranes remains unclear. To investigate this, we examined the classically defined signal sequence of IL10 and identified three cysteine residues, hypothesizing that they play a key role in IL10 loading onto EVs. We investigated how IL10 interacts with EVs during cellular release, focusing on whether the N-terminal region is required for EV loading. We analyzed the effects of N-terminal modifications of IL10 and quantitatively assessed IL10 localization in transfected HEK293FT cells. In addition, EVs derived from cells expressing IL10 mutants were isolated, and their IL10 content was evaluated by western blotting.

TOPICAL OMAVELOXOLONE MITIGATES CORNEAL DAMAGE FOLLOWING CHLOROPICRIN EXPOSURE
Presenter(s): Peter Chu (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Neera Tewari-Singh (College of Osteopathic Medicine)

Chloropicrin (CP), a widely used agricultural soil fumigant, poses a severe chemical hazard due to its potent irritant properties. The cornea is highly vulnerable to CP-induced toxicity, which previous studies have shown is driven by oxidative stress and inflammation. Currently, there is a critical gap in effective therapeutic interventions to prevent or mitigate this ocular injury. Omaveloxolone (RTA 408) is a synthetic triterpenoid and FDA-approved activator of the Nrf2 antioxidant pathway, known for reducing oxidative stress and inflammation across various tissue models. This study evaluated the protective potential of RTA 408 against CP exposure in a mouse model. Male BALB/c mice (6-8 weeks old, n=5/group) were exposed to 2.5% CP vapor for 1 minute on the right eye, while the left eye served as a control. Mice received topical pre-treatment with 0.1% RTA 408 thirty minutes prior to exposure, followed by twice-daily topical administration. Clinical features of ocular injury, including corneal ulceration, were evaluated over 24 hours. The results demonstrated that RTA 408 pre-treatment significantly reduced the severity of corneal ulceration by 66.18% at 6 hours and by 26.96% at 24 hours post-exposure in CP-exposed eyes. These findings indicate that RTA 408 is a promising therapeutic candidate for treating CP-induced ocular injury. Furthermore, this study establishes a foundational model for evaluating countermeasures against CP toxicity. Ongoing research is exploring the effects of RTA 408 on histopathological and molecular markers to further clarify the mechanisms of CP-induced corneal injury and identify viable treatment targets.

ESTABLISHING A FOUNDATIONAL GENETIC PLATFORM: VALIDATION OF GLOBAL AND IMMUNE CELL-SPECIFIC NRF2 KNOCKOUTS
Presenter(s): Jayla Jones (University of Delaware)
Category: Pharmacology & Toxicology
Mentors(s): Cheryl Rockwell (College of Human Medicine)

Nuclear factor (erythroid-derived 2)-like 2 (Nrf2) is a ubiquitous transcription factor that activates critical antioxidant response genes. Previous work in our lab shows that Nrf2-deficient mice suffer from severe immune suppression, highlighting a critical need to advance our fundamental understanding of how this protein regulates specific immune cell types. However, a major knowledge gap remains because an immune-cell-specific knockout model has never been validated to pinpoint these cell-specific pathways. To bridge this gap, our lab crossed Nrf2-floxed mice with Vav-Cre mice to engineer a highly targeted, immune-cell-specific Nrf2 knockout model. My research focuses on comparing Vav-Cre against wild-type models to validate the immune cell-specific knockout model. It is hypothesized that Nrf2 mRNA levels and downstream transcriptional target gene expressions will be significantly reduced in both the global and cell-specific Nrf2-knockout models compared to wild-type controls, confirming successful gene deletion and model fidelity. RNA from spleens will be isolated and used to create cDNA via reverse transcription. Then, qPCR will be used to measure downstream Nrf2 target genes such as HMOX1, NQO1, and GCLC. Finally, RNA seq will be used to analyze gene expression globally. Cell-specific deletion will be validated by comparing Nrf2 expression in the spleen against the kidney and liver. Confirming the baseline stability of these knockout models provides a crucial proof of concept platform needed to confidently map cell-specific Nrf2 behavior in the immune system. By establishing this genetic foundation, these models clear the path for future studies to map cell-specific Nrf2 behavior in the immune system.

RESTORING TUMOR IMMUNOGENICITY: DRUG-MEDIATED RE-EXPRESSION OF MAJOR HISTOCOMPATIBILITY COMPLEX
Presenter(s): Annie Yang (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Jennifer Jacob (College of Natural Science)

Immune systems use surface makers to recognize specific antigens on the surface to activate target mechanisms to attack. Tumor cells downregulate MHC I/II expression to evade immunological surveillance through immunoediting to stop displaying the molecular markers in escape detection by the immune system through the downregulation of MHC molecules, which are essential for antigen presentation and T-cell recognition. Epigenetic modifications, including DNA methylation and histone modifications, can silence genes involved in antigen presentation, allowing tumor cells to evade immune surveillance. This study investigates whether epigenetic regulatory drugs can restore MHC expression in tumor cells. Rodents (Mus Musculus) cell lines including NIH3T3, TUBO, CAM6, TC-1, E0771, and 4T1 were treated with vorinostat (HDAC inhibitor), tazemetostat (EZH2 inhibitor), 5-azacytidine (DMNT), and mitoxantrone (topoisomerase Inhibition). Interferon-gamma (IFN-γ) was included as a positive control due to its known ability to induce MHC expression. The hypothesis is that these treatments will increase MHC Class I and/or MHC Class II expression on tumor cells. Following treatment, flow cytometry was used to evaluate MHC Class I expression, MHC Class II expression, and cell viability. We expect that epigenetic drug treatment will increase MHC expression by reversing epigenetic silencing mechanisms that suppress antigen-presentation pathways to increase the performance of the immune system. Restoring MHC expression may improve the ability of the immune system to recognize and eliminate tumor cells. Understanding how epigenetic therapies influence antigen presentation could contribute to the development of more effective cancer immunotherapies and combination treatment strategies aimed at enhancing anti-tumor immune responses.

OUTCOMES OF PHARMACOLOGIC TREATMENT OF IPLA-2 MUTATIONS IN CAENORHABDITIS ELEGANS
Presenter(s): Aiden Callahan (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Fatemeh Yousefsaber (College of Osteopathic Medicine)

Infantile Neuroaxonal Dystrophy (INAD) is a rare early onset neurodegeneration disorder caused by a mutation in the gene PLA2G6. PLA2G6 encodes for the phospholipase enzyme ipla2-β, which repairs peroxidized lipids in cell membranes, resulting in management of reactive oxygen species (ROS) levels. The ipla2- β protein consists of various structures, with ankyrin repeats, a catalytic domain, ATP binding site, nucleotide binding domain, and CaM binding site being among them. Without a functioning PLA2G6 allele, cellular damage occurs, leading to neurodegeneration-such as that seen in INAD. Currently, more understanding is needed for how mutations in the PLA2G6 gene lead to different INAD presentations. A reliable model for studying neurologic conditions is the nematode Caenorhabditis elegans. C. elegans is utilized in studying nervous disorders because of their neural simplicity and high genetic similarity to humans. In the case of INAD, C. elegans has an ipla2-β ortholog-ipla-2. Thus, this experiment has modelled three variants of the ipla-2 gene in C. elegans and conducted a survival assay among the strains. The assay utilized a wild type (N2) strain, knockout (ipla-2 KO) strain, and an ipla-2 mutant strain (KINO4). It was found that the N2 strain had the highest survival rate, with ipla-2 KO having a significantly lower survival rate, and KINO4 having the lowest survival rate. Hence, we found mutating the ipla-2 protein led to a lower survival rate in C. elegans than the knockout. Our findings point to the need to further investigate how ipla-2 variants affect C. elegans phenotype.

EVALUATING THE EFFECT OF ANTIPLATELET THERAPY ON COGNITION IN NORMOTENSIVE AND HYPERTENSIVE MICE
Presenter(s): Lindsay Kennedy (Michigan State University)
Category: Pharmacology & Toxicology
Mentors(s): Adam Lauver (College of Veterinary Medicine), Afolashade Onunkun (College of Osteopathic Medicine)

Arterial thrombosis is a leading cause of death worldwide. Clopidogrel is a widely used antiplatelet drug for its management; however, recent studies suggest that its action extends beyond platelet inhibition to include adverse cerebrovascular effects. We recently demonstrated that 40mg/kg clopidogrel increases blood-brain barrier (BBB) permeability in hypertensive mice but not in normotensive mice. Hypertensive mice were used because hypertension is a major comorbidity of arterial thrombosis. The BBB is a semi-permeable barrier that regulates entry of substances into the brain. BBB disruption allows neurotoxins into the brain, causing neuroinflammation and contributing to cognitive decline. In this study, we sought to confirm that 40mg/kg clopidogrel completely inhibits platelet activation and then investigated its effect on cognition in hypertensive and normotensive mice. We hypothesized that 40mg/kg clopidogrel would comparably inhibit platelet activation in both Angiotensin II (Ang II)-induced hypertensive mice and normotensive mice but would selectively impair cognition in hypertensive mice. Ang II-filled osmotic minipumps (800 ng/kg/min, 4 weeks) were implanted in 16-to19-week-old male mice (n=7/group). Two weeks post-implantation, the mice received 40 mg/kg clopidogrel or vehicle daily. Platelet activation, assessed using flow cytometry, was significantly inhibited in hypertensive and normotensive mice treated with clopidogrel compared to vehicle-treated mice. To assess cognition, nesting behavior was observed. Hypertensive mice treated with clopidogrel had significantly reduced nesting scores compared to the vehicle-treated hypertensive mice. This effect was absent in normotensive mice treated with clopidogrel. Overall, clopidogrel led to cognitive decline specifically in hypertensive conditions, suggesting the effect is disease dependent.

Physical & Mathematical Sciences

BINARIES AND HOT JUPITERS
Presenter(s): Benjamin Navock (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Jack Schulte (College of Natural Science), Joey Rodriguez (College of Natural Science)

Here we present the discovery and characterization of two Hot Jupiters and one Warm Jupiter (TOI-5647b, TOI-5192Ab, and TOI-4132Ab respectively) orbiting around FGK stars. Two of these planets (TOI-5192Ab and TOI-4132Ab) reside within binary systems. These planets vary widely in radius (1.05 R_J)

EXOPLANET RESEARCH WITH MORP
Presenter(s): Joshua Margherone (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Joey Rodriguez (College of Natural Science)

The MSU Observatory Research Program (MORP) provides hands-on research opportunities for a few dozen undergraduates, allowing them to directly contribute to ongoing scientific efforts while learning how to obtain, reduce, and analyze astronomical observations. Using our 24 inch on-campus observatory located at Michigan State University, we are conducting time-series photometric followup of exoplanet candidates, novae, asteroids, and a variety of other astronomical objects and contributing those observations to ongoing efforts. Currently, our major research endeavor is obtaining precise multi-band photometry of exoplanet candidates from NASA's Transiting Exoplanet Survey Satellite (TESS) mission to help confirm them as bona-fide exoplanets. These followup observations are key to ruling out many false positive scenarios (blends and eclipsing binaries) while constraining the transit ephemeris for future targeted observations. We will discuss our ongoing exoplanet efforts and highlight the key discoveries we have directly contributed to.

ON THE QUANTUM SL3 INVARIANT FOR POSITIVE ALTERNATING LINKS
Presenter(s): Joshua O'Connor (University of Kansas)
Category: Physical & Mathematical Sciences
Mentors(s): Matthew Harper (College of Natural Science)

The SL3 link polynomial is a higher rank relative of the Jones polynomial which can be studied entirely diagrammatically using Kuperberg's web calculus. Building on the work of Harper and Kalfagianni, we construct formulae for the fourth and fifth coefficients of the quantum SL3 link invariant on positive alternating link diagrams in terms of data read from the associated Seifert graph. Then, we give a characterization of the invariant on positive alternating fibered links in terms of elementary symmetric polynomials. We also discuss behavior of our formulas under connected sums, and applications to knot theory.

INVESTIGATING A VOLCANO AT A TRANSFORM FAULT: UNDERSTANDING THE RELATIONSHIP BETWEEN TECTONICS AND MT. EDGECUMBE IN SE ALASKA WITH GNSS DATA
Presenter(s): Jordan Light (Fort Valley State University)
Category: Physical & Mathematical Sciences
Mentors(s): Julie Elliott (College of Natural Science)

Southeast Alaska is a tectonically active region that lies between the Pacific Ocean and western Canada. The main tectonic feature there is the Fairweather-Queen Charlotte fault, a transform fault (a type of fault that has horizontal motion, otherwise known as strike-slip). Transform faults are not usually associated with volcanoes, but Mt. Edgecumbe, a large, recently active stratovolcano, sits east of the fault near Sitka, Alaska. The reason why Mt. Edgecumbe exists next to a transform fault is not understood, partly because of the lack of data. We use a new GNSS dataset from the region along with fault models to investigate regional tectonic motions and whether the fault may have extension or contraction. We evaluate over 100 GNSS site time series in the region and estimate and remove the effects of earthquakes and seasonal hydrologic change to help isolate the long-term tectonic signal. Using these adjusted time series, we develop a new GNSS velocity field. This velocity field will have predictions of glacial isostatic adjustment removed (loss of ice in southeast Alaska impacts the observed deformation) and will be calculated relative to the motion of North America. We will then compare the new velocity field with predictions from several possible fault models of the Queen Charlotte system to see which fault model (strike-slip only motion, strike-slip plus extension, or strike-slip plus contraction) best fits our data. Our results will allow us to gain a better understanding of why Mt. Edgecumbe is located so close to the Fairweather-Queen Charlotte Fault.

PH-ASSISTED ULTRASONIC DEAGGLOMERATION AND CHARACTERIZATION OF NANODIAMONDS
Presenter(s): Victor Nguyen (Harvey Mudd College)
Category: Physical & Mathematical Sciences
Mentors(s): Alex Loomis (College of Natural Science), Shannon Nicley (College of Engineering)

Diamond nanoparticles (DNPs), a nanoscopic allotrope of carbon, possesses interesting chemical, optical, and mechanical properties that enable applications in biomedical and quantum applications. Individual DNPs are beneficial for such applications because of their reduced size and increased brightness. Some techniques for synthesizing DNPs include high pressure high temperature (HPHT) ball-milling, detonation synthesis, and chemical vapor deposition (CVD). In this study, commercially available detonation nanodiamonds (DNDs) were coated with nitrogen-doped CVD-grown diamond in a hot filament system in order to achieve the properties of fluorescent nanodiamonds, a method which is orders of magnitude less expensive than HPHT milled fluorescent nanodiamonds. The CVD-coated DNPs were distributed into five different 50 mL solutions, with varying pH. Next, samples were de-agglomerated by an ultrasonication at high input power settings. The deagglomerated samples were then rinsed in dialysis tubing and filtered with syringe filters. Samples were characterized by dynamic light scattering and electrophoretic light scattering to determine hydrodynamic diameter and zeta potential after each step of post-synthesis processing. Lastly, samples were spin coated onto silicon wafers and imaged with scanning electron microscopy to observe both the sizes of the individual nanoparticles and the sizes of the agglomerates. These results will provide insight into reagglomeration after sonication and the effect of pH on reagglomeration. These findings may assist in further scalable DNP synthesis and post-synthesis processes in commercial uses. Furthermore, efficient deagglomeration of DNPs facilitates their usage in biomedical imaging and quantum sensing as a result of their advantageous composition.

EFFECTS OF INCREASING PARTICLE RESOLUTION IN PLANET FORMATION SIMULATIONS
Presenter(s): Mark Pais (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Seth Jacobson (College of Natural Science)

Many terrestrial planet formation models exist that are able to produce solar system analogs with accurate matches to planet masses and orbital configurations. In these simulations, giant impacts occur between planetary embryos, which are large growing bodies roughly the size of the Moon to Mars. For computational simplicity, previous works have often assumed that all collisions conserve mass and momentum, merging bodies into a single remnant and neglecting the possibility of debris production. However, impact generated debris can influence dynamical evolution, redistribute mass, and leave potentially observable signatures within the solar system. In the limited number of studies that include debris, the number of introduced debris is low, i.e., overly massive particles, possibly capturing the role of imperfect accretion on the growing planetary bodies, but making it difficult to accurately assess the fates of debris particles within the inner solar system. Understanding what happens to this debris is important for building a more physically accurate picture of terrestrial planet formation. In this work, I explore a range of debris particle resolutions using the N body integrator SyMBA with a sophisticated collision model that generates and tracks impact debris. By systematically increasing the number of debris particles produced per collision, I determine the resolution at which the evolution of debris converges and becomes sufficiently resolved to support reliable claims about its dynamical behavior during terrestrial planet formation. By identifying the resolution required to accurately capture debris evolution, this work improves how giant impacts are modeled in terrestrial planet formation simulations and provides stronger constraints on the role of impact generated debris in shaping emerging planetary systems.

A NOVEL MODEL FOR DEFORMATION IN SOUTH-CENTRAL ALASKA
Presenter(s): Charlotte Boehme (University of Arkansas)
Category: Physical & Mathematical Sciences
Mentors(s): Jeffrey Freymueller (College of Natural Science), Julie Elliott (College of Natural Science)

Alaska is a region with complex tectonic activity as well as a number of non-tectonic signals which contribute to the deformation field in the region. This can create a challenge for surveyors, who need accurate estimates of motion at different time scales. The challenge can be overcome in some cases by using a deformation model produced by the National Geodetic Survey called Horizontal Time-Dependent Positioning (HTDP). A deformation model allows surveyors to remove estimates of crustal motion from their survey observations. HTDP does not fully account for time-varying motion, which can lead to errors over time. In particular, the area near Anchorage and around much of Cook Inlet experienced changes in deformation that have made the predictions from HTDP inaccurate. Using data from 154 continuous GPS sites throughout southern Alaska, we develop a new model for spatiotemporal changes in deformation due to factors on a variety of timescales. To construct a model of deformation in southern Alaska, we will analyze time series data from continuous GPS sites across south-central Alaska to remove the effects of earthquakes, equipment issues, and seasonal hydrology in the region. This will leave several unmodeled signals, including time-varying tectonic signals. To estimate these signals, we will create a combined spatial interpolation model of these signals. We will add the previously subtracted models to the new interpolation to create a model of the overall deformation field. This new model can then be used to improve estimates of the complex deformation across south-central Alaska.

CONTROL SYSTEMS IN THE SEARCH FOR TIME-REVERSAL VIOLATION IN PEAR SHAPED NUCLEI
Presenter(s): Ryan Tanzer (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Jaideep Singh (Facility for Rare Isotope Beams)

The existence of the visible part of the universe is thought to be due to subatomic forces unlike each other when you reverse the arrow of time. The Radium Electric Dipole Moment experiment, hosted at Argonne National Lab, is designed to search for these exotic subatomic forces using atomic clocks. A time-reversal violation is indicated by a difference in two atomic clocks oriented clockwise and counterclockwise with respect to an electric field. Radium nuclei are used as these clocks because of their pear-shaped deformations, allowing for a clock rate difference possibly one thousand times that of non-deformed nuclei. The clock rate difference is proportional to the electric field magnitude. However, for this enhancement to matter, you need a large electric field, upwards of 600 kV/cm, which is what our system was upgraded to. For this upgrade, we needed to get fully new components and an entirely new system, due to our old system only being 60 kV/cm. In this talk, I will discuss how we are using relays to switch the electric field, how we use dividers to safely read the voltage, and the other sensors and controls we use to be able to monitor the setup safely from a central computer. This work is supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics under Award Numbers DE-SC0019455, DE-SC0025679, DE-AC02-06CH11357. This work also used resources of the FRIB Operations, which is a DOE Office of Science User Facility under Award Number DE-SC0023633.

CONFIRMATION OF M-DWARF ECLIPSING BINARIES FROM TESS
Presenter(s): Griffin Siersma (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Joey Rodriguez (College of Natural Science)

Current evolutionary models of M-dwarf stars struggle to predict their fundamental parameters, leading to larger uncertainties when studying the exoplanets that orbit them. Specifically, M-dwarfs tend to be larger and cooler than evolutionary models predict. Eclipsing binaries provide well-suited laboratories to test these models directly by measuring model-independent mass, radius, and effective temperature. Using observations from NASA's TESS mission combined with ground-based radial velocities, we have confirmed and characterized 6 systems that contain an F, G, or K-dwarf primary and an M-dwarf companion. I will present the analysis of these systems and how their mass, radius, and effective temperature compare to current theoretical predictions.

POLYDISPERSITY IN GRAVITATIONALLY COLLAPSING PEBBLE CLOUDS AND ITS EFFECT ON FINAL PLANETESIMAL SHAPES, DENSITIES, AND ROTATION STATES
Presenter(s): Vaibhav Chhajed (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Jackson Barnes (College of Natural Science), Seth Jacobson (College of Natural Science)

Planetesimals-the building blocks of planets-form from the gravitational collapse of pebble clouds in protoplanetary disks. This project investigates how the initial size distribution and rotation rate of these pebble clouds influence the physical properties of the resulting planetesimals, including their shapes, densities, and tendency to form binary systems. Using the N-body simulation code PKDGRAV with self-gravity and soft-sphere collision modeling (SSDEM), we simulate both monodisperse and polydisperse pebble clouds under varying rotational conditions. Our results show that monodisperse clouds tend to form more uniform and symmetric bodies, while polydisperse clouds produce more structurally complex and irregular planetesimals. In terms of shape, monodisperse aggregates exhibit crystalline-like packing that leads to more axisymmetric configurations and higher effective internal friction angles, whereas polydisperse systems suppress ordered packing and allow for greater deformation and shape diversity. In contrast, polydisperse planetesimals achieve systematically higher bulk densities, as smaller particles fill voids between larger ones and enhance overall packing efficiency. Monodisperse systems, by comparison, retain larger void spaces due to their ordered packing, resulting in lower bulk densities. Additionally, faster rotation favors binary formation and body flattening, while slower rotation promotes more spheroidal configurations. These findings provide new insights into early planet formation and help explain the observed diversity in shapes and densities among asteroids and Kuiper Belt objects

TOWARDS NUCLEAR SCHIFF MOMENT MEASUREMENT: LASER SPECTROSCOPY OF THORIUM MONOXIDE AND OPTICAL CYCLING
Presenter(s): Alexandria Hunter (Michigan State University), Julia Dunn (University of Notre Dame)
Category: Physical & Mathematical Sciences
Mentors(s): Xing Wu (Facility for Rare Isotope Beams)

Theories beyond the standard model seek to explain the asymmetry between matter and anti-matter in our universe by invoking violations of symmetries in nature, including charge, parity, and time-reversal. One measurement to constrain these theories is the nuclear Schiff moment (NSM), a property that quantifies the symmetry-violating distortion of charge distribution within a nucleus. QuEST lab aims to measure the NSM of radioactive 227ThO, because of its large, deformed nucleus. This experiment requires the construction of a cryogenic beam source to produce 227ThO, demonstrate optical cycling, and prepare and probe 227ThO in a specific quantum state. Optical cycling requires an understanding of the hyperfine structure of a molecule, which has never been charted for 227ThO. To combat this, we developed a laser spectroscopy system to measure the hyperfine structure of 227ThO for the first time. Laser spectroscopy involves flashing light at the object, and finding the number of photons the molecule has emitted back or absorbed. Part of the process is alignment and direction of the laser beam with mirrors and fibers, but there are too many factors for human optimization. Thus, we turned to machine learning, attaching precise motors to the mirrors to construct an association of power values with different mirror locations. This was fed to an AI system in collaboration with MSU's engineering department and tested under different environmental conditions. In the future, this will increase safety, time saved, and data precision. We plan to benchmark the system using the well-documented 232ThO isotope before transitioning to 227ThO.

ACTIVE GALACTIC NUCLEI FEEDBACK IN ELLIPTICAL GALAXIES
Presenter(s): Leslie Lainio (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Brian OShea (Research & Innovation)

At the center of every giant galaxy there exists a supermassive black hole, and although it's incredibly tiny compared to the scale of its host galaxy, processes that occur around this "SMBH" are tightly coupled with the evolution of the galaxy as a whole. Black hole "feedback" is an overarching term that describes the mechanism which drives gas out of the galaxy's nucleus and into its surrounding medium. This outflow of gas essentially regulates galaxy growth and "quenches", or suppresses, the formation of stars, since the SMBH drives hot gas out of the nucleus and prevents a strong cooling flow, which is needed for stellar formation. Feedback is especially important to the evolution of elliptical galaxies, the largest galaxies in the universe, because the SMBHs tend to be much more massive, and in turn the feedback is much stronger. The feedback properties of an "Active Galactic Nucleus", or AGN, determines the behavior of the host galaxy's evolution, so studying initial parameters of AGNs can help us predict and discover how galaxies will evolve over large time periods. Since galactic evolution occurs on such long timescales, astrophysical simulations of massive galaxies are needed to accurately model and predict the behavior of AGNs. We have analyzed a variety of elliptical galaxy simulations to try and determine how the deposition of different types of energy into the surrounding medium of a galaxy impacts evolution.

MULTI-WAVELENGTH OBSERVATIONS OF NOVAE WITH EVOLVED COMPANIONS
Presenter(s): Wilhelm Hawes (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Bella Molina (College of Natural Science), Laura Chomiuk (College of Natural Science)

Classical novae occur in binary systems when a white dwarf accumulates the material from their companion star and causes a thermonuclear eruption in the accreted material. The eruptions emit detectable radiation from a range of wavelengths. Radio observations are useful when studying classical novae eruptions, as they are not impacted by dust and gas. We can use observations from the electromagnetic spectrum to study the physical characteristics of the white dwarf and the eruption. Here we study 11 novae, V723 Cas, V745 Sco, V1370 Aql, V3890 Sqr, V5589 Sgr, V407 Cyg, V1535 Sco, V392 Per, V1534 Sco, U Sco, and RS Oph. These novae present a range of orbital periods as their companions include subgiants to Mira giants. We plot and analyze their radio and optical light curves, estimate their brightness temperature, analyze spectral index evolution and characterize these novae. We are able to determine the main source of the radio emission and compare multi-wavelength properties with binary properties.

IMAGING NGC6822 USING THE LOCAL GROUP L-BAND SURVEY
Presenter(s): Ellie Summerfield (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Laura Chomiuk (College of Natural Science), Thomas Do (College of Natural Science)

The Local Group L-Band Survey targets nearby galaxies in the 1-2 GHz range using data collected from the Very Large Array, with the intent of testing theories regarding cold clouds, interstellar turbulence, and massive stars and supernovae. NGC 6822, one of the 6 main galaxies targeted by the LGLBS, is a low-metallicity, irregular, dwarf galaxy. This poster discusses the process used to calibrate and image NGC 6822 using continuum data collected by the LGLBS.

GEOMETRIC OPTIMIZATION OF HIGH-TEMPERATURE EFFUSION SYSTEMS FOR SHORT-LIVED ISOTOPES
Presenter(s): Guilherme Roda (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Antonio Camargo Villari (Facility for Rare Isotope Beams)

Effusive transport strongly influences the extraction efficiency of short-lived isotopes in high-temperature solid-stopper ion-source systems. In the SOL project at the Facility for Rare Isotope Beams (FRIB), neutral atoms released from a heated stopper must travel through a transfer tube and reach an ion source before radioactive decay occurs. In this work, we investigate the influence of system geometry and surface interactions on the effusion efficiency using test-particle Monte Carlo simulations performed with MolFlow+ under molecular-flow conditions. Cylindrical and conical diffusion chambers with equal volume were compared while systematically varying the radius of the transfer tube. The simulations provide estimates of the mean delay time and the average number of particle-wall collisions for isotopes with half-lives between 0.25 and 10 s at a temperature of 2000 K. The results show that the transport dynamics are primarily governed by the radius of the transfer tube, while the detailed chamber geometry has little impact on the global transport properties. A linearly expanding tube geometry was also investigated and yields intermediate transport behavior between narrow and wide constant-radius tubes. By combining simulated flight times with adsorption data, effusion efficiencies were estimated for representative tracers in a tantalum matrix. The results demonstrate that adsorption properties strongly influence the achievable efficiency, with predicted efficiencies ranging from below 1% for strongly adsorbing species to above 90% for weakly adsorbing tracers at favorable geometries. These results provide guidance for optimizing high-temperature effusion systems for rare-isotope production.

ANALYSIS OF NICKEL-61 HYPERFINE SPECTRA FROM RESONANCE IONIZATION LASER SPECTROSCOPY
Presenter(s): Max Doyle (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Kei Minamisono (Facility for Rare Isotope Beams)

Understanding the structure of nuclei far from stable isotopes is an important goal in nuclear physics because it provides insight into how nuclear properties evolve towards the existence limit of nuclides. We recently performed an experiment to study the structure of short-lived radioactive 52Ni, six neutrons removed from stable 58Ni. For reliable extraction of its structure, 61Ni is an important reference stable isotope , whose well-characterized hyperfine structure is required to extract structural information from the 52Ni data. My project focuses on the analysis of experimental data on the 61Ni collected at the Beam Cooler and Laser Spectroscopy (BECOLA) facility at the Facility for Rare Isotope Beams (FRIB). During the experiment, a beam of Nickel-61 ions was generated in an offline ionsource, neutralized in a sodium charge-exchange cell and resonantly ionized using a single-step laser excitation. As the laser frequency was scanned, the resulting resonant ions were detected to produce a hyperfine spectrum and hyperfine coupling constants were deduced, which are required for the analysis of radioactive 52Ni. I developed Python-based analysis tools to process the experimental data. The analysis included transformation of the experimental to the rest frame frequency via the Doppler-shift, time-gated background reduction, combining multiple scans to improve counting statistics, and fitting the measured spectra with a theoretical model of hyperfine structure with the pseudo-Voigt line profile. As the result of the fit, the hyperfine coupling constants were deduced, which will be used as an important input to analyze the radioactive Ni isotopes including 52Ni. The detail of the measurement, analysis procedure and the results of the hyperfine coupling constants will be presented.

DISTRIBUTIONS OF INTERSTELLAR IMPACTORS ON MERCURY, MARS, AND JUPITER
Presenter(s): Celeste Emery (University of Illinois - Urbana-Champaign)
Category: Physical & Mathematical Sciences
Mentors(s): Darryl Seligman (College of Natural Science)

Three macroscopic ($\sim$km) scale interstellar objects have been detected passing through the Solar System within the last decade. If these detections are drawn from the same source population as smaller ($\sim\mu$m) scale interstellar dust by a continuous power-law size-frequency distribution, then a substantial population of intermediate-sized interstellar objects should also exist. This implies that a subset of terrestrial impactors should have extrasolar origins, although no interstellar meteors have been robustly detected to date. To explain this apparent flux gap, we generate a synthetic population of interstellar objects with M-star kinematics that impact Mercury, Mars, and Jupiter. These simulations provide a per-planet understanding of relative impact rates and orbital properties of interstellar impactors that can be used to identify interstellar objects in impactor datasets, either directly or indirectly. Impactors occur for Mercury, Mars, and Jupiter at a relative frequency of approximately $\sim$2:1:260, demonstrated by numerical simulations and confirmed with an analytic approach. The overall distribution of the impactors' orbital elements are broadly similar per planet. The radiants of the interstellar impactors are more dispersed across the sky/concentrated towards the solar apex as the planet heliocentric distance decreases/increases. Impactors on more distant planets have smaller typical pre-impact velocities and eccentricities. Impacts typically occur at low eccentricities and relative velocities, indicating that they more frequently collide when their perihelia intersect the planetary toroid. We analytically estimate impacts on detected planetary bodies and find that exoplanets are more likely to be impacted than most solar system planets by a factor of 10^2-10^4.

TOWARDS THE TOTAL SYNTHESIS OF OBTUSIN
Presenter(s): Melanie Valtadoros (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Babak Borhan (College of Natural Science)

Obtusin is a natural product in the Laurencia family that can be found in the red sea sponge Laurencia obtusa. Laurencia family molecules are unique in that they are halogenated and contain a terminal alkyne. Ten intermediate steps of the total synthesis were carried out on a gram scale with an overall yield of 20%. The steps carried out lead to a final polyhalogenation cascade, which with one additional deprotecting step will result in the final product.

BENCHMARKING WEPY-PYSCF WITH ENHANCED SAMPLING AB INITIO MOLECULAR DYNAMICS
Presenter(s): Nolan French (Western Kentucky University)
Category: Physical & Mathematical Sciences
Mentors(s): Samik Bose (College of Natural Science)

The goal of this project is to integrate and apply popular quantum mechanical molecular dynamics (QMMD) software package PySCF with Wepy, a weighted ensemble resampling package. Weighted ensemble sampling allows us to simulate rare events such as chemical reactions that occur on timescales inaccessible to standard QMMD. My role in this project was simulating four main, well studied, chemical systems, those being multiple types of SN2 reactions, Butane rearrangement, Malonaldehyde proton transfer, and pericyclic reactions, such as

Diels Alder. I also built a new distance metric incorporating charges and contributed to establishing the analysis pipeline. These distance metrics allow us to define a progress coordinate for the weighted ensemble program. I benchmarked performance by optimizing simulation parameters, wall time, and comparing integrators, namely Langevin Middle and Bussi integrators. The future goal with this project is to prepare its use in larger biological systems using QMMM, which uses classical mechanical MD on most of the system and QMMD on a small region where bond breaking/making is occurring.

ASSESSING FLARING ACTIVITY IN METAL-POOR STARS
Presenter(s): Michael Roshal (University of Texas)
Category: Physical & Mathematical Sciences
Mentors(s): Adina Feinstein (College of Natural Science)

Flares are extreme sudden bursts of energy triggered by the reconnection of tangled stellar magnetic fields. While they can be directly resolved on our own Sun, flares on other stars are observed in time-series observations as a sudden increase in flux. Stellar flares have a unique fast-rise exponential-decay behavior in light curve observations. To differentiate flaring from other phenomena affecting the flux, such as periodicity or noise, algorithms like AltaiPony use a combination of light curve detrending and Markov Chain Monte Carlo to fit candidate flare events. Recent studies show evidence of a link between low stellar metallicity (lack of elements heavier than helium) and reduced flaring activity. In this work, we evaluated the flaring rate of extremely metal-poor stars ([Fe/h] = -1 to -3.6) using observations from NASA's Transiting Exoplanet Survey Satellite (TESS). We wrote a Python program that creates the light curve for any given star using its sky coordinates, identifies flares within the light curve, and removes false detections from the resulting flares. Additionally, we made a tool to view the flares, light curves and Target Pixel Files (TPFs) to manually vet the results and confirm the flares. After running the program for 21,473 stars in parallel on the High-Performance Computing Center, we found only 37 flaring stars to have a total of 88 flares. This extremely low flaring rate follows theoretical predictions. Our results also indicate that low-metallicity stellar flares have a Gaussian behavior, unlike standard flares.

USER-FOCUSED PLATFORM FOR NUCLEAR ASTROPHYSICS
Presenter(s): Skyler Gangestad (High Point University)
Category: Physical & Mathematical Sciences
Mentors(s): Kyle Godbey (Facility for Rare Isotope Beams), Yukiya Saito (Facility for Rare Isotope Beams)

The rapid neutron capture process (r-process) is fundamental to the cosmic nucleosynthesis of heavy elements. The r-process happens during astrophysical events such as binary neutron star mergers or core-collapse supernovae, and it is believed to create around half of the heavy elements. To model the r-process the computational simulations need many different types of nuclear data, with experimental observations being supplemented by theoretical calculations in various regions of the nuclear chart. Currently, the data used for these simulations, both experimental measurements and theoretical calculations, are scattered across disparate sources ranging from published papers to online repositories. There is an existing web application developed by a team at the Facility for Rare Isotope Beams (FRIB) called the Bayesian Mass Explorer (BMEX) that hosts combined experimental and theoretical data on nuclear masses. My project focuses on expanding the capabilities of the BMEX platform to create a centralized, user-focused database for r-process nucleosynthesis research. For this summer period, we will expand existing infrastructure to include critical data such as beta-decay and neutron capture rates. Ultimately, our project will provide an accessible data repository of nuclear properties that can be directly adopted by practitioners to use in their analyses, accelerating discovery and understanding in nuclear astrophysics.

MULTI-WAVELENGTH PHOTOMETRIC ANALYSIS OF KNOWN NOVAE
Presenter(s): Isabella Breedlove (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Allison Crossland (College of Natural Science)

Estimates of the Galactic classical nova rate range from 26-100 eruptions per year, yet only a small fraction of this estimate are discovered observationally each year. This suggests that many novae remain undetected, likely including fast, faint events that are harder to identify with typical search methods. This project uses an archival search for previously identified Galactic novae in infrared and optical survey data from surveys including the Palomar Gattini-IR Survey (PGIR), All-Sky Automated Survey for Supernovae (ASAS-SN), Asteroid Terrestrial-impact Last Alert System (ATLAS), and Zwicky Transient Facility (ZTF). Nova candidates identified through these surveys will be used to examine sources and solutions for any gaps in current nova documentation and improve constraints on the Galactic nova rate. Characterizing these gaps will help determine whether earlier detection of nova eruptions is achievable, which has direct implications for follow-up observations - earlier alerts enable spectroscopic and photometric coverage of the less documented initial phases of nova evolution. Multi-band archival light curves from these surveys allow for better understanding of color evolution across the duration of eruptions and the physical conditions of the ejecta over time. Developing a more complete nova census will contribute to understanding the frequency and properties of nova populations that have been continuously overlooked.

DYNAMICAL INSTABILITIES AND PLANETARY ENGULFMENT IN EXTRASOLAR SYSTEMS

Presenter(s): Evelyn Meyersieck (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Seth Jacobson (College of Natural Science)

Young planetary systems are often dynamically unstable, resulting in ejections, planetary collisions, and planetary engulfment by the host star. During engulfment, the planet is destroyed and its constituent atoms are mixed into the stellar atmosphere, potentially leaving detectable chemical signatures, most notably Lithium which otherwise has typically been depleted earlier in stellar evolution. Understanding the frequency and conditions under which these events occur gives insight on observed stellar chemical abundance and system history. Using the Rebound astrophysical N-body integrator, we simulate the dynamics of formed planetary systems prior to, during, and after numerical instability. Our experiments vary the fundamental parameters describing the initial planetary architectures as a primary independent variable. We monitor the progress and final outcomes to track the evolution of surviving planets and identify engulfment events and their properties. These results will provide a statistical study of the history of engulfment across planetary systems and quantitative results to a hypothesis that is qualitatively well established: that instabilities in planetary systems can leave traceable chemical signatures within the host star. Investigating how dynamical instabilities among forming extrasolar planets inject material into the host star will give a new lens to study internal planet composition, whose material is otherwise inaccessible once destroyed and dispersed within the host star during engulfment.

DESIGN AND SYNTHESIS OF A PROGRAMMABLE CHIRAL CATALYST

Presenter(s): Molly Gaugler (Michigan State University)
Category: Physical & Mathematical Sciences
Mentors(s): Babak Borhan (College of Natural Science)

Interest in supramolecular catalysts has increased rapidly in recent years. Organic and metallic catalysts especially show promise, containing the ability to rival and mimic the effectiveness of enzymes used in similar processes. However, these catalysts are typically locked as one enantiomer, allowing for the synthesis of only one chiral product when used. If there was a catalyst system that allowed for the enantiomeric identity of the catalyst to be switchable, researchers would no longer need to produce both catalyst enantiomers in order to obtain desired products. Our research aims to synthesize a helically switchable chiral catalyst in order to fill this gap. Taking inspiration from well-known catalyst scaffolding, the catalyst will contain the ability to coordinate ligands between bis-porphyrin tweezers, forcing a change in the enantiomeric identity of the catalyst, thereby creating a "programmable" chiral system upon chiral ligand insertion. The ability to selectively obtain either chiral product from a single catalyst is particularly important in pharmaceutical development as well as advancement in the field of synthetic chemistry.

Plant Science

REGULATION OF RHIZOME DEVELOPMENT IN MONKEYFLOWERS
Presenter(s): Esther Woolcock (Michigan State University)
Category: Plant Science
Mentors(s): David Lowry (College of Natural Science), Madison Plunkert (College of Agriculture & Natural Resources)

Perennial yellow monkeyflowers are known to favor vegetative growth, producing many aboveground rooted stems known as stolons and, in some cases, rhizomes. Rhizomes are underground stems that store nutrients and support survival in harsh conditions, with buds that burrow underground that are protected year-round. In yellow monkeyflowers (Mimulus guttatus), overexpression of the ACR8 gene can produce rhizomes in a non-rhizomatous genetic background. While this is true for rhizome production in laboratory generated transgenics, the role of ACR8 is unclear in naturally rhizome producing plants. To determine the impact of ACR8 on rhizome production and associated phenotypes, I compared ACR8 overexpression lines with wild-type plants. I found that ACR8 overexpression lines produced similar numbers of stolons to wild-type, with one transgenic line producing stolons at a higher stem node. Additional anatomical traits, including stem diameter, pith area, vascular area, cortex area, and xylem cell diameter, are also being measured to test whether ACR8 affects traits that are anatomically different between rhizomes and stolons. To characterize the ACR8 expression pattern in natural accessions, I expressed the GUS reporter gene driven by the ACR8 promoter in rhizomatous and non-rhizomatous lines. GUS expression produces a blue color, allowing visualization of ACR8 expression. This experiment will provide insight into the function of ACR8 in natural accessions and will reveal how ACR8, impacts rhizome production. Understanding the role of ACR8 in rhizome production is important for gaining insight into how genes produce morphological diversity.

THE ROLE OF CARBON METABOLISM, PHOTORESPIRATION, AND REDOX SIGNALING IN STRESS ACCLIMATION TO HIGH LIGHT AND PHOSPHATE LIMITATION IN ARABIDOPSIS
Presenter(s): Beyonce Mendoza (Northeastern Illinois University)
Category: Plant Science
Mentors(s): Hiruni Weerasooriya (College of Natural Science), Jianping Hu (College of Natural Science)

Plants rely on tightly coordinated cellular processes to maintain homeostasis, yet key pathways such as carbon metabolism, photorespiration, and redox regulation remain incompletely understood. Carbon metabolism is central to photosynthesis, where rubisco fixes CO_2 into organic compounds but also catalyzes oxygenation reaction, triggering photorespiration that releases CO_2 and lowers photosynthetic efficiency. Redox signaling maintains cellular balance by regulating ROS and antioxidant systems, which are crucial under stress when ROS levels increase. This project examines how mutations in photorespiration (hydroxypyruvate reductase (hpr)1, andhpr2), carbon metabolism (redox responsive transcription factor (rrtf)1, triose-phosphate translocator (tpt), triosephosphate isomerase (tpi)) and redox signaling (gamma-glutamyl cyclotransferase (ggct)-like) affect Arabidopsis thaliana in different stress conditions. HPRs catalyze the conversion of hydroxypyruvate to glycerate, with HPR1 localized in peroxisomes and HPR2 in the cytosol. We hypothesize that localization, substrate specificity, and redox regulation determine the functional hierarchy of HPR isoforms. To test this, we retargeted HPR1 to the cytosol and HPR2 to peroxisomes in hpr1 knockouts and will evaluate growth and photosynthetic performance in high light. The function of the mitochondria and chloroplast localized GGCT-like protein in glutathione turnover and lipid metabolism will be evaluated under phosphate-limited conditions through growth and lipid profiling. In parallel, carbon metabolism mutants will be analyzed under high-light conditions to determine their effects on photosynthetic efficiency. Collectively, this work aims to elucidate how photorespiration, carbon metabolism, and redox signaling contribute to plant stress adaptation and metabolic flexibility. These findings will provide a foundation for engineering climate-resilient crops with enhanced stress tolerance.

ASSESSING LEAF BREAKDOWN CAUSED BY LEAF-ASSOCIATED FUNGI
Presenter(s): Isabella Norton (Michigan State University)
Category: Plant Science
Mentors(s): Linda Hanson (College of Agriculture & Natural Resources)

Michigan consistently ranks among the top-producing states in the U.S. for sugar beets, which are predominantly processed into sugar. Cercospora beticola, has been increasingly affecting crops in the sugar beet industry. This fungal pathogen survives on leaf litter; the spores can spread from plant debris by rain, insects, or wind. This project asks: Which fungi help break down sugar beet leaf litter faster, thereby limiting the spread of Cercospora beticola by removing its protective survival material? By introducing known saprophytic fungi that are strong decomposers, this project will test whether accelerating leaf breakdown can shorten the window during which Cercospora beticola can survive. Spores were sampled from existing Sugar Beet leaves onto ½ V8 media. The seven isolates with the highest growth rate were selected. 64 leaves were defoliated from Sugar beet plants, inoculated with isolates, then placed into sterile cake pans (33cm by 23cm). A spore count was performed to reach a concentration of 100 spores ml-2. Leaves were mostly rotted by day 19 or 20, marking the end of data recording. A photograph of each leaf was taken on each sampling day. Leaves were measured by weight, length, and degree of bend. Leaf weight, length, and degree of bend were not good proxies for leaf decay. Visual degradation was largely inconsistent across the isolates. But Isolates DVII and DW showed consistent breakdown symptoms. These two isolates showed the most significant breakdown, with leaves appearing translucent and/or necrotic.

ASSESSING NITROGEN FLUX THROUGH THE DENITRIFICATION PATHWAY IN PURE BACTERIAL CULTURES
Presenter(s): Alexandra Chisholm (Grand Valley State University)
Category: Plant Science
Mentors(s): Elise Rivett (Research & Innovation)

Nitrous oxide (N2O) is a powerful greenhouse gas and ozone-depleting substance. A significant source of N2O emissions stem from microbial metabolic activity in agricultural soils through the incomplete cycling of nitrate and nitrite into dinitrogen gas. In anaerobic soils, denitrification is the primary pathway contributing to N2O emissions, with various bacteria possessing the genetic capability to initiate the successive reduction of nitrogen oxides using a series of reductases. However, incomplete denitrification is common in soil ecosystems in part due to species that lack vital enzymes, like nitrite reductase (Nir) or nitrous oxide reductase (NosZ), that facilitate this biochemical process. As such, despite soil bacteria's fundamental role in regulating N2O, the precise understanding of how nitrogen fluctuates in the field between consumption and production is incomplete. In this study, we develop protocols for assessing in vitro N2O consumption and production in two species of denitrification-capable rhizobacteria, Ochrobactrum sp. 370MFChir3.1 and Bacillus sp. UNC41MFS5, with comparison to the well- studied denitrifier Stutzerimonas stutzeri ZoBell. We tested NO3- and N2O conversion capabilities of all three species by inducing expression of NosZ in each culture during growth, then resuspending the cells in serum vials and sparging with N2 before introducing N2O. Our results demonstrate how different pure bacteria cultures consume and convert nitrogen compounds at varying rates, which will be critical for measuring and modeling N2O flux in these diverse species.

PUTTING THE BOT IN BOTANY: AUTOMATING DNA EXTRACTIONS FOR PLANT GENOMICS
Presenter(s): Taylor Allen (Ohio Northern University)
Category: Plant Science
Mentors(s): Brent Lieb (College of Agriculture & Natural Resources), Jazlyn Salazar-Lucero (College of Agriculture & Natural Resources), Mason McNair (College of Agriculture & Natural Resources)

Plants are notoriously difficult to extract genomic DNA from, as the various secondary metabolites can complicate mechanical or chemical aspects of conventional DNA extraction. Many procedures have been created to resolve this issue, including commercial kits from Omega Bio-tek, Zymo Research, Qiagen, OPS Diagnostics, and Invitrogen, as well as the modified CTAB protocol. However, DNA extractions remain labor intensive and time consuming. This project aims to automate these DNA extraction procedures on the Opentrons Flex robot in order to increase efficiency and efficacy and reduce labor. The result is several pre-programmed protocols that are shareable and customizable to the larger research community, allowing for more broadly applicable, consistent, easy to follow, and versatile extraction methods. Going forward, the Opentrons robot with its various protocols will be evaluated in application to milkweeds (Asclepias) and eastern redbud (Cercis canadensis). Success is measured by robot efficiency as well as purity and integrity of extracted DNA.

DETERMINING THE ORGANIZATION OF PHOTORESPIRATORY ENZYMES IN THE PEROXISOMAL MATRIX
Presenter(s): Natalie Caragianis (Centre College)
Category: Plant Science
Mentors(s): Berkley Walker (College of Natural Science), Taylor Smith (College of Natural Science)

The oxygenase activity of ribulose-1,5-bisphosphate carboxylase/oxygenase (rubisco) leads to both inefficiency in carbon fixation and the creation of toxic, inhibitory byproducts such as 2-phosphoglycolate. Photorespiration allows for the detoxification of 2-phosphoglycolate and partial recovery of lost carbon into the Calvin-Benson cycle. Because of rubisco's lack of reliable CO2 specificity, there is a high level of flux through the photorespiratory pathway in photosynthetic tissues, with much of this process taking place in peroxisomes. While previous research has demonstrated that the compartmentation of peroxisomes is a function of their dense protein core rather than the peroxisomal membrane, the structural or organizational features which allow for such a high flux through a small, dense organelle are unresolved. This research aims to structurally characterize the peroxisomal matrix and determine its role in the facilitation of photorespiratory flux using various imaging techniques. Cryo-electron tomography (Cryo-ET) of both isolated and in situ peroxisomes will be used to visualize the protein core. Bimolecular Fluorescence Complementation (BiFC) will be used to demonstrate individual interactions between sequential photorespiratory enzymes we expect to have a physical association. We anticipate the peroxisomal protein core will be shown to have higher level organization which allows for substrate channeling of intermediates and greater overall efficiency. The results of this research may also provide insight into potential avenues for engineering more intuitive photorespiratory enzyme scaffolding to improve plant productivity in variable environments.

DEVELOPING IMMUNE ASSAYS IN SWEET CHERRY THAT SCREEN FOR HOST PLANT RESISTANCE AGAINST INFECTION BY PSEUDOMONAS SYRINGAE
Presenter(s): Brian Gavarrete (William Paterson University)
Category: Plant Science
Mentors(s): Michelle Hulin (College of Agriculture & Natural Resources), Sophia Liberto (College of Natural Science)

Pseudomonas syringae is a remarkably diverse, phytopathogenic bacterial species complex consisting of 13 phylogroups and around 60 distinct pathovars. Pseudomonas amygdali pv. morsprunorum (Pam) infects Prunus spp. and can cause bacterial canker disease. Isolates of Pam have previously displayed varying levels of virulence in Prunus spp., which may be influenced by differences in type 3 effector (T3E) protein repertoires. The pathogen is frequently responsible for massive crop losses and devastates nurseries and orchards. Furthermore, current management strategies, such as the use of copper-based biocides and antibiotics like kasugamycin, continue to fail as bacterial resistance increases. A promising solution is a new emphasis on screening and breeding for host plant resistance. In this work we attempted to optimize immune assays in sweet cherry and peach that were previously established in the model plant species Arabidopsisthaliana. We show that assays measuring reactive oxygen species (ROS), an important plant immune response mechanism, shortly following exposure to response elicitors can quantify host plant responses in Arabidopsis and peach. Interestingly, sweet cherry leaf discs did not appear to respond to elicitors, possibly due to a limiting leaf physiology. This work also further investigated the genomic elements underlying the virulence differences among Pam isolates by cloning candidate T3Es into isolates showing divergent virulence. We show that an isolate's virulence could be altered in a predictable manner upon the introduction of new T3Es. Together, this work further emphasizes the need for reproducible means of assessing host plant resistance and explores the factors contributing to pathogen virulence.

ISOLATION OF SUPPRESSORS OF UNFOLDED PROTEIN RESPONSE MUTANTS IN ARABIDOPSIS THALIANA
Presenter(s): Eli Noble (Okemos High School), Kael Fernando (Okemos High School)
Category: Plant Science
Mentors(s): Federica Brandizzi (College of Natural Science), Joanne Thomson (College of Natural Science)

The unfolded protein response (UPR) is an essential cellular signaling network that maintains endoplasmic reticulum (ER) homeostasis during environmental and developmental stress. In plants, key UPR regulators include the ER stress sensor INOSITOL-REQUIRING ENZYME 1 (IRE1) and the transcription factors bZIP28 and bZIP60, which activate cytoprotective pathways that promote survival under ER stress conditions. Loss of these signaling components renders plants hypersensitive to ER stress and leads to activation of cell death pathways. To identify novel regulators of ER stress adaptation and cell survival, we conducted a forward genetic suppressor screen in Arabidopsis thaliana using ire1 deletion mutants and bzip28/bzip60 double mutants. Mutagenized populations were screened on the ER stress-inducing drug tunicamycin, which inhibits protein glycosylation and causes the accumulation of unfolded proteins in the ER. Whereas the parental mutants exhibit severe growth defects and lethality on tunicamycin due to impaired cytoprotective signaling, rare surviving individuals were isolated as candidate suppressor mutants. The objective of this work is to identify genetic mutations that either activate alternative protective pathways capable of compensating for defective UPR signaling or suppress pro-death responses triggered during ER stress. Candidate suppressors isolated during Summer 2025 are being characterized through genetic and molecular analyses, with additional mapping and validation planned for Summer 2026. Understanding the mechanisms that allow plants to survive ER stress has important implications for improving crop productivity and resilience under adverse environmental conditions. Furthermore, because defects in UPR signaling are associated with major human diseases, including cancer, diabetes, and neurodegenerative disorders, this research may provide broader insights into conserved stress-response mechanisms across eukaryotes.

DISCOVERING THE FUNCTION OF STRESS-INDUCED SMALL PROTEINS IN ARABIDOPSIS
Presenter(s): Joshua Funk (Ursinus College)
Category: Plant Science
Mentors(s): Larry Wu (College of Natural Science)

Small open reading frames (sORFs) represent a largely unknown set of translated sequences discovered through ribosome profiling of plant genomes. Previous research identified a set of sORFs in Arabidopsis thaliana using super resolution ribosome profiling. This demonstrated active translation of peptides on transcripts previously identified as non-coding; however, the function of these sORFs remains unknown. Here we present a computational framework to predict sORF function through systematic review of publicly available RNA-seq datasets from the EBI Expression Atlas. We examined cell-type specificity using single cell RNA-seq marker files from 14 Arabidopsis scRNA-seq experiments, identified co-expression networks across 9 baseline RNA-seq experiments comprised of up to 57 conditions, and screened 44 differential RNA-seq experiments for stress-induced expression changes. Our analysis reveals that sORF32 (AT5G17460) and sORF33 (AT4G03341) are constitutively expressed in root cells including cortex, stele, and pericycle, and are strongly induced in drought conditions or ABA treatments. These computational predictions provide a foundation for targeted experimental validation using existing CRISPR/Cas9 lines to run phenotypic assays under both normal and stress conditions, which may highlight possible roles in stress response and help pave the way toward making crops more resilient against climate stress.

PATHOGEN CONSERVED EFFECTOR LOCUS PROTEIN IMPLICATED IN CELL WALL ARABINOGALACTAN PROTEIN DEPOSITION
Presenter(s): Eric Theis (Lansing Community College)
Category: Plant Science
Mentors(s): Deepak Bhandari Dharamchand Bhandari (College of Natural Science)

Bacterial pathogens are a major cause of global agricultural yield losses and associated economic damage. The Arabidopsis thaliana "Columbia-0"-Pseudomonas syringae pv. tomato DC3000 (Col-Pst DC3000) pathosystem has been used to demonstrate that the plant cell wall (CW) is actively remodeled during bacterial infection. Pst DC3000. delivers effector proteins into host cells via a Type III Secretion System (T3SS), suppressing plant immune responses and promoting pathogen virulence. However, some of these effector proteins lead to CW remodeling, including increased deposition of arabinogalactan proteins (AGPs). Previous work from the Brandizzi Lab showed that a T3SS-deficient pathogen mutant, Pst ΔhrcC, which cannot deliver effectors, does not trigger the AGP deposition observed in wild-type Pst DC3000. The effector determinants underlying AGP deposition remain unknown. Here, we systematically investigated which Pst DC3000 effector(s) trigger AGP deposition by deploying Pst DC3000 alongside an array of pathogen polymutants. AGP levels in infected leaf CW were assessed by LM2 immuno-dot blot analysis. An initial screen identified a polymutant, ΔIV ΔCEL, lacking effectors from both effector cluster IV and the conserved effector locus (CEL) that induced reduced AGP deposition compared with wild-type Pst DC3000. Analysis of additional combinatorial polymutants further narrowed this phenotype to the CEL, implicating one or more CEL-encoded effectors in promoting infection-associated AGP deposition. These findings narrow the effector determinants associated with pathogen-induced AGP deposition. Defining how bacterial effectors both manipulate and trigger plant CW remodeling responses may reveal mechanistic targets for engineering CW-based disease resistance in crops.

DEVELOPMENT OF A SESQUITERPENOID-BASED AROMATIC REPORTER SYSTEM IN NICOTIANA BENTHAMIANA

Presenter(s): Rylan McCurdy (Michigan State University)
Category: Plant Science
Mentors(s): Trine Andersen (Research & Innovation)

Reporter systems are used in molecular biology to visualize and quantify promoter activity through the production of detectable markers. They typically rely on colorful or fluorescent marker compounds; however, volatile aromatic compounds could provide a quick, scented, and non-destructive alternative for initial screening. The goal of this project is to develop a model aromatic reporter system. in Nicotiana benthamiana using Agrobacterium tumefaciens mediated transient expression of biosynthetic pathways for three aromatic sesquiterpenoids with distinct structures and scents; rotundone, santalol, and viridiflorol. The candidate reporter pathways were expressed in their native cellular compartment, the cytosol, while chloroplast-targeted expression was included to evaluate potential yield optimization and reduction of interference from native N. benthamiana sesquiterpenoid biosynthesis. Because the usefulness of this system depends on salient aromas, each compound was selected based on scent intensity, with rotundone being particularly detectable at low concentrations. N. benthamiana plants were syringe infiltrated with transformed A. tumefaciens cultures containing each pathway construct and appropriate controls. Following transient expression and preliminary scent-test, leaf tissues were extracted with hexane and analyzed using gas chromatography-mass spectrometry (GC-MS) with internal standards to identify and quantify volatile compound production. Statistical analyses were used to evaluate reporter compound accumulation. This work evaluates the feasibility of using volatile sesquiterpenoids as detectable aromatic reporters in plants as well as the effectiveness of chloroplast targeting for increasing compound accumulation. The long-term goal is to develop a functional aromatic reporter system that provides a convenient tool for studying promoter activity and gene expression in diverse plant systems.

INVESTIGATING SMALL MOLECULE BINDING CAPACITY OF ACT-LIKE DOMAINS IN CHLAMYDOMONAS REINHARDTII

Presenter(s): Brett Kimmel (University of Pittsburgh)
Category: Plant Science
Mentors(s): Erich Grotewold (College of Natural Science)

Plants act as chemical factories for generating multitudes of compounds useful to medicine, agriculture, and stress tolerance. Biosynthetic pathways in plants are tightly regulated processes dependent on precise gene regulation. Transcription factors, including basic helix-loop-helix (bHLH) regulatory proteins, play a decisive part in modulating gene expression. Among angiosperms, some 30% of bHLH transcription factors include an additional ACT-like domain, a combination unique to plants. Canonical ACT domains in eukaryotes are associated amino acid-modifying biosynthetic enzymes, and phylogenetic analyses indicates this plant-exclusive fusion preceded plants' colonization of land. ACT-like domains can dimerize to negatively affect transcription, and recent research shows the domain is capable of binding small molecules to similar effect. The nature and identity of these substrates in vivo remains unclear. This research will illuminate this path by determining the in vitro binding capacity of three of the seven bHLH transcription factors with an ACT-like domain in the green algae C. reinhardtii. After purifying isolated ACT-like domains, nanoscale differential scanning fluorimetry will indicate which small molecules bind to this region, if any. Using homology as a guide, canonical substrates of ACT domains in general (amino acids and dipeptides) will be tested. Determining small molecule binding capacity of the ACT-like domain may reveal clues about ancestral role(s) of bHLH in regulation of biosynthetic pathways. As plant biosynthetic compounds represent essential medicines, fuels, and stress tolerance responses, this potentiates a deeper understanding of ACT-like domains' roles in more anthropologically relevant species.

MAPPING THE RED: TRANSCRIPTOMIC ANALYSIS OF ANTHOCYANIN BIOSYNTHESIS ACROSS STRAWBERRY DEVELOPMENTAL STAGES

Presenter(s): Makayla Paul (Michigan State University)
Category: Plant Science
Mentors(s): Melanie Leonard (College of Agriculture & Natural Resources), Patrick Edger (College of Agriculture & Natural Resources)

Strawberry fruit color was significantly transformed during domestication, transitioning from the small, often pale berries of wild ancestors to the large, deep-red, uniform fruit commonly sold today. This domestication process involved selective breeding that increased the concentration of anthocyanins, the key plant pigments responsible for red coloration in ripe fruit, which also serve as potent dietary antioxidants that mitigate cellular damage. However, beyond a few key genes, the full anthocyanin biosynthetic pathway and the specific genetic variants driving these color changes during domestication remain poorly understood. Therefore, the primary goal of this work was to first uncover the broader suite of genes responsible for anthocyanin biosynthesis in cultivated strawberry. To address this, we investigated transcriptional changes across four developmental stages in strawberry fruit, categorized by phenotypic color, and identified genes in the anthocyanin pathway. We found that the expression of genes involved in anthocyanin production and associated metabolic processes increases progressively throughout development. Specifically, my results indicate that the targeted upregulation of Dihydroflavonol 4-Reductase (DFR) and Leucoanthocyanidin Dioxygenase/Anthocyanidin Synthase (LDOX/ANS) drives the phenotypic color changes during maturation, a trait that directly enhances the commercial value of the crop. Future directions for this project include utilizing High-Performance Liquid Chromatography (HPLC) to profile anthocyanin levels at each developmental stage. This will validate the phenotypic observations and the predicted anthocyanin production derived from the transcriptomic analysis. Additionally, we plan to conduct comparative genomic, transcriptomic and metabolic analyses with undomesticated wild relatives to further trace the evolutionary impact of domestication on these pathways.

KNOCKING OUT A DEAD MAN: CHARACTERIZING XYLARIA NECROPHORA VIA GENE KNOCKOUT

Presenter(s): Ari Verinder (Elon University)
Category: Plant Science
Mentors(s): Annabella Lyndon (College of Agriculture & Natural Resources)

Xylaria necrophora is a newly identified fungal pathogen in plants that harms agricultural plant root and leaf systems. This pathogen may do this in many ways; X. necrophora may secrete a pathogenic compound called cytochalasin, which could cause root decay or leaf necrosis. X. necrophora may also impact photosynthesis through cytochalasin toxins that induce chlorosis. Chlorosis causes leaves to yellow, resulting in photosynthetic inhibition. To note any differences in pathogenicity, we will grow the X. necrophora, X. bambusicola, and X. multiplex on plants. To test the pathogenicity of the cytochalasin compounds, we will do a gene knockout. Gene knockout is a common way to determine gene functions in fungi and to study pathogenicity; however, genetic manipulation has not been described in Xylaria. Because of this, we will perform gene knockout of the melanin biosynthesis enzyme laccase in two Xylaria species, X. multiplex and X. necrophora, as proof of concept for genetic transformation. With the laccase gene knocked out, we can also knock in a geneticin resistance gene in its place as a selection marker. When this is done with our gene of interest, laccase, melanin should not be phenotypically shown in new cells, and they should also have resistance. If this is the case, we should be able to do the same for cytochalasin-producing genes to reduce pathogenicity. With these approaches, we will be able to determine some of the pathogenic factors of X. necrophora and have methods of reducing its pathogenicity on agricultural plant hosts.

FUNCTIONAL CHARACTERIZATION OF CONSERVED REGION 2 IN THE ARABIDOPSIS LRB1 GENE
Presenter(s): Catherine Chappell (Grand Valley State University)
Category: Plant Science
Mentors(s): Matthew Christians (Grand Valley State University)

Plants utilize the Phytochrome and Cryptochrome photoreceptors to molecularly regulate growth and development in dynamic light and temperature conditions. These photoactivated proteins are further modulated by a group of E3 ubiquitin ligases called LRBs (Light-Regulating Bric-a-Brac/Tramtrack/Broad Complex), which tag Phytochromes and Cryptochromes with ubiquitin, and mark these proteins for degradation under specific environmental conditions. Within the LRB gene, three main regions found in the N-terminal portion are highly conserved across the plant kingdom. Our research focuses on Region Two. This region is partially composed of a nuclear localization sequence, but the full function is currently unknown. In this study, we generated transgenic lines of Arabidopsis thaliana with Region Two deleted (called LRB-R2D) from the LRB1 gene, with the purpose of determining its precise role in light and temperature sensing. By comparing the phenotypes of these LRB-R2D seedlings under varying light conditions, we found that the transgenic LRB-R2D gene had little effect on red and blue light responses, suggesting the mutation is non-functional. Experimentation under alternate conditions including variable temperature will be conducted to further investigate the function of Region Two. Adding nuanced understanding of this key regulator of light sensing in plants deepens the general knowledge of how plants grow and develop in response to light, which offers potential application in ecological management or agriculture.

ESTABLISHING PROTOCOL FOR DISENTANGLING FUSARIUM ROOT ROT AND DRY BEAN HOST INTERACTIONS
Presenter(s): Alexandria Wales (Western New Mexico University)
Category: Plant Science
Mentors(s): Alejandro Rojas (College of Agriculture & Natural Resources), Irene Blanco Casallas (College of Agriculture & Natural Resources)

Michigan ranks second in the U.S. for production of dry beans, making them a crucial crop for the state's agricultural economy. Dense cultivation of dry beans in Michigan's eastern regions creates conditions conducive to fungal Fusarium diseases. Fusarium root rot (FRR) has persisted in dry bean production for the last decade, causing significant losses and leaving growers searching for effective management strategies. The disease is caused by pathogens in the Fusarium solani Species Complex (FSSC), a group composed of cryptic species that complicate efforts to characterize pathogen diversity and disease dynamics. This study aimed to recover FSSC isolates from Michigan agricultural soils and evaluate how these interact with susceptible dry bean varieties representing distinct genetic backgrounds. Soil dilutions were performed with soil from eight Michigan dry bean farms to isolate local Fusarium spp. In addition, a dry bean bioassay was performed using 30:70 (wt/wt) ratio of field soil to clay; two cultivars of dry beans susceptible to FRR were planted: "Red Hawk" (Andean lineage) and "Medalist" (Mesoamerican lineage). Seedling traits were evaluated to determine whether differences in host response between gene pools exposed to the same soil microbiomes influence diversity of FSSC isolates. Roots were recovered to quantify disease severity and isolate Fusarium associated with the host. This research determined best practices and developed procedures for the isolation of Fusarium from agricultural soil that will be used in further research linking disease phenotypes with pathogen abundance. This research will be used to guide best practices for Michigan's dry bean growers.

TRANSGENIC LIGNIN COMPOSITION IN SORGHUM AND ITS IMPACT ON ROOT MORPHOLOGY AND CARBON SOIL CYCLING
Presenter(s): Ryan Songco (MiraCosta College)
Category: Plant Science
Mentors(s): Alexandra Kravchenko (College of Agriculture & Natural Resources), Majid Mahmoudabadi (College of Agriculture & Natural Resources), Poulamee Chakraborty (Research & Innovation)

Bioenergy crops have the potential to provide renewable fuel sources while also influencing soil health through their roots. Genetic modifications that improve biomass digestibility may alter the chemical and physical properties of roots, affecting how soil microorganisms process carbon and contribute to soil carbon cycling. Transgenic lines of sorghum with modified lignin composition can improve biomass conversion for biofuel production. However, the effects of these modifications on root decomposition and microbial activity in soil are still not fully understood. This research investigates how root traits from transgenic bioenergy sorghum influence microbial carbon processing and soil carbon cycling. We are comparing four sorghum genotypes with altered lignin composition across two contrasting soil types. Initial analyses include measurements of root biomass and root saturation capacity. Soon, we will be able to characterize root morphological traits and evaluate microbial responses through measurements of carbon mineralization, microbial biomass carbon (MBC), and hydrolytic enzyme activities (HEAs) during and after a 30-day soil incubation. We expect that differences in root chemistry and morphology will influence microbial accessibility to root-derived carbon, and provide patterns in decomposition and carbon cycling among genotypes. This work will help with a better understanding of how bioenergy crop engineering can be optimized to support both biomass production and soil ecosystem function.

UNDERSTANDING SEED DESICCATION IN ARABIDOPSIS THALIANA
Presenter(s): Alaina Martin (Western Illinois University)
Category: Plant Science
Mentors(s): Aidan Deneen (College of Natural Science), Erin Cushing (College of Natural Science), Seung Rhee (College of Natural Science)

Seed desiccation is a crucial self preservation mechanism whereby a seed enters a dry state that halts metabolic activity and resumes normal cellular function when rehydrated. The systems that control the onset of desiccation tolerance and water loss during seed maturation remain unknown. To understand the developmental factors that affect seed desiccation, we measured water content and drying dynamics in Arabidopsis thaliana seeds across the first half of the seed maturation timeline (10-16 days after flowering). To determine percent water content and drying rate, we measured seed weights dried in 9% and 33% relative humidity chambers and an oven at 65°C, until the seeds reached complete desiccation (defined as persistent

UNDERSTANDING SWITCHGRASS DROUGHT RESPONSE: PHYSIOLOGY, METABOLOMICS, AND TRANSCRIPTOMICS
Presenter(s): Chloe Lucas (Southern Nazarene University)
Category: Plant Science
Mentors(s): Binod Basyal (Research & Innovation)

Biofuels are becoming a desirable alternative to fossil fuels, but production minimizes that of edible crops and requires optimization. Switchgrass (Panicum virgatum) is a robust, lignocellulosic, perennial plant with potential for sustainable biofuel production. Still, drought can impair carbon assimilation, alter the metabolism, and shift gene expression in ways that reduce biomass yield and quality. Using a precision irrigation system, plants are subjected to a controlled decline in soil moisture from 15% to 1% during either the vegetative or senescence stage, enabling stage-specific comparisons of drought response between contrasting switchgrass cultivars. Gas-exchange measurements in drought-susceptible and drought-resilient cultivars assess how drought limits CO_2 assimilation is reduced via a decline in Rubisco activity, particularly in vegetative plants. Metabolomic analysis will focus on saponins, which are expected to increase under drought and interfere with downstream yeast-based fermentation due to their anti-fungal properties. Because silica-rich leaves complicate RNA extraction, an optimized protocol has been developed. CO_2 assimilation results explain how switchgrass biomass is hindered by drought exposure in both stages and cultivars, informing growers of planting windows that precede soil moisture declines, reducing early-season drought stress. Saponin level monitoring will explain which stage is critical for saponin production, while an optimized RNA isolation protocol will be used to determine differences in the transcriptome of the vegetative and senescent grasses among different cultivars. Understanding the robustness of switchgrass and the factors that limit its growth and fermentation help identify traits that sustain biomass production under stress, ultimately improving its value as a biofuel crop.

DECODING PLANT SIGNALING: A MACHINE LEARNING PIPELINE FOR PREDICTING THE STABILITY OF PROTEIN-LIGAND-PROTEIN COMPLEXES
Presenter(s): Beatrix Weil (Rochester Institute of Technology)
Category: Plant Science
Mentors(s): Duncan Boren (College of Natural Science), Josh Vermaas (College of Natural Science)

In order to dynamically respond to environmental changes, plants produce small signaling molecules called ligands. When ligands bind to a specific target receptor protein, such as an f-box protein, gene expression levels change, conferring greater levels of fitness to the plant. In some systems, the binding of a ligand to an f-box protein enables the formation of a protein-protein interaction between the f-box protein and the transcriptional corepressor for the pathway that is being upregulated by the ligand binding. However, little is understood about the biophysical metrics that determine whether or not a particular combination of f-box protein, ligand, and corepressor will actually result in the formation of a stable, active complex, and it is expensive to analyze that question experimentally. We screened 5243 combinations that are not experimentally resolved from a list of ligands, f-box proteins, and corepressors provided by Dr. Gregg Howe using AlphaFold3 for structure generation, a data processing pipeline, and a random forest machine learning model to ultimately determine a list of predicted stable complexes. By developing and testing these methods, we were able to elucidate some of the geometric metrics that are most crucial in defining the stability and activity of these complexes and create a list of complexes that we predict to be true binders. These results will help contribute to a greater understanding of plant stress response, as well as potentially give rise to applications in drug target identification.

DO PLANT-PLANT INTERACTIONS SHAPE FUNGAL COMMUNITY AND CARBON FLOW IN SWITCHGRASS BIOENERGY SYSTEMS?
Presenter(s): Natalie Devine (Cedar Crest College)
Category: Plant Science
Mentors(s): Alexandra Kravchenko (College of Agriculture & Natural Resources), Gregory Bonito (College of Agriculture & Natural Resources)

Global warming is an ever-present threat caused by the usage of fossils fuels. Second generation biofuel, such as switchgrass (Panicum virgatum), are derived from non-food sources which allows them to utilize different land and resources. Switchgrass, known for high productivity and carbon sequestering in soil, is a promising candidates for these biofuels since it can grow quickly in a variety of conditions and sequesters greenhouse gasses like CO_2, also helping with global warming. The carbon capture in this experiment was tracked by treating the switchgrass with ^{13}C labeled, then taking samples of the soil to see how much carbon was present and therefore how effective the switchgrass was in removing the CO_2. Neighboring plants or monoculture with switchgrass and root-related fungal microbiomes have been shown to increase the carbon sequestering as more biodiverse communities tend to have higher productivity. One underexplored concept is how plant-plant interactions and the fungal microbiome may interact to increase the efficiency of switchgrass systems. This experiment investigated fungal soil cores placed in the ground underneath switchgrass paired with nine different neighbor plants, including switchgrass monoculture as a control. Here we hypothesize that neighbors will increase the diversity of fungal communities, which in turn increases the carbon sequestration.

EFFECT OF SUNFLOWER POSITION ON STOMATAL DYNAMICS
Presenter(s): Aleksandra Gjorovski (University of Detroit Mercy), Sia Patel (University of Detroit Mercy)
Category: Plant Science
Mentors(s): Eva Nyutu (University of Detroit Mercy)

Stomata are microscopic pores on plant leaf surfaces that regulate gas exchange by allowing carbon dioxide to enter and releasing oxygen and water vapor. Environmental factors, including leaf orientation, can influence stomatal behavior by affecting light exposure and other conditions. This study tested the hypothesis that the orientation of sunflower (Helianthus annuus) leaves upright versus fallen affects stomatal dynamics. A total of 20 leaves were collected: 10 upright, sun-facing leaves and 10 shaded, fallen leaves. A thin layer of clear nail polish was applied to each leaf surface to create stomatal impressions, which were transferred to microscope slides. Each slide was examined at 400X magnification, and stomatal length, stomatal density, and percentage of open stomata were recorded. Upright leaves had higher stomatal length, stomatal density and percent of open stomata compared to fallen leaves although the differences were not significantly different. Although previous research deduced that upright plants have a higher rate of photosynthesis, our study suggests that the fallen leaves might have been collected recently after abscission, and their stomatal characteristics may not have changed yet.

TRANSFORMATION AND PHOTOSYNTHETIC CHARACTERIZATION OF MUTANT CYANOBACTERIA
Presenter(s): Mareiliz Miranda (Interamerican University of Puerto Rico - San German)
Category: Plant Science
Mentors(s): Luke Sharpe (College of Natural Science), Mitchell Ticoras (College of Natural Science)

The Calvin Benson cycle is an essential process for cyanobacteria like Synechococcus elongatus PCC 7942. During this process, the Rubisco enzyme fixes CO2 and transforms it into sugar to obtain energy inside the carboxysome. There is a protein attached to the outside of the carboxysome called GlgC that contributes to source-sink balancing through mediating the storage of sugars. A similar protein with an unknown function in S. elongatus PCC 7942 is CugP and we hypothesize that this protein mediates the usage of sugars and can be found attached to the outside of the carboxysome. Molecular cloning techniques will be used to arrange a plasmid tagging CugP with a neon protein that will then be transformed into S. elongatus PCC 7942 so that we can localize it using microscopy. In relation to this we will explore the regulatory mechanism known as source-sink balancing by which cyanobacteria balance the light energy received through photosynthesis and the capacity to use that energy. Some important components that participate in this process are InvA, an enzyme known to catabolize sucrose, and CscB a protein in charge of sucrose transport in the cell. We will evaluate if the loss of InvA affects the efficiency of CscB through a sucrose assay and determine how metabolites change when the source-sink balance is disrupted using Mass Spectrometry. This work will contribute to providing an insight into essential structures in S. elongatus PCC 7942 and the importance of components that contribute towards metabolic regulation processes.

Psychology

EVALUATING INCLUSIVITY, DIVERSITY, EQUITY AND ACCESSIBILITY IN COMMUNITY-ENGAGED RESEARCH: ANALYSIS OF COMMUNITY-ENGAGED RESEARCH REPORTING GUIDELINES
Presenter(s): Savanah Hammock (Aquinas College)
Category: Psychology
Mentors(s): Amy Drahota (College of Social Science)

Community-engaged research (CEnR) is "the process of inclusive participation that supports mutual respect of values, strategies, and actions for authentic partnership of people affiliated with or self-identified by geographic proximity, special interest, or similar situations to address issues affecting [community] well-being" (Ahmed & Palermo, 2010, p. 1383), and increases research relevance, innovation, and sustainment. CEnR has grown over the past decades, and reporting guidelines have been published to promote consistent and transparent documentation of community engagement principles, practices, and quality (i.e., REACH (Jacquez & Vaughn, 2025), GRIPP2 (Staniszewska et al., 2017)). However, commonalities among CEnR reporting guidelines have not been evaluated, nor have they been evaluated for inclusion, diversity, equity, and accessibility (IDEA; Mullin et al., 2021). This project will evaluate the frequency and measurement of IDEA constructs among CEnR reporting guidelines.
We will conduct a distillation review by identifying reporting guideline "CEnR elements," defined as unique CEnR principles or practices that are required to be reported in scholarly articles. Researchers will conduct content and frequency analyses of these elements, with a particular focus on identifying elements that align with IDEA definitions (Mullin et al., 2021). Additionally, data related to the method of documentation and metrics will be extracted and compared. Analyses will involve a coding, comparison, and consensus method (Willms et al., 1990). There is a need for consistent and standardized reporting of CEnR. This study aims to expand current CEnR reporting guidelines by identifying common elements across reporting guidelines, as well as adding documentation about IDEA.

TESTING THE BRIEF YOUTH SOCIAL RESPONSIBILITY SCALE ACROSS FOUR YOUTH CLASSES: AN EXAMINATION OF PARTIAL MEASUREMENT EQUIVALENCE WITHIN A FACTOR MIXTURE MODEL
Presenter(s): Manuela Montoya (Hunter College, CUNY)
Category: Psychology
Mentors(s): Ignacio Acevedo (College of Social Science), Lexi LaChappa (College of Social Science)

Civic engagement is a multidimensional construct that includes behaviors, attitudes, and cognitions youth use to identify and respond to community needs in ways that support individual and collective well-being. Although these dimensions are related, in study I focus on attitudinal civic engagement, young people's beliefs and feelings about the importance of being informed, helping, and contributing to their communities. My study attempts to identify which items may need to be revised and inspire the development of future measures to include different forms of civic engagement, especially those meaningful for minoritized youth, such as advocacy, activism, and systems change. In this study I built on prior factor mixture modeling work using the 10-item Youth Social Responsibility Scale (YSRS), a survey measure of youth civic engagement attitudes. Researchers previously fit a four-class metric equivalent model, suggesting that youth can be grouped into four classes based on civic engagement attitudes and related identity dimensions, including race/ethnicity, gender, and socioeconomic opportunities. It remains unclear whether all YSRS items function similarly across these classes. My central research question is: Which YSRS items show evidence of non-equivalence within a partial scalar equivalent model across the four youth classes? By using an equivalence testing approach to factor mixture modeling to identify a better-fitting and more equitable way to measure youth civic engagement attitudes. Using existing pre-survey data from youth in a summer civic engagement and inclusivity program, I will test whether specific YSRS items should be modeled differently across classes.

MATERNAL PRENATAL DIET AND CHILD BEHAVIORAL OUTCOMES AT AGES 4-6 YEARS: FINDINGS FROM THE ARCH COHORT
Presenter(s): Kayla Whitfield (Southern University at New Orleans)
Category: Psychology
Mentors(s): Jean Kerver (College of Human Medicine), Tamanna Afroj (College of Human Medicine)

Background: Maternal nutrition during pregnancy may influence offspring neurodevelopment through biological pathways involving fetal brain development, inflammation, and metabolic programming. However, evidence examining specific prenatal dietary components and later behavioral outcomes in children remains limited. Objective: This research examined associations between the mother's pregnancy diet and behavioral outcomes of her 4-6-year-old offspring. Methods: Data were obtained from the Archive for Research in Child Health (ARCH) prospective pregnancy cohort. Participants (n>1,000) were enrolled at prenatal clinics in Lansing, MI, for the purpose of studying environmental factors in early life that may affect baby development. Pregnancy dietary exposures included fruit and vegetable intake and added sugar consumption. Child behavioral outcomes were measured at ages 4-6 years using the Child Behavior Checklist (CBCL). Descriptive statistics were used to characterize the study population. Multivariable linear regression models were used to evaluate associations between prenatal dietary factors and CBCL scores while adjusting for confounders, including child age, sex, and immediate family Autism Spectrum Disorder (ASD) history. Results: Among 112 mother-child dyads, neither prenatal fruit and vegetable intake, nor added sugar intake were significantly associated with child Autism T-scores in unadjusted or adjusted analyses. Dietary variables were also uncorrelated. Child sex, sibling autism history, and race showed no significant associations with outcomes. Conclusion: Understanding the role of prenatal nutrition in early childhood behavioral development could help inform nutritional recommendations and interventions aimed at improving long-term child health outcomes.

WORKING MEMORY AND RHYTHM DISCRIMINATION IN METRIC AND NONMETRIC RHYTHMS
Presenter(s): Habiba Younas (Michigan State University), Michael Salem (Michigan State University)
Category: Psychology
Mentors(s): Bailey Rann (College of Social Science), J McAuley (College of Social Science)

Previous research suggests that working memory (WM) contributes to auditory rhythm discrimination. In music, metric rhythms possess a hierarchical beat structure that supports an internal beat. In contrast, nonmetric rhythms lack a predictable beat structure, potentially increasing reliance on WM. This study investigated how WM relates to rhythm discrimination across rhythms ranging in complexity. We hypothesized that WM would be more strongly associated with rhythm discrimination for complex and nonmetric rhythms. Participants completed the same WM and rhythm perception tasks across two experiments. WM was assessed using a composite measure of the Operation Span, Reading Span, and Symmetry Span. To assess rhythm discrimination performance, participants listened to two standard rhythms and judged whether a third comparison rhythm was the same or different. Trials include simple-metric, complex-metric, and nonmetric rhythms. Participants completed the Beat Alignment Test, a comparison measure not expected to rely on WM. In experiment 1, we observed a significant positive correlation between WM and both metric rhythms, with a stronger association for complex-metric rhythms. In contrast, we did not observe an association between WM and nonmetric rhythms, as performance was at floor. To address poor performance, nonmetric rhythms were modified for experiment 2. Following adjustment, preliminary results reveal a positive, non-significant correlation between WM and rhythm discrimination for all three rhythms. Taken together, our results highlight the importance of metrical structure - greater complexity equating to higher reliance on WM. Importantly, when the hierarchical structure is absent (i.e., nonmetric rhythms), rhythm predictability is lost and discrimination ability decreases.

THINKING IT THROUGH: INDIVIDUALS DIFFERENCES IN NEED FOR COGNITION AMONG DOMINANCE, AUTHORITARIANISM, AND IMMIGRATION ATTITUDES
Presenter(s): Ambar Lopez (Grand Valley State University)
Category: Psychology
Mentors(s): Ashley Bennett (Grand Valley State University)

Beliefs and attitudes about immigration are more important today than ever because they shape how individuals understand belonging and inclusion within the context of the US. Ideological orientation, particularly social dominance orientation (SDO) and right-wing authoritarianism (RWA), are known predictors of decision-making processes. Yet, it is unclear whether these factors are related to immigration attitudes beyond political orientation and conservative media exposure. Additionally, there may be individual differences in need for cognition (NFC) regarding reliance on ideological heuristics when forming immigration attitudes. In the present study, I examine whether SDO and RWA predict immigration attitudes after accounting for political orientation and conservative news exposure. Further, I assess whether NFC moderates how SDO and RWA are related to immigration attitudes. Participants include college students from a large southwestern university who completed a survey for course credit. I hypothesized that RWA will be negatively associated with immigration attitudes regardless of NFC, whereas NFC will moderate the relationship between SDO and immigration attitudes. Specifically, individuals higher in NFC are expected to show a weaker association between SDO and immigration attitudes. Findings may highlight that individual differences in cognitive tendencies can shape the development of ideological beliefs and decision-making, while potentially showing that cognitive motivation may buffer against ideological prejudice.

METHODOLOGICAL INSIGHTS USING DIGITAL RECRUITMENT PLATFORMS FOR AN ONLINE NATURE-BASED MEDITATION BEREAVEMENT PROGRAM
Presenter(s): Samantha Stacey (Michigan State University)
Category: Psychology
Mentors(s): Arienne Patano (College of Nursing), Rebecca Lehto (College of Nursing)

Recruitment of diverse samples remains a persistent challenge in health research. Digital platforms, such as ResearchMatch, provide opportunities to access difficult to reach populations. However, digital recruitment platforms carry risks of fraudulent enrollment and other drawbacks. The purpose was to describe strategies for recruitment of our desired population, based on inclusion and exclusion criteria, for an NCI-funded study, which evaluated a nature-based meditation program for bereaved cancer caregivers. The digital platform ResearchMatch presents operational challenges including substantial workload and time to review for eligibility. Procedurally, a multi-wave recruitment strategy was implemented. ResearchMatch filters were applied sequentially to improve outreach to underrepresented populations. Initial geographic recruitment was broad and was incrementally reduced to 350-miles around the study site. Other filters targeted participants residing across the Midwest, including urban areas, intentionally focusing on areas with dense, diverse racial/ethnic populations, e.g., Native, Asian, African/Black, Middle Eastern, and other underrepresented American populations. Ultimately, 169 individuals were contacted through multiple ResearchMatch recruitment waves, accounting for 40% of overall recruitment efforts. Following contact, additional screening procedures were implemented to detect duplicate, fraudulent, and insincere submissions, reducing eligible participants while improving the sample's accuracy, validity, and overall quality for a broader sample of bereaved cancer caregivers. This recruitment experience informs researchers of the strategies necessary for online recruitment and management drawbacks of time and effort to omit fraudulent and duplicate responses. Researchers must use digital recruitment with caution, allowing time for additional checkpoints. While challenging, the benefits of digital recruitment often outweighed the additional effort.

Social Sciences

IS INCLUSION MORE IMPORTANT THAN DIVERSITY IN NONPROFIT BOARD COMPOSITION AND ORGANIZATIONAL SUCCESS?
Presenter(s): Imelda Hay (Grand Valley State University)
Category: Social Sciences
Mentors(s): Michelle Wooddell (Grand Valley State University)

Boards of trustees are an important component of the success of nonprofit organizations. Until recently, scrutiny surrounding DEI was relatively static, with studies both supporting and invalidating claims that it benefits the workplace. With recent attacks on DEI, the way that people are thinking about these issues has shifted and gained a renewed interest in scholarly research. Something that has not changed is the racial demography of Nonprofit board members. Most boards remain largely white. Boards that do have racial minorities still struggle with obtaining a satisfactory knowledge of the communities they serve. Considering all of these aspects, I am conducting a literature review that seeks to answer the question: how valuable is diversity to boards? In answering this question, I will observe the mitigating factors that inclusive practices, policies, and behaviors can contribute to an environment that lacks physical diversity. I will also look at the impact that inclusive practices, behaviors, and policies can have on board composition and retaining and recruiting minority board members.

OLD MAGIC, NEW TRICKS: THE SELECTIVE RECLAMATION OF ANCIENT WITCHES ACROSS LITERARY HISTORY
Presenter(s): Lilian Hevron (Grand Valley State University)
Category: Social Sciences
Mentors(s): Benjamin Howland (Grand Valley State University)

This research examines the semantic fields of popular witch figures across ancient Greek, Roman, seventeenth-century, and contemporary literature. Through this, the perceptions of these ancient sorceresses were tracked via a feminist and cross-temporal lens. Witches like Euripides' titular character from his play Medea and Lucan's Erichtho from the Pharsalia both created strong archetypes that later adaptations drew upon. Shakespeare's Weird Sisters from his Enlightenment period play Macbeth and Circe from Madeline Miller's contemporary novel Circe both align with these characterizations. This reveals a mirrored relationship between ancient works and modern literature, challenging the idea that time inherently means progress and that modern adaptations have succeeded in reclaiming power for women's voices. Although some contemporary works focused on ancient Greek sorceresses have reclaimed some narratives, the Roman witch has remained largely untouched and is still perpetuated by ageism, sexism, and patriarchal anxieties. Modern feminist revisions, like Circe, have proven to be publishing successes, so there is merit in rewriting new stories of the aging women who have been painted as hags, crones, and monstrosities for centuries. For those reasons, identifying the historical origins and the semantic fields of these depictions is a crucial element of reclaiming the next big stories.

U.S. DRINKING WATER STUDIES FROM 1974-2026: A SCOPING REVIEW OF DRINKING WATER STUDIES FOLLOWING THE SAFE DRINKING WATER ACT

Presenter(s): Juan Ayala Hernandez (Michigan State University)
Category: Social Sciences
Mentors(s): Angelique Willis (College of Social Science), Igor Vojnovic (College of Social Science)

The 1974 Safe Drinking Water Act authorized the U.S. Environmental Protection Agency to establish national standards to protect public drinking water from harmful contaminants. However, there has been limited compilation and synthesis of how U.S. drinking water studies have addressed various contaminants, related public health concerns, and environmental justice themes since the Act's ratification. This scoping review examined peer-reviewed drinking water studies conducted in the United States and published from 1974 through 2026. Relevant literature was identified through PubMed, Scopus, and Web of Science using search terms related to drinking water, contaminants, public health, and environmental justice, followed by screening based on predetermined inclusion and exclusion criteria. The review identified the contaminants most frequently studied, the public health concerns discussed, the populations and geographic areas represented, and the environmental justice themes addressed throughout the literature. Findings indicate that drinking water contamination exhibits distinct geographic patterns across the United States. For example, Lead and Copper Rule (LCR) violations were concentrated in the Great Lakes and South-Central regions, while nitrate contamination was most prevalent throughout California, Texas, the Midwest, and the North Atlantic. These regional differences may reflect variations in land use, including industrial activities in the Great Lakes region and agricultural practices across the Great Plains. Overall, this review provides a comprehensive picture of how U.S. drinking water research has developed since 1974, identifies populations and issues that remain underrepresented in the literature, and helps guide future research and more equitable drinking water protections.

HEXAVALENT CHROMIUM IN U.S. DRINKING WATER, 1993-2026: A SCOPING REVIEW OF OCCURRENCE, EXPOSURE PATHWAYS, AND HEALTH OUTCOMES

Presenter(s): Kordell Green (Morehouse College)
Category: Social Sciences
Mentors(s): Angelique Willis (College of Social Science), Igor Vojnovic (College of Social Science)

Fifty-two years after the Safe Drinking Water Act established federal protections for public drinking water, important questions remain about where hexavalent chromium occurs, how people are exposed to the contaminant, and which health outcomes have been reported across U.S. communities. In 1993, Erin Brockovich began investigating the groundwater in Hinkley, California, where hexavalent chromium contamination in the local drinking water wells was associated with Pacific Gas and Electric Company (PG&E). Since the Hinkley case gained national attention, research has increasingly examined the occurrence of hexavalent chromium in drinking water, its transformation between chromium species, potential exposure pathways, and possible health effects. National attention to hexavalent chromium has persisted through the years, but there has been limited synthesis of how U.S. drinking water studies have examined chromium speciation, the occurrence of Cr(VI), potential exposure pathways, geographic patterns, and reported health outcomes. This scoping review examined 30 peer-reviewed articles on how U.S. studies published from 1993 through 2026 have investigated the occurrence of hexavalent chromium, exposure pathways, and reported health outcomes. Peer-reviewed articles involving Cr(VI) were identified through keyword searches across 4 databases: PubMed, Google Scholar, Scopus, and Web of Science, and screened using predetermined inclusion and exclusion criteria. This review mapped where chromium-6 research has been conducted, which populations have been studied, and where important gaps remain, which may help guide future research, strengthen drinking water monitoring, and support more equitable protections for communities facing potential exposure.

THIN-IDEAL INTERNALIZATION, FELT EMPOWERMENT, AND EYE GAZE
Presenter(s): Arikka Franklin (Eastern Michigan University)
Category: Social Sciences
Mentors(s): Nancy Rhodes (College of Communication Arts & Sciences)

Analysing thin-ideal norms and their impact on how people process visual messages is the center point of this research. While past studies have focused on how thin ideals affect women's self-confidence, our research will explore how accessible these themes are. This will be measured by conducting an eye-tracking experiment in which participants view advertisements featuring women. We will analyze where participants look and how long they focus on different parts of the ads. This part of the study will provide quantitative data, and we will compute the data through IBM SPSS Statistics. Participants will be female MSU college students recruited both online through the paid SONA platform and through in-person referrals. We will ask participants questions about the advertisements they have seen, adding a qualitative element. To assess thin-ideal internalization, we will use the receiver operating characteristic (ROC) analysis to check the effectiveness of the Sociocultural Attitudes Towards Appearance Questionnaire-4 (SATAQ-4) method. SATAQ is a self-report questionnaire designed to measure the internalization of Western beauty standards and pressure to conform to these. We will also use the Visual Analogue Scales (VAS) that are used to assess negative moods, measuring levels of anxiety, depression, happiness, anger, and confidence. The measure we will utilize to assess felt empowerment is the Personal Progress Scale Revised (PPS-R). This 28-item instrument evaluates personal empowerment in women by examining various aspects related to empowerment, including positive self-evaluation, self-esteem, etc. Our expected results correlate with participants with high accessibility to thin-ideals with time length viewing of advertising.

LIVELIHOOD IN SOUTH ASIA
Presenter(s): Auynha Smith (Michigan State University)
Category: Social Sciences
Mentors(s): Linda Racioppi (James Madison College), Sejuti Das Gupta (James Madison College)

Despite real GDP growth, India and Sri Lanka face a paradox of development in the prevalence of poor livelihood opportunities for women. Women in both Sri Lanka and India face gendered labour divisions, unequal domestic labour responsibilities, and a lack of access to education. In each sector in the economy these paradoxes were observed through field visits and community based research to varying organizations and villages, along with external research. We argue that addressing this development paradox requires targeted interventions, including childcare facilities such as Mumbai Mobile Creches, gender-equitable labor laws, and education opportunities designed to transition women from precarious labor to sustainable livelihood such as the Aftertaste foundation.

EXAMINING DIFFERENCES IN FELT ACCOUNTABILITY ACROSS RACE AND GENDER IN ORGANIZATIONAL CONTEXTS
Presenter(s): Unique Taylor (University of Detroit Mercy)
Category: Social Sciences
Mentors(s): Angela Hall (College of Social Science)

Felt accountability-when an individual believes that other people are observing their actions or decisions and as a result will face consequences or receive benefits because of them-has been extensively examined within organizational behavior research. However, existing scholarship primarily addresses accountability as a broad, universal construct and gives comparatively limited attention to how accountability experiences may vary across social identity categories such as race and gender. This study investigates employees from two organizations, the first being a large public university located in the Southeastern United States and the second being a medium-sized family-owned business that's located in the Midwestern United States. This research will be utilizing archival data that was collected through a dyadic research design where information from two surveys was gathered from employees and their supervisors. The sample included Black, White, and Hispanic respondents with an average age of 40 years old. This study will examine whether employees' felt accountability differs systematically by race and gender, thereby addressing a critical gap in the literature. Given the limited nuanced understanding within the field regarding how intersecting demographic identities shape accountability perceptions in organizational contexts. An empirical examination of these relationships will be conducted within this study by employing regression analysis to test for statistically significant differences in felt accountability across racial and gender groups while measuring felt accountability through an unidimensional scale developed by Hochwarter, Kacmar and Ferris.

TOUCH AND MENTAL HEALTH IN OLDER ADULTS: A SCOPING REVIEW
Presenter(s): Malaysia Reed (Winston Salem State University)
Category: Social Sciences
Mentors(s): Fei Sun (College of Social Science)

In this research, we will explore the extent and nature of research on touch and physical contact as a factor associated with mental health in older adults. The review focuses on touch and physical contact as factors associated with mental health outcomes among older adults 65 and older. This review is expected to identify what types of touch have been examined like therapeutic, social, and affective. As well as how touch has been measured or operationalized. Five databases will be used for our scoping review which include PubMed, PsycINFO, Sociological Abstracts (ProQuest), Social Science Citaiton Index (Web of Science), and Cinahl. Firstly, we will develop a scoping review protocol that defines the research questions, eligibility criteria, search strategy, and data extraction plan. Secondly, we will begin to develop keywords and search terms to run our search strategy in each database. Once the search is complete, results from all five databases will be transferred into Covidence, a platform used for conducting scoping and systematic reviews. Screening will begin with a title and abstract review, followed by full-text screening after team discussion of any conflicting decisions. Articles that meet the eligibility criteria and align with the research questions will be selected. Valuable information will then be extracted from each article, including key findings, participant characteristics, and mental health outcomes. Identify common patterns, themes, and gaps in the literature and summarize what the studies found overall. We will explain what is known, what remains unclear, and what the future should address. The findings will be summarized to provide an overview of the relationship between touch, physical contact, and mental health in older adults. This scoping review findings anticipates that positive forms of physical contact like hugs, holding hands, and affectionate touch, are associated with improved mental health outcomes.

"THEY DON'T WANT TO UNDERSTAND ME": HOUSING PRECARITY AMONG NON-NATIVE ENGLISH SPEAKING RENTERS
Presenter(s): Roberto Garcia (Michigan State University)
Category: Social Sciences
Mentors(s): Stephen Przybylinski (College of Social Science)

This research project seeks to determine the extent to which people who do not speak English as their first language are at elevated risk of eviction due to language barriers. This is particularly important because a tightening housing market in most American cities (e.g., higher rents) limits housing opportunities for low-income people. In addition, immigrants face limited opportunities in work, relationships, and social services due to Limited English Proficiency (LEP). Housing is a primary need that immigrants face when entering the country. As such, this research project seeks to uncover and improve available strategies to protect LEP people in the Lansing area from housing precarity and from becoming unhoused. Our research question examines whether non-native English speakers experience housing discrimination based on their LEP. We believe that there is a relation between LEP and housing precarity. We will conduct approximately 30 semi-structured interviews with Lansing renters who are housing-unstable and have limited English proficiency. Participants may be clients of local agencies, such as the Tenant Resource Center, the Refugee Development Center (RDC), and Samaritas. We will also interview professionals in the field who work with this demographic. For interviews with a language barrier, translation services will be used via a live language interpreter from the RDC or online language translation through LanguageLine. We will gauge the impact their limited English proficiency has on their experience in the housing market.

WHAT IS THE RELATIONSHIP BETWEEN ATHLETIC INJURY AND DEPRESSION AMONG COLLEGE FOOTBALL ATHLETES
Presenter(s): Dillan Harmon (Southern University A&M College)
Category: Social Sciences
Mentors(s): Leapetswe Malete (College of Education)

Depression is a growing concern among collegiate athletes, particularly following sport-related injuries that may limit participation, identity, and overall well-being. While previous research has examined the relationship between injury and mental health outcomes, less is known about the role social support plays in influencing depressive symptoms among injured athletes. Therefore, this scoping review aims to examine the existing literature on the relationship between social support, sport-related injury, and depression among collegiate athletes. Specifically, this review will explore how different sources of social support, including coaches, teammates, family members, and athletic staff, may impact the psychological well-being of injured athletes. Relevant peer-reviewed studies will be identified, screened, and analyzed to identify key themes, trends, and gaps within the literature. It is expected that this review will contribute to a better understanding of the protective role social support may play in reducing depressive symptoms following injury and provide recommendations for future research and practice within collegiate athletics.

ARTISANS OF CHANGE: CRAFTING OPPORTUNITIES IN WOMEN ENTREPRENEURSHIP IN INDIA
Presenter(s): Mikayla Lewis (Michigan State University)
Category: Social Sciences
Mentors(s): Eddie Boucher (College of Social Science)

This project explores how women in Rajasthan, India navigate a patriarchal society and their many daily responsibilities. By looking at this research through the lens of sustainability, material culture, and empowerment, we can further understand how women overcome barriers and achieve success in a constantly changing economy. Using interviews and visual documentation conducted in Udaipur and Jaipur, India we can begin to look at the similarities and differences that each woman faces when creating their own business. Many of these women are using craft as a way to obtain independence, financial security, and a sense of identity. While men commonly experience privilege and freedom in their entrepreneurial pursuits in craft sectors and in life more generally, women often struggle with having a sense of autonomy. However, craft-based entrepreneurship can allow for these women to gain a voice and have more agency in their professional, personal, and life decisions.

RETHINKING CORRECTIONAL LEADERSHIP: HUMAN-CENTERED LEADERSHIP FOR A CHANGING WORKFORCE
Presenter(s): Sara Mohammad (University of Maryland - College Park)
Category: Social Sciences
Mentors(s): Vivian Aranda-Hughes (College of Social Science)

Introduction: Correctional agencies across the United States currently face a workforce crisis marked by severe staffing shortages, high turnover rates, employee burnout and poor mental health and adjustment outcomes. One contributing factor to this crisis is the hostile workplace culture. Though some efforts have been made to improve correctional workforces, notably through wage increases and shortened trainings, few interventions have been developed to improve work environments. Purpose: This paper examines the relevance of human-centered leadership within correctional organizations and explores how leadership approaches grounded in emotional intelligence, self-awareness, communication, and relationship-building may address contemporary workforce challenges. The current paper aims to advance conceptual frameworks for correctional leadership. ConceptualFramework: Practices associated with human-centered leadership and grounded in emotional intelligence, such as leading by example and coaching, should be emphasized as necessary among supervisors, but also frontline staff. These practices should be implemented alongside traditional prison management models. Implications: The proposed framework expands on established leadership theories, such as emotional intelligence theory or authentic leadership. Using this framework, correctional systems should collaborate with researchers to develop evidence-informed training programs aimed to foster important skills. Such programs should be examined within correctional environments, especially its impacts on employee retention and work culture. Researchers should also assess how effectively the model addresses concerns among key players, especially correctional staff and incarcerated people; particularly, impacts on staff satisfaction, recidivism, and use of restrictive housing should be evaluated.

THE MAGNIFICENT SEVEN AND THE BREAKDOWN OF TRADITIONAL ASSET PRICING: A REGIME SHIFT ANALYSIS (2020-2025)
Presenter(s): Naisha Singh (Michigan State University)
Category: Social Sciences
Mentors(s): Morad Zekhnini (Eli Broad College of Business)

This paper examines whether traditional multi-factor asset pricing models can still explain stock returns in a market where seven companies now make up more than a quarter of the S&P 500. Using the Carhart 4-Factor Model, I test the returns of the "Magnificent Seven" (Apple, Microsoft, Alphabet, Amazon, Nvidia, Meta, and Tesla) against a 12-stock control group spanning multiple sectors over 2020-2025. The results show that NVIDIA generates a statistically significant abnormal return (annualized alpha of 61.49%, $p = 0.0006$) that the model cannot account for, while Apple and Microsoft have grown so large that their returns move with the market rather than independently of it, leaving little residual alpha for the model to capture. A robustness check using 2005-2010 data reverses this pattern - Apple was the idiosyncratic outlier, and NVIDIA traded like an ordinary stock - suggesting these findings reflect a current regime shift in how mega-cap technology firms are priced, rather than a permanent feature of the firms themselves.

WHERE DO PEOPLE WITH CRIMINAL RECORDS WORK? A QUALITATIVE ANALYSIS OF LABOR MARKET EXPERIENCES
Presenter(s): Adrianne Butler (Michigan State University), Oniya Brown (Michigan State University)
Category: Social Sciences
Mentors(s): Meghan O'Neil (College of Social Science)

Employment is an essential component of successful community reintegration; however, individuals with criminal justice involvement often face legal barriers that influence their workforce participation. This study worked to characterize employment patterns such as main job classifications and legal factors among 400 justice-involved adults participating in a randomized controlled trial in addiction treatment centers. Employment responses were qualitatively coded into occupational sectors; including the industry and positions participants reported. The most common occupational sectors included food service, construction, retail, and manufacturing. Around 1/3 of respondents reported having engaged in sex work.
Legal factors that may influence employment, including participation in informal employment, were also categorized and summarized. The most frequently reported legal factors included revoked or suspended driver's licenses, monetary legal concerns (LFOs and child support enforcement), difficulty obtaining work due to a criminal record, court related appointments, and treatment participation. Approximately two-thirds of participants reported engaging in informal employment, or "off the books" work.
These findings provide valuable insight for employment among justice-involved adults, establishing a foundation for future analyses examining how legal barriers may influence occupational opportunities and employment outcomes. Through understanding employment patterns within this population, it may assist in informing reentry programming, workforce initiatives, and future evaluations aimed at improving access to employment.

WHAT FACTORS MOST SIGNIFICANTLY ENABLE OR HINDER EQUITABLE ENERGY TRANSITIONS IN URBAN NEIGHBORHOODS
Presenter(s): Patrick Stephens (Winston-Salem State University)
Category: Social Sciences
Mentors(s): Meghan Wilson (College of Social Science)

As cities work to reduce carbon emissions and expand sustainable energy systems, the question of equity remains central to understanding how energy transitions unfold in urban neighborhoods. This study examines the factors that most significantly enable or hinder equitable energy transitions, with primary emphasis on Detroit, Michigan.

In this project, equitable energy transitions are defined as efforts to move away from fossil fuel-based energy systems toward cleaner and more sustainable alternatives while ensuring that benefits and burdens are distributed fairly across residents, particularly in historically marginalized communities. Using Detroit as the central case study, this research examines state legislation, local policy implementation, scholarly literature, and media coverage to identify the social, political, and structural conditions that shape energy transition outcomes. Particular attention is given to community engagement, affordability, policy support, access to funding, and accountability in implementation. Preliminary findings suggest that enabling factors include strong public policy, partnerships between organizations, and meaningful community involvement, while barriers include affordability concerns, limited participation, uneven resource distribution, and historical inequities in development. This research is important because it helps explain how urban energy transitions can be designed in ways that support both environmental sustainability and social equity. By focusing on Detroit, this study contributes to broader discussions of environmental justice, urban governance, and the future of equitable clean energy policy in the United States.

A WAR OF WORDS: AN ANALYSIS OF PRESIDENTIAL RHETORIC, THE WAR IN AFGHANISTAN, AND PUBLIC OPINION
Presenter(s): Joyce Peterlin (Michigan State University)
Category: Social Sciences
Mentors(s): Daniel Bergan (College of Communication Arts & Sciences)

Among academics, there is an understanding that the United States presidency exists in two dimensions: domestic and foreign policy decision-making. A president faces challenges in both capacities, but the modern presidency has encountered far less on the foreign front and executive power within that dimension has only grown. This makes foreign policy the most powerful weapon in the president's rhetorical arsenal. The primary question is whether or not the president can influence public support for foreign military action with public remarks. For the sake of this paper, I examine the War in Afghanistan and public opinion regarding it over the course of the George W. Bush administration. This is specifically done by reading the Bush administration's remarks about Afghanistan and collecting data from the number of words and parts of speech used throughout. From there, I cross reference the speeches with public opinion polling regarding the War in Afghanistan before and after the remarks were made to ascertain the influence they did or did not have. This study draws from both the quantitative differentials of the polling data available, but also the contents of the speeches to inspect the communication strategy employed by the White House and how it aligns with the American national identity.

SCHOOL DISCIPLINARY PRACTICES AND ITS INTERACTION WITH IMMIGRANT YOUTH
Presenter(s): Isabella (Bella) Yeo (Truman State University)
Category: Social Sciences
Mentors(s): Caitlin Cavanagh (College of Social Science)

U.S. school systems have long faced issues concerning how to appropriately discipline students. For marginalized youth (i.e., youth of color, low-income, and immigrant youth), school disciplinary practices can entangle them in a deep-rooted system of institutional racism. Yet, little research has explored how immigrant youth are being treated via school sanctions as well as other marginalized youth and whether or not these sanctions are exclusionary or not. The following research questions in this study will be: (1) Are immigrant students more likely to receive exclusionary or non-exclusionary responses compared to native-born students? (2) Are immigrant students more likely to receive punitive responses or rehabilitative responses compared to native-born students who have been disciplined? (3) How do punishments differ within the local mid-western school district between those who have committed only one violation versus multiple violations? To address these questions, the present study uses official juvenile court records as well as, official disciplinary records from a local mid-western school district to: identify the treatment of immigrant youth within the local mid-western school district, whether their punishment is more exclusionary or non-exclusionary, and if more than one violation leads to more exclusionary responses. Potential solutions for these issues within the United States are explored, which may provide a better lens of understanding as to how teachers and principals within local mid-western school districts treat immigrant students when it comes to their type of punishment.

PHYTOLITHS FROM THE DENTAL CALCULUS OF INDIVIDUALS FROM CAVES BRANCH ROCKSHELTER (CBR), BELIZE
Presenter(s): Krystin Nelligan (Michigan State University)
Category: Social Sciences
Mentors(s): Aubree Marshall (College of Osteopathic Medicine)

The research aims to give a unique perspective into Mayan culture by looking at two individual diets from the dental calculus of skeletal remains found in the Caves Branch Rockshelter (CBR) in Belize, rather than using stable isotope analysis to give a generalized look into their diet. By examining each individual's dental calculus, their phytoliths can provide insight into their season of death, their lived experiences, and how social identity affected food access. The phytoliths found in the dental calculus were compared to reference photographs using shape, cross-polarizations, segments, arms, size and length, and texture to ultimately identify which plant it is associated with.

Science, Technology, Engineering, Mathematics

BASIC SKILLS FOR STUDYING THE LIFE HISTORY OF THE MODEL ORGANISM, DAPHNIA MAGNA
Presenter(s): Mia Starks (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Nina Wale (College of Natural Science)

When first joining the Wale lab, my experience began with basic lab support tasks, where I focused on maintaining a healthy and well-managed environment for the water flea Daphnia magna. This organism is important in evolutionary biology because its short-lifespan and rapid reproduction allows us to quantify its evolutionary fitness and the impact of environmental stressors. My responsibilities included harvesting algae for feeding, cleaning beakers, monitoring Daphnia health, and assisting seasoned lab members with routine procedures. Through completing these tasks, I achieved an understanding of responsibility and real laboratory work and gained knowledge necessary for future undergraduate research. As I became more familiar with laboratory operations and demonstrated reliability, I was given the opportunity to assist a graduate student with her own independent research project, where she was exploring elemental resource allocation to eggs during Daphnia developmental stages. While continuing to contribute to husbandry efforts, I was able to participate in laboratory organization and data collection throughout her experiment. Specifically, the timing of reproduction and number of eggs from individual Daphnia mothers was collected. This was a specific branch of research that I was able to develop further by analyzing the variation in the number of eggs produced, which allowed me to connect observations to broader ecological and evolutionary questions. This presentation highlights the progression of my role within the laboratory, from learning the fundamentals of undergraduate laboratory research to contributing to an ongoing research project, all while gaining valuable technical skills and developing a deeper understanding of experimental design.

SCREENING MIGRATORY PACIFIC SALMON TO DETECT TETRACAPSULOIDES BRYOSALMONAE IN WILD FISH IN MICHIGAN
Presenter(s): Mantaj Singh (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Bartolomeo Gorgoglione (College of Veterinary Medicine)

Tetracapsuloides bryosalmonae is a myxozoan parasite known to cause Proliferative Kidney Disease (PKD) in salmonid fishes in Europe and Northwestern America. PKD pathobiology may progress to a severe disease in highly susceptible fish, leading to marked kidney pathology and host death. We recently discovered that T. bryosalmonae completes its lifecycle in the Great Lakes watershed, being detected in fish, bryozoans and waters. Although, clinical PKD has not yet been observed in infected fish from this region. In the fall of 2025, 601 adult salmonids were sampled during their seasonal spawning migrations. Chinook and Coho Salmon, along with a small number of Rainbow Trout, were collected from five fish weirs operated by MI-DNR on rivers connected to Lakes Michigan and Huron. Kidney samples were tested for the presence of T. bryosalmonae using sensitive molecular biology screening methods (qPCR followed by sequencing confirmation of positive specimens). Positive fish were found at all locations sampled, although infection rate was low, and no visible clinical signs of PKD were observed. These findings corroborate evidence of this parasite persisting in adult salmonids across Michigan waters, through asymptomatic life-long carriers. Screening wild juvenile fish and performing laboratory-controlled infections, once the whole parasite lifecycle may be replicated in laboratory conditions, will allow to better understand whether PKD could become a concern in the Great Lakes region upon the ongoing climate and environmental changes trend.

SINGULARITY ALGORITHMS FOR NON-HERMITIAN QUANTUM ELECTRODYNAMICS
Presenter(s): Bera Ayyildiz (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Angela Wilson (College of Natural Science), Benjamin Peyton (College of Natural Science), Jared Weidman (College of Natural Science)

Optical microcavities are structures that confine light in tiny volumes, composed of two reflective surfaces separated by distances of a few micrometers or nanometers. When a molecule is introduced into the cavity, the light frequency can be tuned to resonate with a molecular transition, splitting the excited state into hybrid light-matter polaritonic states. The strength of these cavity-molecule systems lies in the high degree of precision and control that can be achieved by directly interfacing with light and matter.
When the potential loss of photons (light) from the cavity-molecule system is incorporated into the quantum theoretical framework, the Hamiltonian operator describing the system becomes non-Hermitian, introducing a unique set of challenges and phenomena. One particularly interesting problem is identifying singularities in parameter space where molecular transitions, corresponding to the eigenvalues and eigenvectors of the Hamiltonian, coalesce. In this work, an algorithmic approach, referred to as the "loop method", is used to locate these singularities. This approach involves sweeping through parameter values and optimizing to find a point at which coalescence is attained.

BEHAVIORAL EFFECTS OF HUMAN INFANTS' GUT MICROBIOTA IN MICE
Presenter(s): Kristina Johnson (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Rebecca Knickmeyer (College of Human Medicine)

Studies of germ-free, antibiotic-ablated, probiotic-treated, and humanized mouse models reveal that the gut microbiome influences neurological development and behavior. However, relatively little is known about how microbial communities present in the human infant gut shape such outcomes. Using the light-and-dark box test, this study examines how two microbial stool communities, common in human infants, affect anxiety-like and exploratory behaviors in mice. One of these communities is relatively rich in Bacteroides, and the other is rich in Bifidobacterium. Microbial communities were introduced into pregnant germ-free animals at mid-gestation (pregnancy day 10). For comparison, another group of pregnant germ-free animals was inoculated with fecal material from specific-pathogen-free mice (SPF), and a final group with autoclaved fecal material from SPF mice (GF). Using two-way ANOVA, anxiety-like behavior was tested, operationalized as time spent in the dark compartment, and exploratory behavior, as the number of entries from the light to the dark compartments. Microbiome groups showed no significant effect of microbiome group on percent time spent in the dark chamber, $F(3,69) = 1.22$, $p = .308$. There was no significant effect of gender, $F(2,69) = 2.72$, $p = .073$, and no significant interaction between microbiome group and gender, $F(3,69) = 0.32$, $p = .813$. However, there was a significant effect in the number of transitions between chambers, $F(3,70) = 3.62$, $p = 0.017$. Post hoc tests showed GF mice had significantly more transitions than the BIF and SPF groups. These findings suggest that the microbiome may influence exploratory behavior. Using two-way ANOVA, anxiety-like behavior was tested, operationalized as time spent in the dark compartment, and exploratory behavior, as the number of entries from the light to the dark compartments. Microbiome groups showed no significance in time spent in the light chambers, $F(3,70) = 0.83$, $p = 0.484$. There was no significance of microbiome group time spent in the dark chambers, $F(3,70) = 1.29$, $p = 0.266$. However, there was a significant effect in the number of transitions between chambers, $F(3,70) = 3.62$, $p = 0.017$.

Post hoc tests showed that GF mice had significantly more transitions than the BIF and SPF groups. These findings suggest that the microbiome may influence exploratory behavior.

SOCIAL PREFERENCES IN A NEW SOCIAL BEHAVIOR MODEL, THE NILE GRASS RAT
Presenter(s): Lara Korkmaz (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Alexa Veenema (College of Social Science), Bridgette Weiss (College of Natural Science)

Much like humans, Nile grass rats (Arvicanthis niloticus) are diurnal and show biparental care. Although not much else is known about their social behavior, these traits separate them from common rodent model organisms and make them appealing for social behavioral research. To help determine their use as translational animal models, we conducted ten-minute three chamber tests in male and female Nile grass rats to understand their preferences for social approach (novel rat vs. novel object), social novelty (novel vs. familiar rat), and opposite sex (same-sex vs. opposite-sex rat).We then analyzed these preferences both as averages across the whole duration of the test and minute-by-minute to determine if they remained consistent over time. We also compared our findings to the more commonly used Wistar rat. Both species generally preferred novel rats in social approach and social novelty testing; however, male Nile grass rats did not show a social novelty preference. Both species also tended to prefer opposite-sex rats in opposite-sex preference testing except female Wistar rats. Minute-by-minute data was consistent with ten-minute averages across groups and behavioral tests. However, minute-by-minute social novelty preferences in male Nile grass rats showed high variability within and between individuals that weren't observed in other tests. Overall, these findings show that Nile grass rats exhibit both similarities and differences in social preferences compared to Wistar rats that are important to inform their use as translational models. Future directions could include behavioral testing coupled with brain manipulations to better understand the neural mechanisms underlying these behaviors.

ACCELERATING CHEMICAL DISCOVERY: USING GPU-POWERED SIMULATIONS TO CAPTURE RARE MOLECULAR EVENTS
Presenter(s): Aadhyaa Gauli (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Samik Bose (College of Natural Science)

Chemical reactions often involve "rare events"-critical molecular transformations like bond-breaking or proton transfers that happen in fractions of a second but take vast amounts of computational time to simulate. Traditional modeling software spends most of its processing power simulating molecules sitting quietly in stable states, making it incredibly difficult to capture the exact moment a reaction occurs. To solve this efficiency problem, we developed a powerful, graphics processing unit (GPU) accelerated computing framework that combines advanced "weighted-ensemble" sampling with quantum mechanical simulations. The weighted-ensemble method works by actively identifying and duplicating simulation paths heading toward the reaction, preventing wasted computational effort on inactive states. By pairing this sampling strategy with high-performance GPU acceleration, we drastically reduce the time and cost required to compute complex electronic structures. We successfully demonstrated this tool by mapping simple proton transfers and gas-phase chemical reactions. Furthermore, we extended this framework to model complex biochemical systems, allowing us to simulate a reactive region with precise quantum mechanics while treating the surrounding molecular environment with standard computational physics. This integrated approach allows us to resolve precise reaction pathways, structural changes, and chemical rates for processes previously too slow to simulate, ultimately expanding the scope of how computers can model complex chemistry and targeted drug discovery.

DEVELOPMENT OF SOLID HARVESTING METHODOLOGY FOR ZN-62 AT FRIB FOR APPLICATIONS IN RADIOPHARMACY
Presenter(s): Alexa Annika Calderon (Michigan State University), Vaughn House (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Ferris Bissen (College of Natural Science)

The Isotope Harvesting Program at the Facility for Rare Isotope Beams (FRIB) captures radionuclides produced as byproducts during linear accelerator operations. This process provides researchers with access to radioisotopes that are otherwise difficult to obtain through conventional production methods, enabling expanded production of radionuclides which are applicable across multiple research areas. Harvested isotopes can achieve high isotopic purity, which is suitable for radiopharmaceutical development, including Positron Emission Tomography (PET) imaging. Solid isotope harvesting at FRIB employs a series of metal foils positioned to intercept a purified fragment beam containing the radionuclide of interest. These foils capture the desired radionuclide, enabling targeted investigation of specific isotopes after separation from its carrier foil. This project investigates the development of a solid-harvesting methodology for Zn-62 ($t_{½}$ = 9.2 h), a promising radionuclide for PET imaging applications. A primary Zn-64 beam was fragmented and separated to produce Zn-62, which was subsequently collected on copper foils. The foils were dissolved in hydrochloric acid, and Zn-62 was separated from copper impurities using anion exchange chromatography, yielding a product with high specific activity. To evaluate radiolabeling performance, DOTA and NOTA chelators were complexed with Zn-62. Chelation efficiency was assessed using thin-layer chromatography. Results demonstrated greater binding affinity for NOTA-based chelation, suggesting improved stability for potential PET imaging applications. These findings support the continued development of Zn-62 based radiopharmaceuticals and establish a methodological foundation for solid-harvesting isotope production at FRIB.

IDENTIFYING GENETIC MARKERS FOR SEX DETERMINATION IN THE SPOTTED GAR
Presenter(s): Mars Baas (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Ingo Braasch (College of Natural Science)

There are multiple modes of sex determination that differ among species, including genetic sex determination (GSD). Within GSD, sex is determined by genetic factors that may involve one or more chromosomes, which can vary in number or size between the sexes. The spotted gar (Lepisosteus oculatus), an emerging model for vertebrate comparative biology, exhibits no observable traits distinguishing sexes, and a genetic mechanism of sex determination has yet to be determined. Recent work by Pinto et al. introduced the Sex Chromosome Identification by Negating Kmer Densities (SCINKD) method to identify putative sex chromosomes in vertebrate genomes. SCINKD has been applied to our new spotted gar genome assembly from a male individual by analyzing haplotype differences (sets of allele variations). Using this approach, chromosomes 14 and 18 were identified as potential sex chromosomes due to differences in haplotype length and higher levels of repeat content compared to other chromosomes. Our analyses thus reveal a putative dual X1/Y1 (chr14) X2/Y2 (chr18) male sex determination mechanism in spotted gar. To validate these findings, Polymerase Chain Reaction (PCR) assays have been developed to amplify and compare regions of the identified chromosomes between sexes. Because exploration of these specific genomic regions is novel, effective primers have not yet been established. Our ongoing research focuses on testing a set of 24 candidate primer sets to determine their amplification success, optimal annealing temperatures, and sex specificity. Validation of these primer sets will enable the first experimental confirmation of the genetic basis of sex determination in spotted gar.

PREDICTION OF POSTPARTUM HYPERKETONEMIA IN DAIRY COWS FROM PREPARTUM METABOLIC AND MANAGEMENT VARIABLES: A COMPARISON OF FEATURE DOMAINS, MACHINE-LEARNING ALGORITHMS, AND CLASS-IMBALANCE STRATEGIES
Presenter(s): Dev Jyoti Ghosh Arnab (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Zelmar Rodriguez (College of Veterinary Medicine)

Hyperketonemia (HYK) in early lactation reduces milk yield, impairs reproduction, and predisposes cows to displaced abomasum and other transition diseases. Tools that flag at-risk cows before calving would enable preventive management. Our objectives were to develop and compare machine-learning models for predicting postpartum hyperketonemia (HYK) using prepartum data and to determine which types of information, including management variables, metabolite measurements, or their combination, and which prepartum temporal patterns provide the greatest predictive value. Records from 132 cows, including 18 HYK-positive cows (prevalence, 13.6%), were analyzed. Predictors included a 15-analyte blood gas and metabolic panel measured at 3 prepartum time points, plus within-cow linear slopes, yielding 60 metabolite features. Ten management features derived from close-up duration, dry-period duration, parity, and gestation length were also evaluated. Three feature sets, Metabolites, Management, and Combined, were assessed using logistic regression (LR), random forest, XGBoost, and support vector machine (SVM) under 3 imbalance strategies: no adjustment, synthetic minority over-sampling technique, and cost-sensitive weighting. Imputation, standardization, and oversampling were performed within leave-one-out cross-validation folds. Precision-recall area under the curve (PR-AUC) was the primary metric because of class imbalance. Management features outperformed metabolite features, with maximum PR-AUC values of 0.486 and 0.237, respectively. Including all 70 features reduced performance, with a maximum PR-AUC of 0.342, likely because of the high feature-to-event ratio. Grouped Shapley additive explanation values ranked management variables as the most important predictors. Among metabolite features, the earliest prepartum week and slopes across weeks provided more predictive information than the intermediate week. Greedy forward selection identified 7 predictors: total dry-period duration, base excess 2 weeks before calving, hematocrit 1 week before calving, dry period longer than 60 d, glucose slope, gestation length, and dry period shorter than 45 d. Using these features, LR achieved the highest PR-AUC of 0.510, 3.8 times the no-skill value of 0.136, with ROC-AUC of 0.763, sensitivity of 0.78, specificity of 0.76, and negative predictive value of 0.96. SVM with oversampling achieved the highest F1 score of 0.538 and Matthews correlation coefficient of 0.473, although performance was unstable without resampling. Logistic regression was the most robust algorithm. Prepartum management information predicted postpartum HYK more effectively than the metabolite panel alone, whereas a compact model combining selected management and metabolite features achieved the best overall performance and may support prepartum screening, particularly for identifying low-risk cows.

SEIZURE RISK IN AUTISM WITH INTELLECTUAL DISABILITY: TRENDS AND PATTERNS FROM A BIBLIOMETRIC ANALYSIS
Presenter(s): Sam Fisher (Grand Valley State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Emily Mai (University of California Berkeley)

Autism is often accompanied by co-occurring neurological and developmental conditions, including seizures and intellectual disability (ID). Several clinical studies have pointed towards a trend of people with intellectual disability and autism having a heightened risk for seizures. Research on this topic is cross-disciplinary, making it useful to examine how this topic has been defined and studied and how the literature has developed over time. We extracted data from the Web of Science, identified the Top 100 Most Cited Articles relevant to our topic, and performed data cleaning to facilitate bibliometric analysis of research trends, citation networks, and the evolution of the field. Among the Top 100 most-cited articles, publication output increased steadily from 2017, peaking at 29 papers in 2020 before declining in subsequent years. The literature spanned five thematic areas - Seizure Mechanisms, Clinical Outcomes, Genetics & Biomarkers, Animal & Cell Models, and Treatment & Intervention - with Seizure Mechanisms and Clinical Outcomes most heavily represented. Molecular Autism published the greatest share of top-cited work (6 papers), followed by Frontiers in Psychiatry (5 papers). Citation counts were notably higher among older papers, particularly those published before 2018, reflecting the accumulated influence of earlier foundational studies. These findings suggest that intellectual disability is a significant factor in the study of seizure risk among autistic individuals, as shown from the highly cited literature on seizure mechanisms and clinical outcomes. The amount of influential studies in these areas highlights the importance of further investigating the neurological and biological pathways that may link autism, intellectual disability, and seizures.

GLOBAL PUBLICATION TRENDS AND THEMATIC EVOLUTION IN AMYLOID-β AND TAU PROTEIN INTERACTION IN ALZHEIMER'S DISEASE RESEARCH

Presenter(s): Siddh Sheth (University of Michigan - Ann Arbor)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Sydney Do (University of California Berkeley)

Global Publication Trends and Thematic Evolution in Amyloid-β and Tau Protein Interaction Research in Alzheimer's Disease (2000-2025) Objectives: The objective of this study is to examine global publication trends and thematic evolution in research on amyloid-β (Aβ) and tau protein interactions in Alzheimer's disease from 2000 to 2025. Using bibliometric analysis of the top 100 most cited articles from the Web of Science database, we evaluated patterns in citation counts, key contributors, and publication trends. Background: Alzheimer's disease is a progressive neurodegenerative disorder characterized by the decline of memory and cognitive function. Amyloid-β (Aβ) and tau proteins are key contributors to disease pathology, as Aβ accumulates to form extracellular plaques that disrupt neuronal communication, while tau becomes hyperphosphorylated within neurons, forming neurofibrillary tangles that lead to neuronal dysfunction and death. Increasing evidence suggests that interactions between Aβ and tau play a critical role in disease progression, as Aβ accumulation can accelerate tau pathology. The combined presence of both proteins has been shown to more strongly predict cognitive decline than either pathology alone. Methods: The Web of Science database was used to identify the top 100 most cited articles on amyloid-β (Aβ) and tau protein interactions published between 2000 and 2025. Bibliometric analysis was conducted to evaluate citation counts, authorship patterns, contributing institutions, and keyword trends. These data were analyzed to identify global research trends and examine how the focus of research has evolved over time. Results: Citation counts in Aβ-tau interaction research increased steadily from 2000, with a peak between 2010 and 2013. The most prolific senior authors were Götz, J. (n=4) and Rosa-Neto, P. (n=3). Leading institutions included the Autonomous University of Barcelona (n=5), Boston University, and Case Western Reserve University (n=4 each). The Journal of Neuroscience and JAMA Neurology were the top journals (n=5 each), followed by the Journal of Biological Chemistry (n=4). Keyword analysis of the top 100 most cited studies identified "tau," "amyloid-beta," and "mouse" as the most frequent terms, with increasing mentions of biomarkers, oxidative stress, and neuroinflammation. Conclusions: Our bibliometric analysis of the top 100 most cited studies demonstrates a clear increase in research on amyloid-β and tau protein interactions since 2000, with a peak in highly cited publications between 2010 and 2013. Contributions were largely driven by leading institutions in the United States and Europe, with key journals playing a central role in disseminating influential work. Thematic evolution shows a shift from early molecular-focused studies to more recent research emphasizing protein interaction, biomarkers, and clinical relevance. These findings highlight the growing importance of studying Aβ and tau together, supporting future research and therapeutic strategies targeting both proteins to improve outcomes in Alzheimer's disease.

SOLID-STATE NMR SPECTROSCOPY OF FUNGAL CELL WALL REMODELING

Presenter(s): Aswath Karai (Michigan State University)
Category: Science, Technology, Engineering, Mathematics (multiple disciplines)
Mentors(s): Tuo Wang (College of Natural Science)

In our current healthcare system, fungal infections are a rapidly rising problem. Specifically, aspergillosis, candidiasis, and cryptococcosis result in the death of millions of individuals annually. Many current antifungal mediciations are ineffective, as current cell wall models are incomplete. Here, we are using solid-state NMR to track cell wall structures and their remodeling in natural environments.

Social Sciences, Arts, Humanities

PARTICIPANT ENGAGEMENT AND SKIN CAROTENOID CHANGES IN VULNERABLE PREGNANT WOMEN FOLLOWING A FOOD-BASED INTERVENTION

Presenter(s): Miriam Haddad (Michigan State University)
Category: Social Sciences, Arts, Humanties (multiple disciplines)
Mentors(s): Sarah Comstock (College of Agriculture & Natural Resources)

Maintaining a healthy maternal diet plays a significant role in facilitating the growth and development of the infant during pregnancy and postpartum. Understanding the importance of a high-quality diet during pregnancy may provide insight into the health implications of increasing maternal carotenoid consumption during pregnancy. The research objective was to evaluate the correlation between participant engagement levels in a food-based intervention and changes in the skin carotenoid values among pregnant women experiencing food insecurity, obesity, or risk for substance use disorder. Pregnant women (n=26) in the Pregnancy EAting and POstpartum Diapers 2 study (PEAPOD 2) provided dietary intake information using structured food logs spanning 10 consecutive days. Participant engagement was quantified based on the adherence to the predefined criteria of the food intervention. Individuals were categorized as non-engaged, engaged, or highly engaged. Pre- and post-intervention skin carotenoid values were considered to determine the efficacy of the food intervention relative to each participants' engagement. A one-way analysis of variance (ANOVA) test was conducted to compare changes in skin carotenoid values across engagement groups. There was no statistically significant difference in the change in skin carotenoid values among engagement categories. Substantial variability in carotenoid response across engagement groups was observed, indicating high individual variability. These findings suggest that engagement alone may not be sufficient to predict carotenoid response among pregnant women facing health vulnerabilities. Future work should further clarify the role of engagement, and other behavioral factors, in influencing carotenoid response.

UPPER-LEVEL BIOLOGY FLY-CURE ENHANCES STUDENTS' SCIENTIFIC SELF-EFFICACY, SCIENCE IDENTITY, CAREER INTENTIONS, AND SELF-ASSESSED RESEARCH SKILLS

Presenter(s): Zachary Bailey (University of Detroit Mercy)
Category: Social Sciences, Arts, Humanties (multiple disciplines)
Mentors(s): Eva Nyutu (University of Detroit Mercy)

Recruiting, training, and retaining a diverse scientific workforce remains a critical priority in STEM education. Course-based Undergraduate Research Experiences (CUREs) provide an inclusive, scalable means of offering authentic research opportunities to all students, fostering scientific skills, science identity, sense of belonging, and persistence in STEM fields. This study examines the impact of the Fly-CURE program-a semester-long genetics laboratory course utilizing Drosophila melanogaster to engage upper-level undergraduates, primarily pre-health majors, at a primarily undergraduate institution. Focus group analyses explored outcomes related to science identity, sense of belonging, research skills, and career intentions. Findings indicate that participation in Fly-CURE enhances scientific self-efficacy, technical competencies, critical thinking, and students' sense of community within science. While most participants viewed research experiences as integral to their future STEM or health-related careers, some suggested that projects more closely aligned with pre-health interests could further enhance engagement. These results are consistent with the broader CURE literature, emphasizing the potential of course-based research to strengthen retention and cultivate a diverse STEM workforce. This study highlights the value of embedding authentic research into upper-level curricula and informs ongoing efforts to optimize CURE design for diverse student populations.

SELF-CONCEPT CLARITY AS A MODERATOR OF INTERNALIZED STIGMA AND SYMPTOM SEVERITY IN PSYCHOSIS: A CROSS-CULTURAL REVIEW
Presenter(s): Nitya Thakur (Michigan State University)
Category: Social Sciences, Arts, Humanties (multiple disciplines)
Mentors(s): William Chopik (College of Social Science)

Internalized stigma, the process by which individuals with mental illness adopt negative societal stereotypes about themselves, is a well-documented barrier to recovery in psychosis, associated with reduced help-seeking, treatment nonadherence, and poorer functional outcomes. Cross-cultural research has established that collectivist cultural contexts predict higher levels of internalized stigma in psychosis, likely because individuals with mental illness are more readily perceived as social deviants in societies that prioritize conformity and group cohesion. However, a critical psychological mechanism linking cultural context, stigma, and symptom severity remains underexplored: self-concept clarity (SCC), defined as the extent to which an individual holds a clear, consistent, and stable sense of self. Emerging evidence suggests that individuals with psychosis demonstrate significantly lower SCC than healthy controls and that lower SCC is associated with greater symptom severity and functional impairment. Despite this, a systematic review of 73 cross-cultural studies on internalized stigma in psychosis found that fewer than 6% measured any SCC-adjacent construct, representing a substantial gap in the literature. The present project proposes a theoretical model in which SCC moderates the relationship between internalized stigma and symptom severity and in which this moderating effect varies by cultural context: individuals in collectivist cultures may experience higher stigma-related identity disruption, making SCC an especially critical protective factor. This review synthesizes evidence for each pathway in this model and calls for future cross-cultural research to formally test SCC as a moderator of stigma outcomes in psychosis.

FROM PROVIDER BIOGRAPHIES TO LIBRARY PRIVATE ROOMS: ADOLESCENT INPUT ON BUILDING TRUST AND ACCESSIBILITY IN VIRTUAL MENTAL HEALTH CARE
Presenter(s): Nour Almounajed (University of Michigan - Flint)
Category: Social Sciences, Arts, Humanties (multiple disciplines)
Mentors(s): Lily Ethington (University of Michigan - Flint)

Problem or Purpose: Adolescent perspectives are essential for designing virtual mental health services that support engagement, privacy and communication. Many adolescents attend virtual appointments independently, including video and phone visits. Understanding adolescent recommendations for improvement can guide enhancements in privacy and communication. Procedure: This study explored adolescents' recommendations for improving virtual mental healthcare. Participants aged 14-17 were recruited from Genesee County, Michigan. During interviews, participants suggested how to improve telehealth visits with mental health providers. Interview transcripts were analyzed in Dedoose by identifying themes. Among the 81 adolescents, 16 (19.8%) were aged 14, 20 (24.7%) were 15, 23 (28.4%) were 16, and 22 (27.2%) were 17. Results: Participants preferred to have the ability to review provider biographies before appointments as a way to gain trust. Adolescents valued the chat function for sharing sensitive information when privacy was limited. They preferred the use of appointment agendas in advance and appreciated access to private rooms in community settings, such as libraries for visits. Conclusions and Implications: The findings demonstrate that adolescents have clear ideas on how to improve virtual mental health visits. By sharing provider biographies, providers can build early trust with adolescents. Offering library private rooms gives youth a quiet, confidential space especially when their homes are crowded. Research may test if the suggested strategies keep youth in therapy and improve their mental health.

PERSPECTIVES OF AUTISTIC COLLEGE STUDENTS ON SUPPORTS AND SERVICES THAT ADDRESS THEIR MENTAL HEALTH NEEDS
Presenter(s): Sam Fisher (Grand Valley State University)
Category: Social Sciences, Arts, Humanties (multiple disciplines)
Mentors(s): Jamie Owen-DeSchryver (Grand Valley State University)

As colleges and universities begin to develop more inclusive frameworks for students with disabilities, autistic students have begun to pursue post-secondary education at higher rates. Universities are beginning to integrate a variety of supports and services to promote the overall well-being of autistic students. However, recent research has shown that while a variety of academic and social supports are available, there may be a need for additional supports to address ongoing mental health concerns. This is an issue worthy of significant concern, being that autistic students are at high risk of experiencing mental health concerns, including anxiety, depression, and suicidal thoughts and behaviors. The current study addresses the gap in knowledge concerning mental health-specific supports and services for autistic college students. Through a cross-sectional survey, we asked autistic college students to share their first-hand experiences with mental health concerns, mental health support service usage, and barriers to accessing supports. Our survey was distributed to more than 300 universities in the Midwestern United States and measured the experiences of over 65 students. We hope that this research will inform how colleges and universities implement neurodiversity-affirming mental health supports and services for autistic student populations.

COMPARING BLACK ADOLESCENTS VERBAL CONSENT PRACTICES BY SEXUAL ORIENTATION
Presenter(s): Jeannie Correa (Hunter College)
Category: Social Sciences, Arts, Humanties (multiple disciplines)
Mentors(s): Amy Drahota (College of Social Science)

Verbal consent is an indicator of affirmative consent, a priority in sexual assault prevention education. Affirmative consent uses a "yes-means-yes" rather than a "no-means-no" viewpoint, consisting of verbal and non-verbal cues when engaging in sexual activity. Limited research on adolescent consenting practices exists, despite adolescence being critical to forming sexual attitudes and practices. Further, little research has investigated the influence of overlapping identities on verbal consent practices, especially Black adolescents with diverse sexual orientations. Analyzing 2023 Youth Risk Behavior Survey (YRBS) data, I will examine Black US high school students' verbal consenting practice by sexual orientation. I hypothesize a significant difference in Black adolescents' verbal consent practices by sexual orientation. The YRBS measures health risk behaviors among high school students in the US. A subgroup (n=706) of the 2023 YRBS sample will be included. Eligibility includes: 1) Black racial identity and 2) Prior sexual contact. The categorical independent variable, sexual orientation, includes: Heterosexual, Gay/Lesbian, Bisexual, Questioning, and "Some other way". The binary dependent variable is derived from a single YRBS item: "The last time you had sexual contact, did you ask for consent verbally?" (Yes/No). Logistic regression will examine whether there is a statistically significant difference between Black adolescents' verbal sexual consent practices by sexual orientation. The 2023 YRBS was the first national survey to collect data on practices asking for sexual consent verbally among high school students. This study bridges the gap in literature regarding sexual orientation and verbal sexual consent practices, centered on Black high school students' experiences.

MENTAL HEALTH AND SUICIDALITY IN AUTISTIC COLLEGE STUDENTS
Presenter(s): Sam Fisher (Grand Valley State University)
Category: Social Sciences, Arts, Humanties (multiple disciplines)
Mentors(s): Emily Sanchez (Grand Valley State University)

Autistic college students are significantly more likely to experience suicidal thoughts and behaviors (STBs) than the general college student population. Jackson et al. (2018) found that 74.6% of autistic college students experienced some form of suicidal behavior at some point in their lives. Autistic college students are also more likely to successfully complete suicide on the first attempt. Suicide death is 3-7 times more common among autistic people than the general population (Cervantes et al., 2022). Co-occurring mental health conditions are also extremely prevalent among autistic people and elevate suicide risk. Yet college campuses are often uninformed or under-informed on how to best support autistic students and provide resources to help them navigate co-occurring mental health diagnoses. University faculty are also often unaware of how to best support autistic students and college counseling offices may not understand the types of interventions that should be implemented to reduce suicide. Through a narrative literature review, we analyzed autistic college students' experiences with mental health, suicidality, emerging adulthood, and college life. The intention of this review is to understand how post-secondary autistic students navigate the university environment and what support services can be put in place to meet the needs of these students.

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