JULY 24

2024

MID-SURE

Mid-Michigan Symposium for Undergraduate Research Experiences

ACKNOWLEDGEMENTS

The goal of the 14th annual Mid-Michigan Symposium for Undergraduate Research Experiences (Mid- SURE) 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 350 undergraduate students from over 100 different institutions presented their outstanding research and creative endeavors at Mid-SURE on July 24, 2024. These students are mentored by more than 300 faculty, staff, graduate students, and government or industry researchers.

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 2024:

- Advanced Computational Research Experience for Students (ACRES)
- Biomedical Research for University Students in Health Sciences (BRUSH)
- Bridge to PhD in Neurosciences Program (BPNP Endure)
- Building Bridges
- Communities and Future Earth Scientists (GeoCaFES)
- Cross-Disciplinary Training in Sustainable Chemistry and Chemical Processes (SCCP)
- Developmental Sciences Recruitment and Retention Program (DSRRP)
- Engineering Summer Undergraduate Research Experience (EnSURE)
- Entomology Research and Outreach Fellowship (EROF)
- Great Lakes Bioenergy Research Center Summer Undergraduate Research Program (GLBRC SURP)
- High School Honors Science/Math/Engineering Program (HSHSP)
- Physics & Astronomy Research Experience for Undergraduates
- Plant Genomics Research Experience for Undergraduates
- Research Experience for Undergraduates in Structural and Functional Neural Biology (ASPET SURF)
- Summer Research Opportunities Program (SROP)

Behind the Scenes

Mid-SURE 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:

- Our undergraduate and support staff: Anapaola Almaguer-Morales, Katy Anderson, Binitha Chandrasena, Joesy Esparza, Neha Gopalakrishnan, Sydney Logsdon, Grace Stys, and Martina Yen
- Casie Chunko, Administrative Assistant for Academic Initiatives
- Heather Dover, Coordinator for Undergraduate Research and lead Mid-SURE organizer
- Brittany Finch, Assistant Director for Undergraduate Research
- Brian Keas, Director for Undergraduate Research
- Korine Wawrzynski, Assistant Dean, Academic Initiatives

We appreciate the work of numerous MSU assistant and associate deans for identifying faculty, staff, post-doctoral fellows, and graduate students to evaluate student presentations.

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 Melissa Utykanski, ‘24 BFA in Graphic Design from the College of Arts & Letters.

Artist Statement: Influenced by the wide range of research topics presented at Mid-SURE, I developed this playful, Tetris-inspired composition to emphasize that no matter the shape, size, or color of the building blocks, there is a way to fit them together. Conceptually, this reflects the research process where thinking outside the box leads to inventive solutions. The typography interacts with the blocks and seamlessly conforms to their shape, making it part of the puzzle for the viewer to solve. The retro color palette is nostalgic yet bright and inviting to all of the different perspectives attending the event.

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Abstracts

Abstracts are organized by category. Please note that all abstracts are were limited to 1500 characters. Longer abstracts were truncated.

Agriculture & Animal Science

DOES HEIGHT IMPACT CATCH ABUNDANCE IN DIY MOTH TRAPS?

Presenter(s): RE Deforest (Lansing Community College)
Agriculture and Animal Science
Mentor(s): Hannah Burrack (College of Natural Science)

After years of trapping moths, it has been suggested that 5 feet (1.5 meters) is the ideal height to place the trap. In the Moth Ed project, teachers ask what height their students should place their traps, and they are told 5 feet (1.5 meters); although what if there's a better height to place the trap? To test this, two models of stands were built out of PVC pipes and hooks were drilled in at heights 2.5 ft, 5ft, and 10ft. The trap being used is a Plastic Bottle LED Trap, the same used in the Moth Ed project. By finding the height where not only moths are most abundant, but all insects caught, data will be recorded to show which ones are more or less abundant at which heights. This can be used to help projects or individuals who may be targeting a specific type of insect, such as moths in the Moth Ed project.

DROUGHT EFFECTS ON SOIL FUNGAL BIOMASS IN AGRICULTURE AND GRASSLAND SYSTEMS

Presenter(s): Allison Voneida (Michigan State University)
Agriculture and Animal Science
Mentor(s): Maxwell Oerther (Research and Innovation), Poulamee Chakraborty (Research and Innovation)

As drought frequency and duration increase along with the progression of climate change, the importance of understanding the impacts of drought on soils also increases. Fungi are essential to the soil environment because they stabilize soil structure, sequester carbon, and mine for nutrients, impacting soil health and plant and microorganism growth. Water is essential for fungal absorption of nutrients; it is needed to release enzymes, which break down nutrients for the fungus to absorb. Drought conditions may limit fungal growth due to reduced available moisture. Clear impacts of drought on fungal biomass have yet to be determined, hence the need for further research. Ergosterol, a sterol biomarker found in fungal membranes, is a strong indicator of fungal biomass. Therefore, quantifying ergosterol using methanol extraction and chromatography for soil under drought and no drought treatments can be used to indicate the effect of drought on fungal abundance. We obtained soil samples from multiple experimental sites where drought conditions were simulated through installed rain-exclusion shelters. Samples were collected from Long-Term Ecological Research sites, Marginal Land Experimental sites throughout Michigan, and a Shortgrass Steppe experimental site in Colorado. At each site, the two studied treatments were the ambient (no drought) and the reduced (drought) precipitation arranged in RCBD. We hypothesize that the ergosterol concentration in drought soils limited in moistur

PILOT STUDY TO EVALUATE THE USE OF "BEDSIDE" NT-PROBNP TEST FOR ASSESSING THE RISK OF FLUID OVERLOAD IN HOSPITALIZED CATS

Presenter(s): Alejandra Gomez Martinez (University of Puerto Rico Ponce)
Agriculture and Animal Science
Mentor(s): Tamilselvam Gunasekaran (College of Veterinary Medicine)

Fluid overload in cats with occult heart disease is a fatal complication of fluid therapy in hospitalized cats. However, identification of cats with occult heart disease is challenging in an emergency setting. We propose the use of a beside blood test, N-terminal brain natriuretic peptide (BNP) levels to assess the risk of fluid overload in hospitalized cats. We hypothesize that the change in BNP values during hospitalization will correlate to rate of fluid therapy. Additionally, the percent change in BNP will be higher in cats with occult heart disease and can predict the risk of fluid overload. Eleven cats that were admitted for fluid therapy were prospectively recruited. BNP levels were assessed at baseline, and at every 24 hours during hospitalization. Cats also received echocardiogram to assess heart disease status at baseline. During hospitalization the volume of fluid administered, and vitals parameters were recorded. Correlation analysis and Mann-Whitney U test were used for data analysis. The BNP values changed by 44%±30% from baseline at 24 hours. The change in BNP values had poor correlation to the volume of fluid administered ($r = 0.077$). The change in BNP values were significantly higher in cats with heart disease as compared to normal cats ($p = 0.017$). No cat developed fluid overload during hospitalization. The results show that the degree of change in BNP during fluid therapy is higher in cats with heart disease. Continued study enrollment is needed to evaluate

DAY AND NIGHT IRRIGATION OF SOYBEAN AND ITS EFFECT ON FROG-EYE MOLD PRESENCE

Presenter(s): Caden Wade (Michigan State University)
Agriculture and Animal Science
Mentor(s): Younsuk Dong (College of Natural Science)

The amount of time that a soybean leaf is wet determines its susceptibility to disease, like that of frog-eye mold, as the leaves are moist and tender, therefore easier to be infiltrated by pathogens. By watering during the day, after the dew period had passed, the severity of disease presence can be increased. However, by watering while dew is on the leaves, the time that water-related disease can spread is limited. By watering at a time other than midday, the evaporation of water particles from sprinklers will also be reduced, and therefore more efficient.

HOW TALL IS TALL? THE EFFECT OF PLANT-MICROBE INTERACTIONS ON SWITCHGRASS GROWTH

Presenter(s): Sophia Burke (Michigan State University)
Agriculture and Animal Science
Mentor(s): James Moran (College of Natural Science), Leah Dunlap (Michigan State University)

Nitrogen is often the limiting nutrient for plant growth, giving rise to large amounts of fertilizer being applied to agricultural fields. Chitin contains nitrogen and is the second most abundant naturally occurring organic polymer in soils, making it a high-value target for fertilization. The nitrogen in chitin is not bioavailable for plant uptake but requires microbial depolymerization before it can be consumed by plants. We are investigating how switchgrass can focus root exudation at locations of chitin in addition to stimulating microbes to break down chitin and release nitrogen for switchgrass to uptake. Our next steps include visualizing root exudate and chitinase activity location.

SPATIAL VARIABILITY OF SOIL MOISTURE AND ELECTRICAL CONDUCTIVITY WITHIN A BLUEBERRY ORCHARD

Presenter(s): Stewart Tucker (Michigan State University)
Agriculture and Animal Science
Mentor(s): Younsuk Dong (College of Natural Science)

Climate change has impacted Michigan fruit production through variable temperatures and erratic precipitation. This has complicated farmers to decide when and how much to water. Irrigation scheduling using soil moisture sensors has proven effective in improving irrigation management. However, selecting a location for the sensor most representative of the field is difficult due to the variability of soil characteristics, management practices, and topography. This study was focused on investigating the reason for varying soil moisture, as well as selecting a location within the field that is representative for the sensor. The HydraGO Portable Soil Moisture Probe was used to measure the volumetric moisture content and electrical conductivity at 100 points over three fields in a blueberry orchard. Soil texture and organic matter tests were measured from each point in the field. The soil moisture content and electrical conductivity were mapped using ArcGIS Pro with the Inverse Distance Weighted technique to display the spatial variability within the plot. Preliminary results show that the combination of statistical and geometric methods was able to identify the locations that represent the field condition with 95% confidence with 2% error. The percentage of sand, clay, silt, and organic matter was important to determine the most representative point within the field. The variability of soil moisture did not directly align with the electrical conductivity.

ASSESSMENT OF CARDIOVASCULAR HEALTH IN INTACT FEMALE DOGS UNDERGOING DIET-BASED OBESITY INDUCTION

Presenter(s): Carolina Bernal (Michigan State University)
Agriculture and Animal Science
Mentor(s): Viviane Cristine Leite Gomes (College of Veterinary Medicine)

The rising prevalence of obesity among pets poses a significant health concern worldwide. According to the Association for Pet Obesity Prevention, approximately 59% of dogs in the United States are affected by this nutritional disorder. This parallels the escalating rates of obesity in humans. Excessive adiposity is a known risk factor for human cardiovascular disease, including hypertension, coronary artery disease and heart failure. While there is some evidence of cardiovascular disorders in obese dogs, research to date has predominantly focused on male subjects, largely overlooking well-known sex differences in physiological responses to obesity-induced cardiovascular disease. Additionally, cardiovascular changes throughout weight gain remain poorly understood. Herein, we aim to characterize cardiovascular health in intact female dogs throughout diet-based obesity induction. Our hypothesis is that intact female dogs undergoing diet-induced obesity will exhibit a progressive increase in blood pressure compared to baseline measurements and develop left ventricular hypertrophy. Intact female Beagles at reproductive age and ideal body condition score (n=5) will be fed a hyperenergetic diet ad libitum, with 75% of caloric intake from dry dog food and 25% from wet dog food. Obesity will be defined as a body weight increase of at least 20% from baseline. Heart rate, systolic, diastolic, and mean arterial pressure will be assessed weekly via oscillometry (SunTec Vet20®). Additiona

A SLIPPERY SLOPE: EXPLORING THE CONSEQUENCES OF CONSERVATION MANAGEMENT ON SLUG PESTS IN MICHIGAN ROW CROPS

Presenter(s): Makayla Guenther (Michigan State University)
Agriculture and Animal Science
Mentor(s): Deshae Dillard (College of Natural Science), Hannah Burrack (College of Natural Science)

Slugs (Mollusca: Gastropoda, primarily *Deroceras* spp.) are pests of annual row crops, including soybeans and corn in Michigan and cause damage in early development stages during the spring and fall. Slugs prefer cool, wet conditions as well as decaying plant residue on the soil surface which provides food and shelter. As farmers sustainably intensify agriculture using conservation practices such as no-tillage and/or cover cropping, slugs have increased in abundance and emerged as a pest of field crops, especially soybean. Slugs damage results in poor stand count, slower plant growth, and greater weed pressure due to delayed crop growth. If slugs are more abundant in fields using conservation management practices, they may limit farmer adoption. In this experiment, we used shingle traps to monitor slug pest pressure in soybean and corn under conventional and sustainably managed crops. We found more slugs under shingle traps in areas of high plant residue and which had not been tilled and in wet conditions. In soybean plots, we found high levels of damage and observed lower stand counts in those using conservation practices. Slug management may be necessary for farms using conservation practices, and management tools should be developed and evaluated.

EFFECTS OF PRE-TREATMENTS AND MILLING TECHNOLOGIES ON THE NUTRITION AND PHYSICOCHEMICAL PROPERTIES OF PULSE FLOURS AND FOOD PRODUCTS

Presenter(s): Alex Hutchinson (Messiah University)
Agriculture and Animal Science
Mentor(s): Karen Cichy (College of Natural Science), Sharon Hooper (College of Natural Science)

The reputation of pulses as healthy and sustainable foods has contributed to increased consumer demand for pulse-containing food products in both domestic and global markets. One area of particular interest to food companies, is the replacement of conventional wheat and maize flours with pulse flours or the incorporation of them into food products such as pastas, snacks, and baked goods. However, differences in physicochemical properties commonly pose challenges with product functionality, texture, and off-flavors, leading to poor consumer acceptability. As a relatively new industry, there are no standard specifications for pulse flours and there is a need to understand how factors such as pre-processing and milling impact flour functionality as well as product texture, appearance, flavor, and safety. This study aims to help inform these areas of interest by analyzing the nutritional and physicochemical properties of pinto and navy bean flours that have been subjected to pre-treatments, including roasting and infrared exposure, and have been milled using different technologies: compression/decompression milling, lab-scale hammer milling, and stone milling. The total starch, resistant starch, available carbohydrates, protein digestibility, protein concentration, and amino acid composition, will be used to develop an understanding of each flour's nutritional profile. Lectin activity will serve as a marker to assess the efficacy of pre-treatments in improving the safety of

LEGACY OF DROUGHT ON SWITCHGRASS

Presenter(s): Dylan Minor (Michigan State University)
Agriculture and Animal Science
Mentor(s): Berkley Walker (College of Natural Science), Binod Basyal (Research and Innovation)

With global temperatures on the rise, the intensity and frequency of drought has been surging throughout the world. As a result, crop growth and yield are negatively impacted. Perennial bioenergy crops, such as switchgrass (Panigum virgatum), can also be adversely affected by drought. With the series of persistence drought, crops have to endure multiple subsequent droughts. Since drought is a multi-year phenomenon, it becomes important to understand how previous drought exposure affects plants in their future drought encounter. We are currently conducting a drought legacy effect study on switchgrass. Our main objectives are a) to investigate whether there are any drought legacy effects on switchgrass and b) to find out if the legacy response is mostly physiological or related to plant-soil feedback. We are comparing switchgrass grown from rhizomes that previously experienced drought with those that were grown from rhizomes that did not experience drought. We further impose drought (1% soil moisture) on half of all the plants and keep another half well-watered (25% soil moisture). Throughout the experiment, we are measuring the growth, gas exchange and chlorophyll fluorescence. We will collect leaf samples for RNA extraction and gene expression analysis. Ultimately, we will ferment aboveground biomass to see if there is any effect of drought legacy on biofuel production as well.

EXPLORING PULSE IRRIGATION VERSUS CONVENTIONAL IRRIGATION ON PLANT GROWTH, GAS EXCHANGE, AND FRUIT QUALITY

Presenter(s): Macy Schafer (Michigan State University)
Agriculture and Animal Science
Mentor(s): Josh Vanderweide (College of Natural Science)

Blueberry is an important crop in Michigan that requires irrigation, due to a shallow root system and preference for growing on sandy soils. Conventional irrigation involves a daily application of water, for approximately one hour. The soil becomes temporarily saturated, but the plants are unable to efficiently uptake water. Due to the high volume applied during a short period, much of the water is lost through runoff. Pulse irrigation uses the same volume of water as conventional irrigation, but instead distributes the water across four, 15-minute applications at 9am, 12pm, 3pm, and 6pm. Using BLIS (Blueberry LOCOMOS-based Irrigation System) to sense the depth at which water penetrates, irrigation automatically starts when soil moisture is low, using solenoid valves. In conventional irrigation, water penetrates deep into the soil, reaching depths past 24 inches. However, deep penetration is unnecessary for blueberry plants, as their root systems only extend a maximum of 12 inches into the soil. With pulse irrigation, the water only penetrated 6 to 12 inches of soil depth, which prevented water waste. To measure the differences between conventional irrigation and pulse irrigation, the plant growth and gas exchange rates of multiple blueberry cultivars, including 'Draper', 'Bluecrop', and 'Envoy', were monitored weekly. Shoot length increased using pulse irrigation with 'Draper' and 'Bluecrop', compared to the increase observed using conventional irrig

ESTIMATING NITRATE DYNAMICS IN SANDY SOIL USING ELECTRICAL CONDUCTIVITY SENSORS

Presenter(s): Mia Dagati (Michigan State University)

Agriculture and Animal Science

Mentor(s): Younsuk Dong (College of Natural Science)

Recent extreme and unpredictable precipitation episodes have left Michigan's agricultural industry struggling to maintain crop yields. Improper irrigation and fertilization management, particularly in the context of excessive rainfall, can lead to elevated soil water content and nutrient runoff. When soil water content exceeds its holding capacity, nitrate dissolves into water, leading to runoff or leaching into groundwater. With the USEPA's maximum contaminant level for nitrate set at 10 mg/L-N, minimizing nitrate leaching is critical for both health and environmental reasons. This project aims to estimate nutrient availability in soil based on electrical conductivity (EC) readings, as EC correlates with soil concentrations of many fertilizers. Three soil samples were prepared and flushed to an initial EC of 0.000 mS/cm. Different nitrate concentrations (0.0, 2.5, 5.0, 10, 25, and 50 mg/L-NO3) were applied, and EC readings were collected and analyzed. This process was repeated three times to ensure accuracy. Additionally, the same procedure was conducted using sodium phosphate to compare the impact on EC. Results indicated a strong relationship between nitrate concentration and soil EC, with an average increase of 0.0032 mS/cm per 1 mg/L-NO3. Conversely, the relationship between sodium phosphate concentration and soil EC was negligible, showing insignificant changes. These findings suggest that EC readings can effectively estimate nitrate levels in soil. The development of a

ANNUAL TIMING AND ABUNDANCE OF GRAPE BERRY MOTH AND INFESTATION IN MICHIGAN VINEYARDS

Presenter(s): Joshua Striegle (Michigan State University), Sydney Chrome (Northern Michigan University)

Agriculture and Animal Science

Mentor(s): Lauren Goldstein (College of Natural Science), Rufus Isaacs (College of Natural Science)

Grape berry moth is a prevalent insect pest in grape vineyards across eastern North America. A temperature-based model was developed to predict timing of this insect's development, but this was created based on weekly calendar-based observations when spring conditions were more predictable. Unprecedented temperatures occurring early in the year have led to concerns about poor alignment between the model and this insect's life history. To address these concerns, we analyzed multiple years of moth trapping and infestation data from Michigan vineyards to assess the accuracy of the predictions produced by the temperature-based model compared to the calendar-based observations. This poster will present recommendations for improved management of grape berry moth by updating our understanding of how temperature drives development of this key vineyard pest.

Biochemistry & Molecular Biology

ELUCIDATING THE BIOSYNTHESIS OF BIOACTIVE CLERODANES IN AJUGOIDEAE

Presenter(s): Abby Smith (Louisiana Tech University)
Biochemistry and Molecular Biology
Mentor(s): Nicholas Schlecht (College of Natural Science)

Humans have had many diverse applications for plants throughout history, some of them still well-known today. The mint family, Lamiaceae, has many species historically known for their various bioactive properties. Diterpenoids, a large and diverse class of specialized plant metabolite, are well known for their wide range of medical, bioenergetic, and insect antifeedant properties. For this reason, diterpenoids have high commercial potential. We previously identified the Ajugoideae subfamily as an abundant source of furano-clerodane type diterpenoids. These plants often produce a cocktail of diterpenoids at once, making the usage of the individual products difficult while simultaneously limiting their quantities. Despite this difficulty, it is possible to amplify their production by identifying and harnessing the metabolic pathways that contribute to their biosynthesis. This includes identification of the specific genes involved. Using previously sequenced leaf transcriptomes, enzymes involved in the biosynthesis of furanoclerodanes such as terpene synthases (TPSs) and cytochrome P450s (CYPs) may be tested by cloning sequences from *Teucrium* and *Ajuga* species. To reduce candidate genes to be assayed, co-expressed genes related to orthologs of identified steps in furanoclerodane metabolism, ArTPS2 and ArCYP76BK1 were utilized. The cloned genes will be separately transformed into *Agrobacterium tumefaciens*. Using transient expression in *Nicotiana benthamiana* and gas chromatography mass spectrometry analysis, we will identify which of our candidates express furanoclerodane diterpenoids. We may later identify the structures of the compounds through NMR analysis. Resolving the biosynthetic pathways will enable us to eventually bioengineer these genes in order to increase their production for potentially industrial applications.

RSAD2 OVEREXPRESSION MAY CONTRIBUTE TO RACIAL DISPARITIES IN AFRICAN AMERICAN MEN

Presenter(s): Murtaza Barkarar (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Olorunseun Ogunwobi (College of Natural Science)

Prostate cancer (PCa) is a leading cause of cancer-related deaths and aggressive PCa incidence is expected to increase 5% annually. Castration-resistant PCa grows without androgen and can develop into neuroendocrine PCa (NEPC). Currently there is no standard therapy for NEPC resulting in poor outlook (1-year survival). Factors such as race and ethnicity influence aggressive prostate cancer incidence and mortality. African American (AA) men face the highest PCa risk, they are 1.7 times more likely to be diagnosed and 2.1 times more likely to die compared to men of European ancestry. PVT1 is a long-noncoding RNA gene and we found PVT1 exon 9 enriched in PCa samples from males of African ancestry (moAA). RNA-sequencing analysis of PVT1 exon 9 overexpression revealed RSAD2 is the top differentially expressed gene. RSAD2 inhibits viral RNA replication, plays a critical role in innate immune signaling and inhibits NAD+ metabolism. Downregulation of RSAD2 leads to loss of cell proliferation. We hypothesized PVT1 exon 9-RSAD2 overexpression contributes to prostate cancer in moAA. We use the publicly available dataset GSE223405, RT-qPCR and mammalian cell culture to explore this. We found RSAD2 was significantly overexpressed in the GSE223405 moAA cohort. We further found a large percentage of genes altered by PVT1 exon 9 were present in higher abundance within the moAA cohort. Functionally, we found RSAD2 controls epigenetic mechanisms, a known contributi

ROLES OF CHLOROPLAST GET3B PROTEIN AND OTHER STROMAL CHAPERONE PROTEINS IN THYLAKOID TARGETING OF TAIL-ANCHORED PROTEINS

Presenter(s): Ella VarnHagen (Kalamazoo College)
Biochemistry and Molecular Biology
Mentor(s): Yan Lu (Western Michigan University)

The chloroplast stroma of photosynthetic eukaryotes contains a GET3B (Guided Entry of Tail-anchored proteins 3B) protein. GETB includes an ATPase domain, a Get3 motif, and the CXXC motif required for zinc coordination and homodimerization. We previously showed that GET3B transports thylakoid-targeted TA proteins to thylakoid membranes. In addition to GET3B, the chloroplast stroma of photosynthetic eukaryotes contains four DJA-type chaperone proteins: DJA4, DJA5, DJA6, and DJA7. Each DJA protein include a J domain, a Gly/Phe-rich domain, and a C-terminal domain with a CXXCXGXG motif and a dimer interface. Because J domains have been found to interact with ATPases, we hypothesize that DJA-type stromal chaperone proteins may interact with GET3B and assist in the transport of thylakoid-targeted TA proteins. To test this hypothesis, we crossed the get3b mutant with dja single, double and quadruple mutants. We plan to determine the amounts of thylakoid-localized TA proteins in the resulting compound mutants and perform co-immunoprecipitation of the wild-type Arabidopsis chloroplast lysate with anti-DJA and anti-GET3B antibodies. The first set of experiments will reveal whether simultaneous mutations in GET3B and DJAs have additive effects. The second set of experiments will inform whether DJAs interact with GET3B.

MODELING BIOMOLECULAR CONDENSATES OF RESILIN-LIKE POLYPEPTIDES (RLPS) VIA RESIDUE-BASED COARSE-GRAINING AND ATOMISTIC MODELS

Presenter(s): Julie Tran (Wichita State University)
Biochemistry and Molecular Biology
Mentor(s): Alexander Jussupow (College of Natural Science), Michael Feig (College of Natural Science)

At a cellular level, liquid-liquid phase separation is increasingly attracting attention for understanding the compartmentalization of cellular functions. Key questions revolve around the molecular determinants that lead to condensation and the biophysical properties of the condensates once they are formed. Computer simulations may give predictive insight into the molecular behavior inside condensates. Previous work in the Feig lab has established the coarse-grained model COCOMO (COncentration-dependent Condensation-Model) for generating condensates from peptides and/or RNA as a function of composition and concentration. In this study, resilin-like protein (RLP) condensates formed via COCOMO were converted to atomistic detail using a machine learning tool, cg2all, and subsequently subjected to atomistic simulations via openMM. The atomistic simulations provide a realistic view of the molecular details inside the RLP condensates. The simulations were analyzed for various properties, such as the radius of gyration, end-to-end distances of protein segments, diffusion coefficients, and viscosity. Lastly, the experimental properties were compared to dilute conditions that were modeled by single-chain simulations for any changes specific to liquid-liquid phase separation.

UNDERSTANDING THE ROLE OF LIPASES AND LYSOLIPIDS IN CORAL THERMAL TOLERANCE

Presenter(s): Darnilla Samuel (University of the Virgin Islands)
Biochemistry and Molecular Biology
Mentor(s): Robert Quinn (College of Natural Science), Sabrina Rosset (College of Natural Science)

Corals are colonial organisms that live in a symbiotic relationship with the dinoflagellates of the family Symbiodiniaceae. Although it is well-documented that rising ocean temperatures disrupt coral-algal symbiosis, several studies have shown that there is a spectrum of thermal tolerance across the coral-reef Symbiodiniaceae. Corals associated with symbionts of the genus Durusdinium are more thermally tolerant than those hosting Cladocopium. However, the molecular mechanism underlying thermal tolerance in Durusdinium symbionts is not well understood. Previous comparison of the metabolomes of coral associated with either Durusdinium or Cladocopium showed Durusdinium-dominant corals having higher abundances of lyso forms of betaine lipids and phospholipids compared to Cladocopium corals, which have higher levels of diacyl forms of these lipids. The aim of this research is to determine if there are varied lipase activity between Durusdinium and Cladocopium hosting corals resulting in a higher ratio of lyso lipids to diacyl lipids in their metabolome. To explore this, 42 tentacle tissue samples of the coral species Galaxea fasicularis hosting either algal genus were left at room temperature for 24hrs to allow for lipolysis activity. Samples were collected at different time points and extracted for lipidomic analysis using HPLC-MS/MS mass spectrometry. Pearson correlation analysis on lipids of interest with time will be used to determine if the molecules are changing differently

HYPERTENSION PROMOTES COLLAGEN DEPOSITION IN THE THORACIC AORTA OF COARCTED MICE

Presenter(s): Becca Lefkowitz (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Andres Contreras (College of Veterinary Medicine)

Cardiovascular diseases (CVDs) are the leading cause of annual deaths worldwide. A key contributor to CVDs is hypertension (HTN), defined as chronically elevated blood pressure. HTN may induce vascular remodeling, classified by greater extracellular matrix deposition, inflammation, and elastin degradation, increasing vessel stiffness. HTN-induced changes have been described in most vascular layers (tunicas intima, media, and adventitia). However, limited information exists regarding perivascular adipose tissue (PVAT) remodeling during HTN. This is a critical gap in knowledge as remodeling of PVAT, which secretes vasoactive molecules, may be key to the pathogenesis of HTN. We hypothesized that HTN enhances collagen deposition in the PVAT. PDGFRa-CreERT2/R26-LSL-tdTomato mice 7-weeks-old were used. A coarctation of the thoracic aorta induced HTN in the upstream region vs downstream. After 8 wk, tissue samples were collected, stained with Masson's Trichrome, imaged, and analyzed using ImageJ. One-tailed T-tests were performed to assess total collagen area percentage within the tissue and PVAT. Collagen deposition in the thoracic aorta was greater in coarcted (15.2±2.4%) than sham mice (9.7±2.4%; $P<0.05$). Regions upstream the ligature displayed increased collagen content (19.7±2.6%) relative to downstream the ligature (10.7±2.6%; $P<0.01$) in coarcted but did not differ between groups in sham mice ($P>0.1$). Within PVAT of coarcted animals, c

MOLECULAR CLONING OF SGRNA CONSTRUCT FOR USE IN CRISPR GENOME EDITING

Presenter(s): Quynh Tong (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Masako Harada (College of Engineering)

CRISPR-Cas9 has been demonstrated as a genome-editing tool with great promise of applications for biomedical purposes. Crucial to this technique is the generation of the single-guide RNA (sgRNA), which is the RNA that binds to the DNA sequence the c endonuclease will cleave. The aim of the project is to create two plasmid constructs containing the gene that codes for two different sgRNA that can target the gene of human lactadherin using molecular cloning techniques. Specifically, the U6 backbone was prepared through restriction digestion, and the inserts encoding the sgRNA were created through hybridization of single-stranded DNA sequences. Afterwards, the fragments were homologously recombined using the Seamless Ligation Cloning Extract (SLiCE) cloning method. Techniques such as gel electrophoresis, bacterial transformation, and PCR-RFLP were used to ensure the successful cloning of the desired construct. The next steps for these constructs would involve using them in conjunction with Cas9 endonuclease to edit the genome of cells and establish a cell lines that can generate EVs (Extracellular Vesicles) with specific protein on its surface.

ISOLATING AND CHARACTERIZING ENVIRONMENTAL PHAGES RESULTING IN THE PURSUIT OF AN UNEXPECTED SHIGELLA INFECTING PODOPHAGE

Presenter(s): Rachel Passage (Lake Superior State University)
Biochemistry and Molecular Biology
Mentor(s): Hazel McGuffin (College of Natural Science)

Around the mid 20th century, bacteriophage had lost the interest of the Western world due to historical events such as the red scare and rise of penicillin. In recent years the antibiotic resistance crisis has allowed for to have reach in the scientific world once again and further the potential for phage therapy as treatment. In this 13 environmental phages. Collected water samples filtered, plated PE577 (a strain of) on agar media, and plaque purified. Once a stock is created from a singular site of infection, a host range test is completed using strains coli, other of shigella, and PE577 as a control. Electron microscopy methods are used to determine potential for genome extraction each environmental phage. The first known podovirus Michigan capable of infecting a strain of shigella. The significance of this discovery helps promote the importance of bacteriophage diversity as well as bearing relevance to ongoing research being completed within this laboratory setting at Michigan State University.

MONITORING EV SECRETIONS VIA PCS-MIP-NANOLUC

Presenter(s): Kayla Bello (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Masako Harada (College of Engineering), Yuki Harada (College of Engineering)

Extracellular vesicles (EVs) are particles secreted by cells that naturally carry nucleic acids, lipids and proteins. Due to their ability to carry genetic information throughout the body, EVs have the potential to serve as therapeutic carriers for certain diseases such as type I diabetes. Mouse insulin promoter (MIP) is a promoter specific for the expression of proteins found only within the pancreatic β cells of mice. Nanoluc is a type of luciferase that, when expressed, emits bioluminescence. When coupled with MIP, Nanoluc can be expressed, producing bioluminescence that can be detected and provide proof of the expression of certain genes controlled by the promoter. This project aimed to create a plasmid containing MIP and Nanoluc that can be transformed into pancreatic β cells of mice. The MIP- coding plasmid was used as a backbone template, while a NanoLuc-coding plasmid served as the insert template to create the final construct. PCR amplification of MIP backbone and Nanoluc was confirmed by gel electrophoresis to ensure proper amplification of desired fragments. Gel purification followed by homologous recombination performed via Seamless Ligation Cloning Extract (SLiCE) was then used to combine purified fragments together. Bacterial transformation and colony PCR was utilized to further verify the creation of the final construct. The final plasmid will be used in mouse pancreatic β cells to express Nanoluc, allowing us to determine whether Nanoluc c

VISUALIZING ACETYLATION-INDUCED CHANGES IN THE PLANT SECONDARY CELL WALL STRUCTURE AND DYNAMICS THROUGH MOLECULAR SIMULATIONS

Presenter(s): Murtaza Barkarar (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Josh Vermaas (College of Natural Science)

The thickened secondary cell wall is essential to the mechanical properties of plants and particularly woody tissues. The cell wall composed of hemi-cellulose and cellulose polysaccharides, as well as heteroaromatic lignin polymers, which represent a significant renewable resource for multiple applications, including construction materials. While wood has been used for millennia, modifying the structure of the underlying biopolymers for enhanced mechanical strength is far newer. It has been previously demonstrated that acetylation slows down the wood degradation, but also resists further treatment. In this work, we examine the structure and dynamics at the nanoscale caused by acetylation through the lens of molecular dynamics simulation. We observe that the diffusion coefficients decrease by 2-3x for hemi-cellulose, lignin, ions and water upon acetylation for the systems wherein Na+ are the counterions. Fe3+, given its larger atomic mass and valency, diffuses over 10-fold slower than Na+, and the Fe3+ diffusion coefficient doesn't indicate a clear correlation with the increasing degree of acetylation, unlike Na+. The reduced diffusion with Na+ is driven by interactions water molecules make at the nanoscale, particularly with carbonyl oxygen on the acetyl acting as a hydrogen acceptor. The partial negative charge interacts strongly with cations and forms many hydrogen bonds with surrounding water molecules. As a consequence, wa

EXPRESSING THE POLY-3-HYDROXYBUTYRATE PATHWAY IN ZYMOMONAS MOBILIS

Presenter(s): Mia Bruno (University of the Virgin Islands)
Biochemistry and Molecular Biology
Mentor(s): Elhussiny Aboulnaga (Research and Innovation), Michaela TerAvest (College of Natural Science)

Petroleum-based products such as fuels and plastics have had detrimental impacts on the earth’s climate, temperatures, and ecosystems. Conversely, plant biomass production is healthy for the earth as it reduces global warming by decreasing the amount of carbon dioxide in the atmosphere. Plant biomass contains sugars that can be utilized by bacteria to generate products like ethanol and biodegradable plastics. Zymomonas mobilis is a unique bacterium being harnessed due to its ability to produce and resist high ethanol, through the breakdown of sugars like glucose. Z. mobilis, unlike most other bacteria, uses acetaldehyde rather than acetyl-CoA as its major central metabolite. However, many important pathways depend on acetyl-CoA for the synthesis of bioproducts. One such pathway is the poly-3-hydroxybutyrate (PHB) pathway which produces PHB, a biodegradable plastic. Here we are investigating why Z. mobilis does not use acetyl-CoA as its major central metabolite, and how the PHB pathway expression affects its metabolism. To address this question, we cloned the PHB-operon from Cupriavidus necator H16 into a vector for expression in Z. mobilis. Afterward, we tested PHB production in E. coli, and it was found to work successfully. When we transferred the plasmid to Z. mobilis, there was no effect on the growth of the cells when it was not induced, however, when it was induced, we detected PHB production and a decrease in cell growth. We are currently introducing acetyl-CoA-produci

LINKING ENZYMES AND LIMITING DYNAMICS

Presenter(s): Meiers Dixon (Bucknell University)
Biochemistry and Molecular Biology
Mentor(s): Scott Calabrese Barton (College of Engineering)

Coarse-grain (CG) modeling allows for increased computational speed due to the simplification of the atoms in the system. This makes CG modeling an appealing approach for researchers studying large systems containing tens of thousands of atoms. In this project, we focused on analyzing the protein-protein interaction of the first two enzymes in the pentose-5 phosphate pathway. To study this interaction, a polyarginine bridge was constructed connecting the Hexokinase (HK) and the G6P Dehydrogenase (G6PDH). The role of the bridge in stabilizing the complex's structure was studied using CG simulations to determine if the two enzymes remained independent when linked. By increasing the proximity of the enzymes, this project explored whether their moieties would interact with one another and how the polyarginine bridge would impact the complex's quaternary structure. Data was analyzed using statistics from the MDAnalysis toolkit and used to better quantify the movement of each molecule in the system. This project also used metadynamics to overcome the high energy barriers the protein-protein interaction created. Understanding the intermolecular forces involved in the movement of HK and G6PDH could improve artificial enzyme creation or predict the mechanism of protein-drug interactions.

EPIGENETIC PERSISTENCE AFTER CAFFEINE STRESS

Presenter(s): Cameron Liu (Okemos High School)
Biochemistry and Molecular Biology
Mentor(s): Tommy Vo (College of Human Medicine)

A universal feature of all successful life is the ability to adapt in the face of unexpected environmental stresses. After stress, cells can alter gene expressions that help them survive. These alterations are primarily driven by epigenetic changes, which refer to changes in chemical modifications of DNA or histone proteins that influence gene expression. It is unclear how long cells can retain epigenetic changes after temporary stress and how those changes could be transferred across generations. To investigate this problem, we will explore how yeast cells (Schizosaccharomyces pombe) epigenetically respond to the stress of caffeine exposure and how those epigenetic changes may persist after the stress is gone. We will use non-dividing quiescent yeast cells that have never been exposed to caffeine, exposed for a short-term with caffeine, or continuously exposed to caffeine. Then, we will perform chromatin-immunoprecipitation (ChIP) experiments to measure epigenetic changes that occur after the various caffeine treatments. Lastly, we will perform yeast pedigree analyses to test whether stress of parental yeast cells will affect the ability of yeast offspring to respond to caffeine. This project will provide insights into how epigenetic changes after stress affect parental and offspring cells, with important implications for understanding inter-generational inheritance of environmental experiences.

FATTY ACID PROFILE AND VITAMIN D-ASSOCIATED NEUROCOGNITIVE DECLINE IN HIV POPULATION

Presenter(s): Deagan Moore (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Ilce Medina Meza (College of Natural Science)

HIV is an enveloped, RNA retrovirus that is transmitted sexually or congenitally. HIV has a tropism for cells of the immune system, such as macrophages, dendritic cells, and T-cells. The virus has a wide range of effects on those infected and requires intervention by anti-retroviral therapy (ART). Without treatment, the virus can cause cardiogenic, neurologic, immunologic, and musculoskeletal pathologies during its progression to AIDS (acquired immunodeficiency syndrome). HIV is also thought to contribute to neurocognitive decline, known as HIV-associated Neurocognitive Decline (HAND). Specific nutritional markers, such as fatty acid composition and Vitamin D, are believed to impact these viral comorbidities. This is due to their roles in antioxidation, immunomodulation, and cellular integrity. In this study, plasma and serum samples from a cohort of 8-23 year old Ugandan civilians who have HIV were analyzed. Fatty acids were extracted from respective biofluids using MTBE as the extraction solvent. Once extracted, the remaining lipid fraction was dried under nitrogen and prepared for methylation. Methylation was performed using MeOH and BF_3 as a catalyst. This step was necessary to volatize the fatty acids for quantification. Once methylated, the fatty acids were placed into an GC vial and ran on a gas chromatograph (GC), equipped with an autoinjector (AOC-20i) and a flame ionization detector (FID). Peaks were identified and the data was manually integrated.

SETTING UP FEMTOSECOND LASER-INDUCED IONIZATION/DISSOCIATION TANDEM MASS SPECTROMETRY FOR UNAMBIGUOUS MAPPING OF POST TRANSLATIONAL PROTEIN MODIFICATIONS

Presenter(s): Clayton Wicka (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Marcos Dantus (College of Natural Science)

Phosphorylation is one of the most important post translational modifications of proteins, wherein specific amino acid residues are chemically bonded to a phosphate group, altering the protein's conformation and functionality. Identifying which amino acid residues these phosphorylations occur at provides useful proteomic information but can also prove challenging, requiring extensive chemical processing and purification. In an effort to streamline this identification, Femtosecond Laser-induced Ionization/Dissociation Tandem Mass Spectrometry (fs-LID-MS/MS) was developed. This method has a unique advantage over other Ms/Ms approaches due to the femtosecond laser's ability to break stronger peptide bonds while leaving the weaker phosphate bonds intact, which prevents phosphate loss and scrambling, permitting unambiguous identification of which residues carry the phosphate. Since its conception, this method has not been put to extensive use due to the difficulty of set-up and limiting technical requirements. In this project, I am working in Professor Marcos Dantus' laboratory in collaboration with Professor Liangliang Sun to modify and recalibrate a Fisher Scientific LTQ XL mass spectrometer to accept an amplified femtosecond laser, enabling fs-LID-MS/MS and opening this method of research to study benchmark phosphorylated proteins.

SINGLE PIECE CLONING OF PCDNA-MCHERRY TO PCS-MC HERRY TO IMPROVE UPTAKE INTO MAMMALIAN CELLS

Presenter(s): Tiffany Rennells (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Masako Harada (College of Engineering), Yuki Harada (College of Engineering)

Fluorescent proteins such as mCherry are widely used in molecular and cellular biology research used to visualize gene expression and protein localization. This project aims to generate a new plasmid construct, pcS-mCherry from pcDNA-mCherry. The goal was to enhance its uptake efficiency in mammalian host cells, thereby improving transient gene expression. Firstly, Polymerase Chain Reaction (PCR) amplified essential components including mCherry expression cassette of the DNA. Thereafter Seamless Ligation Cloning Extract (SLiCE) was performed to circularize DNA fragment by homologous recombination. The SLiCE reaction mixture was subsequently transformed into e coli , with successful transformants selected on antibiotic-containing agar plates. To ensure the validity of the product, techniques such as gel electrophoresis and transformation were employed. Finally,restriction digest analysis confirmed the size of the pcS-mCherry construct. This newly engineered plasmid is expected to be a valuable tool for researchers providing efficient red fluorescent marker for experimental applications.

ASSESSING THE INTERACTION BETWEEN AHR AND TSPO AND THEIR ROLE IN CALCIUM REGULATION IN MLE-12 MITOCHONDRIA

Presenter(s): Angel Strobach (University of Delaware)
Biochemistry and Molecular Biology
Mentor(s): John LaPres (College of Natural Science)

The aryl hydrocarbon receptor (AhR) is a ligand-activated transcription factor. Inactivated AhR exists in the cytosol, bound to the chaperone proteins, heat shock protein 90 and the AHR interacting protein. Recent evidence has suggested a portion of the cellular pool of AhR exists in the mitochondria (mitoAHR). The role of mitoAHR has not been extensively studied, however, recent publications have suggested a degree of crosstalk with another mitochondrial protein, the translocator protein (TSPO). The AHR: TSPO crosstalk impacts the expression of several genes, many involved in modulating calcium trafficking in the mitochondria.Given this information, we hypothesize that: The absence of either AhR or TSPO will affect calcium transport into the mitochondrial matrix in the presence or absence of each proteins corresponding ligands. Methods: Calcium levels will be assessed in wild-type, AhR (-/-) and TSPO (-/-) mouse lung epithelial cells using confocal microscopy and the fluorescent calcium marker Fluoro- 4 and Mitotracker red. These changes will also be observed in the presence of ionomycin, a calcium ionophore. Results: AhR knockout cells have a higher mitochondrial area with a similar number of cristae in comparison to wild type cells. AhR knockout cells had an increased response to ionomycin than wild type cells. A significant difference in response was not observed in TSPO knockouts. Conclusions: Loss of AhR cau

HUMANIZING YEAST TO STUDY HUMAN GENE FUNCTION

Presenter(s): Micah Williams (Florida A&M University)
Biochemistry and Molecular Biology
Mentor(s): Tommy Vo (College of Human Medicine)

Abstract: The human genome encodes >20,000 protein-coding genes; however, it is unclear what most of their functions are. Addressing this problem is significant for disease-associated human genes because knowing how gene functions contribute to diseases is required to develop effective treatments. For decades, yeast model organisms have successfully been used to explore human gene functions by studying conserved genes. The number of functionally conserved genes between humans and yeast strongly suggests the effectiveness of using yeast to study human biological processes. This project focuses on a conserved gene called rpb9; the Rpb9 subunit comprises 113 amino acids and is the only non-essential subunit of Schizosaccharomyces pombe RNA polymerase II, & is involved in stress response, transcriptional accuracy, and epigenetic gene regulation in yeast. Since the cellular functions of rpb9 are better understood in the yeast S. pombe, we will determine which of its yeast functions can be recapitulated by human POLR2I. We hypothesize that human POLR2I can do the same functions as its yeast counterpart. We will test this by expressing the human POLR2I gene in yeast cells and testing various yeast phenotypes. The expression of human POLR2I in yeast will be achieved through PCR, PCR purification, and genetic manipulation. Altogether, this project will reveal the functions of yeast rpb9 that are directly translatable to human POLR2I.

"THE ROLE OF SPOIVFA IN INHIBITION OF BACILLUS SUBTILIS INTRAMEMBRANE PROTEASE SPOIVFB"

Presenter(s): Achala Bannur (Michigan State University)
Biochemistry and Molecular Biology
Mentor(s): Lee Kroos (College of Natural Science)

Intramembrane proteases (IPs) are proteins that are found within cell membranes and can cut other proteins located in the same membrane or near its surface. IPs play critical roles in various signalling pathways and protein degradation processes in different organisms. Each family has specific functions and targets in the cell. Metallo IPs, like SpoIVFB, activate transcription factors in all three domains of life (bacteria, archaea, and eukaryotes). They are involved in processes such as cholesterol homeostasis, stress responses, viral infection in mammals, chloroplast development in plants, and fungal virulence. For example, SpoIVFB is crucial for the formation of endospores in bacteria like *Bacillus subtilis*. The inhibition mechanism of SpoIVFB by BofA and SpoIVFA is different from the regulation of other IPs. In this case, the second transmembrane segment of BofA occupies the active site of SpoIVFB, blocking access to its substrate, Pro- σ_K. This unique inhibition mechanism provides valuable insights for potential strategies to design therapeutic IP inhibitors that could have broad applications in various organisms. We made changes in SpoIVFA (F132C) and SpoIVFB (F66C) to test if we could see any disulfide cross-linking between them. However, we did not find evidence to support this hypothesis. Now, we are working toward testing the model-based hypothesis that SpoIVFA P129 and/or L130 are near SpoIVF

EXPLORING UNBALANCED ELECTROFERMENTATION TO ENHANCE ETHANOL PRODUCTION IN ESCHERICHIA COLI

Presenter(s): Carrie Gregg (Lake Superior State University)
Biochemistry and Molecular Biology
Mentor(s): Michaela TerAvest (College of Natural Science)

About 83% of energy consumption is reliant on fossil fuel, it is one of the major factors that contributes to environmental degradation. An alternative to fossil fuels is production of ethanol from renewable biomass resources, however, side products such as lactate and acetate reduce the efficiency of ethanol production. Electrofermentation is one possible method to enhance the efficiency of ethanol production by reducing side-product formation. Escherichia coli expressing the Mtr pathway natively found in Shewanella oneidensis is capable of extracellular electron transfer. Our goal is to leverage this engineered pathway and the native fermentative pathways of E. coli to direct electron flux through Mtr to drive the production towards ethanol. However, fermentation limits product scope due to its strict requirement to be balanced; this can be overcome by inducing unbalanced fermentation through manipulating the electron flow. With the addition of the Mtr pathway and an electrode, production of ethanol rather than acetate and should be possible by improving fermentation routes that are normally hindered via redox balance.

MUTAGENESIS SCREENING OF THE RPB2 GENE IN SCHIZOSACCHAROMYCES POMBE

Presenter(s): Eglesiana Pierra Mutavu (Sewanee: The University of the South)
Biochemistry and Molecular Biology
Mentor(s): Tommy Vo (College of Human Medicine)

Heterochromatin, characterized as compact DNA structures that are enriched for repressive histone modifications such as histone H3 lysine 9 trimethylation (H3K9me3), is important for chromosome segregation and genomic stability in eukaryotes. In diverse organisms from yeast to mouse, initial transcription of repetitive DNA regions by RNA polymerase II (Pol II) and subsequent action by the RNA interference (RNAi) pathway is required to form heterochromatin. However, it is unclear whether Pol II contributes to heterochromatin formation through transcription-independent roles. Our lab has recently characterized a mutant variant of the Pol II subunit, called Rpb2, in the fission yeast Schizosaccharomyces pombe (which is a well-accepted yeast model for studying heterochromatin biology). This mutant prevents heterochromatin assembly but not the initial transcription process, suggesting that the Rpb2 subunit may be involved in a transcription-independent role to promote heterochromatin assembly. This summer, my goal was to further investigate whether other Rpb2 variants can similarly affect heterochromatin assembly through random mutagenesis screening. I expect that my project will reveal novel biochemical understanding of how Rpb2 promotes heterochromatin formation after/during the initial transcription.

WHAT ROLE DO MACROPHAGES PLAY TOWARDS THE ONSET OF TYPE 1 DIABETES

Presenter(s): Brian Jaramillo-Contreras (University of North Carolina at Pembroke)
Biochemistry and Molecular Biology
Mentor(s): Ping Wang (College of Human Medicine)

Type 1 Diabetes (T1D) is an autoimmune disease characterized by the destruction of insulin-producing beta cells in the pancreas. Macrophages, a type of immune cell, play a crucial role in this process. Macrophages can exist between a spectrum of pro- and anti-inflammatory states. The pro-inflammation (M1) state produces inflammatory products to combat pathogens and the anti-inflammatory (M2) state produces products to combat the inflammation. This study investigates the temporal dynamics of macrophage involvement in T1D progression and explores strategies to modulate their polarization state, mitigating beta cell destruction. Pancreatic tissue samples from diabetic mice at 4, 8, and 12 weeks were analyzed using fluorescence microscopy and ImageJ software. Specific markers identified macrophages, beta cells, and total cells, allowing quantification of their relative populations. We hypothesize a higher relative macrophage population at disease onset, decreasing as macrophages are cleared and the T-cell attack intensifies. Capturing this timeline could accurately predict T1D onset and elucidate underlying physiological processes, enabling earlier diagnosis and therapeutic interventions. By intervening early, before significant beta cell destruction, the progression of T1D may be delayed or prevented, improving patient outcomes. Understanding macrophage involvement in T1D pathogenesis is crucial for developing targeted therapies and improving disease management strategies. Looki

Biosystems & Agricultural Engineering

EFFECTIVENESS OF AEROBIC TREATMENT OF BLACKWATER USING ACTIVATED SLUDGE UNDER SHORT HYDRAULIC RETENTION TIME

Presenter(s): Braden Kehr (Olivet Nazarene University)
Biosystems and Agricultural Engineering
Mentor(s): Wei Liao (College of Natural Science)

As the global population rises, the demand for food rises, and access to clean water decreases, this means practical and sustainable water recycling and resource recovery methods must be developed. One such method is the aerobic treatment of blackwater using activated sludge. This method allows for the nitrogen levels in the water to be maintained for removal later in the treatment process which can be sold to offset costs of operation and installation. This method also utilizes a quicker cycle due to its shorter hydraulic retention time (HRT) than most common anerobic treatments, which allows for streamlined use on a smaller scale, ideal for rural and remote use. In this study the effect of a short HRT, in this case 7.2 hours, is investigated to see its effects on chemical oxygen demand (COD), and ammonia levels. To do this, a bench scale reactor was set up using synthetic blackwater made from a mixture of raw sewage and primary sludge. The reactor was monitored while it stabilized in its new environment for three weeks. Throughout the study COD, total nitrogen, ammonia, nitrate, phosphorus, total suspended solids (TSS), turbidity and pH levels were recorded. The results can be used to determine the effectiveness of using aerobic treatment as a primary method for treating blackwater under different HRTs for reuse and resource recovery on a small scale.

INFLUENCE OF ELEVATED TEMPERATURES ON WATER ACTIVITY OF APPLES FOR BETTER UNDERSTANDING OF MICROBIAL INACTIVATION

Presenter(s): Emily Woodyard (Michigan State University)
Biosystems and Agricultural Engineering
Mentor(s): Ian Hildebrandt (College of Natural Science)

Water activity plays an important role in the ability of foodborne pathogens to maintain viability and multiply during food processes, including fruit drying. However, currently it is not understood how elevated temperatures during processing impact the water activity of foods. This study aims to represent fruit drying conditions, evaluating the relationship between elevated temperature and water activity of apple samples at 60, 70, and 80°C. Gala apples were cored, sliced, and conditioned to specific water activities from a range of 0.20-0.99. Each temperature was tested using 4 relevant water activities, resulting in 12 treatment combinations. A custom-designed high temperature water activity meter (Decagon Devices, Pullman, WA) was used to measure the temperature and water activity of each sample in a hot air oven (model 725F, Thermo Fisher Scientific, MA) until readings were stabilized at the desired elevated temperature. The results include a high temperature water activity value for the 12 treatment combinations. In addition, the modified Halsey Model was fitted to predict the impact of elevated temperature on water activity of apples within the range of conditions tested. These results provide an early representation of the impact that oven temperatures would have on apples at "real-time" during the fruit drying process. Further work, including measuring the thermal resistance of foodborne pathogens in apples, can then help create more accurate food safety standar

MEASUREMENT OF RESIDUAL METHANE POTENTIAL OF DIGESTATE

Presenter(s): Jacqueline Hawkins (Michigan State University)
Biosystems and Agricultural Engineering
Mentor(s): Sibel Uludag-Demirer (College of Natural Science)

Anaerobic digestion is a process through which microbes convert organic materials into gas. This process occurs in the absence of oxygen and produces carbon dioxide, methane, and hydrogen sulfide. Anaerobic digestion is most commonly applied to manage waste - specifically animal manure - or to produce fuels. The effluent from a manure-fed anaerobic digestion process, digestate, is usually used to make fertilizers. This report aims to investigate the residual methane potential of digestate through BMP trials, gas volume measurements, gas composition, and calculations pertaining to SMP and total volume of methane produced. Biochemical methane potential (BMP) is used to analyze methane production. A sample is incubated with inoculum containing anerobic microorganisms and incubated for a month. The gas production is measured over this period and can be a useful parameter in calculating specific methane yield (SMP) or volume of methane produced. Results pertaining to digestate's residual methane potential could relate to efficiency of anaerobic digesters and provide another parameter for their analysis.

ENGINEERING SHEWANELLA ONEIDENSIS MR-1 FOR POLYLACTIC ACID DEGRADATION TO GENERATE ELECTRICAL ENERGY

Presenter(s): Caroline Erpelding (Michigan State University), Hien Le Le (Michigan State University), Leland Huber (Michigan State University), Minh Dang (Michigan State University), Nayeema Siraj (Michigan State University)
Biosystems and Agricultural Engineering
Mentor(s): Bjoern Hamberger (College of Natural Science), Masako Harada (College of Engineering), Michaela TerAvest (College of Natural Science)

Many researchers have challenged the degradability of the biopolymer Polylactic Acid (PLA), hugely popular in 3D printing. To address PLA's environmental persistence, we are working to engineer the bacterium Shewanella oneidensis MR-1 to degrade PLA and generate power from its breakdown. S. oneidensis is a gram-negative, facultative anaerobe capable of extracellular electron transfer, and can break down organic material and generate electricity in microbial fuel cells. It utilizes lactic acid as its carbon source to produce electricity. Therefore, we engineered S. oneidensis with genes encoding for PLA depolymerases from the bacteria Paenibacillus amylolyticus strain TB-13, Amycolatopsis sp. K104-1, Alcanivorax borkumensis and Rhodopseudomonas palustris. When expressing these genes, we expect that S. oneidensis will be capable of depolymerizing PLA to lactic acid, then using the lactic acid as a substrate for electricity production. The engineered S. oneidensis strains were tested on solid and emulsified PLA to detect degradation of PLA to monomeric lactic acid. The S. oneidensis strains that were successful in degrading PLA will be used in a microbial fuel cell for electricity production with PLA as the carbon source.

OPTIMIZING GROWTH MEDIA FOR DUCKWEED TO EXAMINE ITS METABOLISM OF SULPHONAMIDES: TREATING WASTEWATER POLLUTION USING PLANT MICROBIOMES

Presenter(s): Angie Stefannia Tasayco (University of Central Florida)
Biosystems and Agricultural Engineering
Mentor(s): Dawn Dechand (College of Natural Science)

The small aquatic plant, Lemna minor (duckweed), is well established in the treatment of wastes, such as dairy, swine, municipal wastewaters, and toxic runoff via phytoremediation. Characteristically having a remarkable ability to grow in waters polluted with nutrients, heavy metals, pesticides, and antibiotics at a global scale, duckweed continues to be researched to increase the flexibility and specificity in remediating agricultural sites. The plant's exudates, growth rate, and, subsequently, its sustainability are dependent on the growth media. Historically, many different but standardized media formulations have displayed different biological activity. Minimal exudate research has been done for duckweeds in different media, and there is no standardized method for growth conditions when examining exudates. The first goal of this study was to find an optimal media that balances growth while not dramatically affecting exudation nor occluding metabolites of interest. The second goal was to investigate the effects of the presence of sulfamethoxazole (SMX) on L. minor to further understand duckweed exudate-microbiome communications and the removal of antibiotics. Experimentally, we created and tested 5 historically common duckweed growth media. Our duckweed biomass from Rutgers Duckweed Stock Cooperative was grown for 8 days after an acclimation period of 7 days. Exudates were analyzed in triplicate reactors. To analyze growth rates, we compared fresh weights and dry weights.

THE ADSORPTION KINETICS OF DIFFERENT SALMONELLA SEROTYPES ON GLYCAN-COATED MAGNETIC NANOPARTICLES

Presenter(s): Kevin Villatoro (University of Central Florida)
Biosystems and Agricultural Engineering
Mentor(s): Evangelyn Alocilja (College of Natural Science)

The U.S. Centers for Disease Control and Prevention (CDC) estimates that *Salmonella* causes about 1.35 million infections, 26,500 hospitalizations, and 420 deaths in the United States annually. Detecting it in different food products is pivotal in mitigating the impacts of these infections. Hence, *Salmonella* and other foodborne pathogens must be detected before ingestion to protect the public. However, conventional detection methods require lengthy preparation and extended analysis times. An alternative preparation method, using glycan-coated magnetic nanoparticles (MNPs), has been shown to speed up sample preparation by forming conjugates with bacteria quickly recovered using a magnet. This project aims to study the interaction between different *Salmonella* serotypes and glycan-coated MNPs to understand how differences in antigen expression can affect the adsorption profiles of bacteria. We hypothesize that different serotypes would exhibit different adsorption parameters due to the differences in their surface protein structures. Adsorption experiments were performed using different *Salmonella* serotypes, and the data was fitted into known kinetic and isotherm models. Analyzing the generated kinetic and isotherm parameters provided more profound insight into the interaction between *Salmonella* and the MNPs. Microscopy, hydrodynamic size, and zeta potential measurements will be performed to characterize the interaction between bacteri

ROLE OF SPICES IN HOME COOKING METHODS ON THE OXIDIZED LIPID PROFILES OF SEAFOOD

Presenter(s): Summer Luick (Michigan State University)
Biosystems and Agricultural Engineering
Mentor(s): Ilce Medina Meza (College of Natural Science)

Oxidized lipids are linked to chronic diseases like cancer and heart disease. Home cooking methods cause oxidation of lipids in foods we eat through exposure to heat, light, radiation, and oxygen. In industry, natural and artificial antioxidants are added to seafood products to reduce oxidation and increase shelf time. Spices are a natural source of antioxidants that can be added to food and safely consumed. This study aims to determine how the addition of spices to seafood during home cooking effects their oxidized lipid profiles. Seafood was prepared with and without spices. Lipid extraction was performed on 30g of the sample. To analyze fatty acid content, a portion of the fat extract was methylated and injected into a Gas Chromatography Flame Ionization Detector. Another portion of the lipid extract was used to analyze oxidized cholesterol. Saponification was used to separate fatty acids from the sample. 10% of the sample was directly salinized while 90% of the remaining sample was run through SPE NH2 filters to isolate COPs and then salinized. These samples were injected into a gas chromatography mass spectrometer to analyze the compounds present in the sample. While no results have been obtained yet, this study aims to provide insight on how levels of oxidized lipids in home cooked seafood are impacted by the addition of spices.

AUTOMATED NANOPARTICLE-BASED BIOSENSOR DATA ANALYSIS

Presenter(s): Shauryaveer Narwal (Michigan State University)
Biosystems and Agricultural Engineering
Mentor(s): Evangelyn Alocilja (College of Natural Science)

In order to prevent antibiotic-resistant illnesses, protect the public's health, and preserve economic stability, rapid pathogen identification is essential. In order to enable early, quick, and affordable point-of-care diagnostics, this research focuses on enhanced nano biosensor technologies that combine magnetic nanoparticles for pathogen extraction and gold nanoparticles for DNA detection. The study also investigates how to prevent counterfeit items from reaching customers by integrating blockchain, nano, and bio-enabled anti-counterfeiting technology. To make the comparison and interpretation of large amounts of laboratory-collected experimental data easier, a comprehensive data analysis tool was created. This procedure used to need manual analysis, which was labor-intensive and prone to human mistake. Python programming is utilized by the automated system to effectively manage big datasets, carry out precise wavelength comparisons, and produce comprehensive outcomes. The data analysis tool makes use of libraries for advanced statistical analysis and machine learning techniques, including pandas, scipy, numpy, and scikit-learn. The tool's capacity to spot patterns and trends in intricate biosensor data is improved by the application of KMeans clustering and standardization techniques.This automation expedites the analysis of data from several biosensor investigations, enhancing the precision and dependability of diagnostic and anti-counterfeiting soluti

Cell Biology, Genetics, & Genomics

SIGNIFICANCE OF A SPLICE MUTATION IN THE GENE SCRIBBLE IN BREAST CANCER

Presenter(s): Joshua Dixon (Michigan State University)
Cell Biology Genetics and Genomics
Mentor(s): Anthony Schulte (Division of Student Life and Engagement), Eran Andrechek (College of Human Medicine)

Around 13% of women in the United States will develop breast cancer. The mouse mammary tumor virus long terminal repeat (MMTV-LTR) promoter is used as a transgenic model. MMTV transgenics allows for expression of specific oncogenes and growth factors, including c-Myc. Our research utilizes a MMTV-Myc model to develop an understanding for this oncogene as it relates to other genes. Of particular interest was a splice mutation in the scribble. Low levels of scribble are associated with a poor prognosis, lending support to the theory that scribble is a tumor suppressor. Mis-localization of Scribble, a result of epithelial-mesenchymal transition (EMT), triggers Hippo signal activation leading to aggressive breast cancer development. In our research, we will explore the prevalence of the splice mutation in scribble on chromosome 15. Given that scribble plays a critical role in human breast cancer and is associated with EMT in a small subset of our mouse model tumors, we have hypothesized that it is critical in development of the MMTV-Myc EMT pathology. Using EMT tumors from MMTV-Myc mice, PCR to amplify scribble will be performed. The PCR product is run on a gel to verify the target's length, then sequenced. These results will determine if the mutation is conserved in histological subtypes of the MMTV-Myc tumors. Review of the data using C-bio-portal and current literature will aid in determining the relevance of scribble

IDENTIFYING THE KEY AMINO ACIDS WITHIN DUSP8 PROTEIN THAT DETERMINE ITS ACTIVITY

Presenter(s): Annabel Maag (Grand Valley State University)
Cell Biology Genetics and Genomics
Mentor(s): Ruijie Liu (Grand Valley State University)

Dual-specificity phosphatases (DUSPs) are a family of functionally similar proteins that oppose the phosphorylation of target proteins. A previous pulse-chase analysis in our laboratory has demonstrated that mouse DUSP8 protein is degraded over time, however the molecular mechanism underlying DUSP8 stability is unknown. Bioinformatic analysis of mouse DUSP8 protein sequence has identified two regions (426-452, 544-603) contain unique PEST sequences which are rich with proline [P], glutamate [E], serine [S], and threonine [T] amino acids. The goal of this study was to experimentally determine whether these two PEST regions play any role in DUSP8 stability. Using an In-Fusion Cloning system from Takara, two DUSP8 mutants have been generated that lack one of the two PEST regions. The expression of two mutants have been validated in human embryonic kidney cells (HEK293). In conclusion, this study will provide a novel mechanism of DUSP8 activity regulation by generating PEST mutants.

CHARACTERIZATION OF DIPEPTIDE REGULATION OF GLYCOLYTIC ENZYMES IN ARABIDOPSIS

Presenter(s): Jacob Holcomb (Michigan State University)
Cell Biology Genetics and Genomics
Mentor(s): Aleksandra Skirycz (College of Natural Science), Pallavi Agarwal (College of Natural Science)

Protein-metabolite interactions (PMIs) play a central role in contributing to key enzymatic activities and metabolic fluxes. This project focuses on the newly discovered enzyme-dipeptide interaction networks and its role in central carbon metabolism in Arabidopsis thaliana. Looking at protein metabolite interactions, this research investigates dipeptide interactions of phosphoenolpyruvate carboxykinase (PEPCK) and pyruvate kinase (PK), which are key enzymes in gluconeogenesis and glycolysis. We hypothesize that the newly discovered enzyme-dipeptide interaction networks contribute to the regulation of central carbon metabolism. We also speculate that the different dipeptides will act at distinct points of flux control, leading to diverse metabolic phenotypes. There are several aims to address the variability, binding, and expression of PMI's. Using multiple sequence alignment, a comparison of PK isoenzymes can help infer their diversity in composition. Using nanoDSF, or nano differential scanning fluorimetry, the ligation of dipeptides binding to a specific enzyme can be assessed. Screening lines of Arabidopsis to provide a phenotypic expression will also provide a qualitative way in which enzyme-dipeptide interactions can be observed. The aim of this research is to gather results as to how dipeptides interact with metabolic counterparts, and to possibly characterize the effect or expression of those PMI's. This research will help provide insight to dipeptide interaction

BIOENGINEERING ENERGY SORGHUM TO INCREASE BIOMASS AND MINIMIZE DEVELOPMENTAL DEGRADATION OF MIXED LINKAGE GLUCAN

Presenter(s): Anastasiya Buryak (Athens State University)
Cell Biology Genetics and Genomics
Mentor(s): Clayton Lewis (Research and Innovation), Federica Brandizzi (College of Natural Science), Sang-Jin Kim (College of Natural Science)

The increasing demand for sustainable energy sources has led to the exploration of plant-based biofuels. Energy sorghum is an attractive candidate for energy sources due to its high biomass yield, drought tolerance, broad adaptability and environmental sustainability. Bioenergy sorghum can be further improved by accumulation of easily convertible hemicellulose, mixed-linkage glucan (MLG). At Brandizzi lab we are working on programming and improving energy sorghum to acquire more biomass and higher levels of MLG for future use in biofuel production. MLG is easily modified for its simple structure and easily extracted from the cell wall of sorghum. Although there is a high production of MLG in younger plants, MLG is degraded at the later developmental stages. We want to use synthetic biology methods to program MLG synthesis at sorghum's later developmental stages to have high yield of MLG with higher yield of biomass of the stem. We aim to modify sorghum with overexpression of CSLF6 enzyme, the MLG synthase for increased production; reduce lichenase enzyme to prevent MLG degradation; and compartmentalize MLG production and deposition in the vacuole. Within this project we want to implement these traits into energy sorghum to facilitate production of biofuels.

VIVO TRACKING OF TRANSPLANTED PROGENITOR CELLS IN LUNGS USING MAGNETIC PARTICLE IMAGING FOR PULMONARY FIBROSIS TREATMENT

Presenter(s): Chris Lin (Hunter College)
Cell Biology Genetics and Genomics
Mentor(s): Katie Uhl (College of Human Medicine), Ping Wang (College of Human Medicine), Saumya Nigam (College of Human Medicine), Xiaopeng Li (College of Human Medicine)

Pulmonary Fibrosis (PF) is a chronic and irreversible condition characterized by repetitive alveolar injury, leading to airway scarring and thickening. Current pharmacological treatments have limited efficacy in restoring lung function by primarily delaying the fibrotic process and providing temporary anti-inflammatory relief. Surgical lung transplantation, while an option, carries significant risks due to its invasive nature and potential for pro-inflammatory responses. Stem cell therapy offers a novel treatment approach but faces criticism for its reliance on invasive methods to monitor effectiveness in vivo. This study utilizes Magnetic Particle Imaging (MPI), an emerging technology that directly images iron-oxide nanoparticles, to longitudinally monitor and quantify progenitor cell transplantation in vivo. MPI provides high sensitivity for cell tracking with minimal background signals, offering a non-invasive technique to monitor the biodistribution of progenitor cells. Human lung progenitor cells were labeled with Vivotrax+ at different doses and their 2D MPI signal intensity was acquired and analyzed. From the elevated signal intensity, a dose of 250 µg/ml was decided for cell labeling for future in vivo studies. The in vivo studies will be carried out on immunocompromised NOD/SCID mice. The labeled cells will be administered via oropharyngeal aspiration. These transplanted cells are expected to target the airway and alveolar epithelium and will be monitored o

CHARACTERIZATION OF H3K9ME3 IN EMBRYONIC ZEBRAFISH

Presenter(s): Sean Monahan (Michigan State University)
Cell Biology Genetics and Genomics
Mentor(s): Jose Cibelli (College of Natural Science)

Nuclear cloning, also referred to as Somatic cell nuclear transfer (SCNT), is a technique that allows for the development of an identical organism. This is done by taking a cell that has often been fully differentiated into a specific cell type and inserting its nucleus into an enucleated recipient oocyte arrested at metaphase 2 of meiosis. An issue arises as the donor somatic cell is epigenetically modified through histone acetylation or DNA methylation, which may be irreversible even when the nucleus is in the optimal conditions of the oocyte. This happens because the chromatin of somatic cells does not allow the embryonic genome to be activated, this process must be completed by the oocyte, a process that the oocyte is not adequately equipped to handling. These modifications are part of why SCNT often has poor success rates. One such epigenetic mark is H3K9me3 known to block embryonic genome activation. Our current hypothesis states that using donor nuclei with lower expression of H3K9me3 will yield a higher rate of embryonic development of clones. In this project, H3K9me3 will be characterized in Zebrafish (Danio rerio) embryonic fibroblasts, 1-cell embryos, 64-cell embryos, 256-cell embryos, dome, and 50% epiboly stage embryos through immunocytochemistry. In the future, cells known to have low levels of H3K9me3 will be isolated using flow cytometry and used as donors for somatic cell nuclear transfer.

USING DEEP LEARNING FRAMEWORKS TO INVESTIGATE RELATIONSHIP BETWEEN RNA ABUNDANCE PROFILES AND PROTEIN LEVELS.

Presenter(s): Katharine Falzarano (Klein Cain High School)
Cell Biology Genetics and Genomics
Mentor(s): Yuying Xie (College of Natural Science)

Measuring mRNA and protein levels at a cellular level is important to gain a deeper understanding of cellular states and dynamics, especially in the case of vaccine development. In order for this to occur, understanding the relationship between the abundance of mRNA and how it correlates to protein levels within the cell to uncover gene expression dynamics is crucial. Single cell RNA sequencing (scRNA-seq) has become a standard tool for quantifying RNA abundance, yet predicting protein levels directly from RNA data is currently a challenging task due to the complex and non-linear nature of gene expression regulation. However, deep learning frameworks show promise in modeling this complex relationship and revealing obscure patterns of large-scale omics data. Several different deep learning frameworks, such as graph neural networks, will be explored and leveraged to predict protein levels from RNA abundance profiles. In this project, I will With the ability to infer protein abundance from RNA-seq data, improved and more efficient methods of vaccine manufacturing can be made possible.

TARGETED MUTAGENESIS BY HOMOLOGOUS RECOMBINATION FOR THE SYNTHESIS OF BACTERIAL CELLULOSE

Presenter(s): Xander Fetterman (Michigan State University)
Cell Biology Genetics and Genomics
Mentor(s): Emily Greeson (College of Natural Science), Gemma Reguera (College of Natural Science)

The ability of some bacteria to produce copious amounts of an essential pure cellulose exopolymer is of significant interest for applications in the food and cosmetic industry, biomedicine, among other biotechnology applications. We recently expanded these applications to the development of wood biofillers with promising properties for the manufacturing of carbon negative building materials. These novel biomaterials rely on the production of a cellulose filler by Komagataeibacter bacteria once infiltrated inside the pores of abundant but otherwise underutilized local wood species. Critical to these applications is the development of molecular tools for the development of strains with robust performance and sustained viability inside the wood. Here I describe a method for the construction of DNA contigs that enable the homologous recombination of foreign genes in targeted locations of the chromosome of Komagateibacter xylinus. The research additionally identified steps that could be targeted to facilitate multiple-fragment PCR ligation and recovery of linear DNA constructs for electroporation and recombination in targeted chromosomal loci. This method bypasses the instability and low transformation efficiencies of current targeted mutagenesis approaches relying on plasmid vectors, an important consideration for advancing studies of the microbial physiology and metabolism of cellulose-producing bacterial product and their industrial applications.

AI-DRIVEN DISCOVERY OF TNIK AND CDK9 AS THERAPEUTIC TARGETS IN PLATINUM-RESISTANT HIGH GRADE SEROUS OVARIAN CANCER

Presenter(s): Harini Ram (University of Michigan)
Cell Biology Genetics and Genomics
Mentor(s): Analisa DiFeo (University of Michigan)

Current treatment options for high grade serous ovarian cancer (HGSC), the most common and lethal ovarian cancer subtype, are mostly limited to taxol/platinum-based chemotherapy and cytoreductive surgery. However, there is a need to uncover better therapies for platinum-resistant, recurrent disease. To address this, we used primary patient cell lines to model platinum-resistant HGSC in order to identify novel therapeutic targets. However, performing high-throughput phenotypic screens using 3D assays, which better mimic in vivo tissue architecture, are difficult. Thus, we utilized BenevolentAI's machine learning platform to generate a small but powerful list of unapproved compounds with known targets that can be screened in vitro with 3D models. We found that NCB-0846, a known TNIK (TRAF2 and NCK-interacting protein kinase) inhibitor, has novel therapeutic potential through dual inhibition of both TNIK and CDK9, an established component of the Wnt signaling pathway and a transcriptional regulatory enzyme, respectively. Experiments with TNIK-null and TNIK-knockdown cell lines showed modest effects compared to standard platinum-resistant cell lines treated with NCB-0846, prompting us to hypothesize alternative targets. Computational studies along with cell-free kinase assays identified CDK9 as a potential alternative target. Our results supported this hypothesis by demonstrating that NCB-0846's efficacy is dependent on CDK9 expression and its ability to regulate Wnt activity. Fu

IDENTIFYING FACTORS THAT REGULATE CHEMORESISTANCE IN OVARIAN CANCER

Presenter(s): Jordyn Smalls (Spelman College)
Cell Biology Genetics and Genomics
Mentor(s): Sachi Horibata (College of Human Medicine)

Ovarian cancer claims the lives of nearly thirteen thousand women yearly, making it the most lethal gynecologic cancer. Standard treatments include a platinum-based chemotherapy (cisplatin or carboplatin) paired with paclitaxel. While this treatment is effective initially, the majority of ovarian cancer patients will relapse and become resistant to therapy. Previous RNA sequencing of cisplatin-resistant and cisplatin-sensitive cells shows an upregulation of the Tubulin Polymerization Promoting Protein Family Member 3 (TPPP3) gene associated with cell proliferation and microtubule bundling. We found that TPPP3 plays a major role in the development of chemoresistance. However, we do not know how TPPP3 is being regulated. A potential regulator of TPPP3 is Forkhead Box Protein J1 (FOXJ1). FOXJ1 is a transcription factor responsible for the assembly of microtubule-based cilia. TPPP3 and FOXJ1 are commonly upregulated in the same cells, indicating a possible linkage. We hypothesize that FOXJ1 upregulates the TPPP3. To test this hypothesis, we will first compare gene expression levels in cisplatin-resistant and cisplatin-sensitive high-grade serous ovarian cancer (HGSOC). We will also examine how TPPP3 expression changes in FOXJ1 knockdown cell lines. To measure gene expression differences, we will utilize qPCR and western blot. Additionally, we would like to determine if FOXJ1 directly regulates the expression of TPPP3 by binding to the TPPP3 promoter region. To do this, we will pe

ROLE OF BETA-CATENIN IN PANCREATIC DUCTAL ADENOCARCINOMA ASSOCIATED FIBROBLASTS

Presenter(s): Shelby Stakenas (University of Michigan)
Cell Biology Genetics and Genomics
Mentor(s): Marina Pasca Di Magliano (University of Michigan)

Pancreatic cancer is the third leading cause of cancer-related death in the US. WNT signaling is aberrantly activated in pancreatic cancer. In canonical WNT signaling, WNT family ligands bind cell surface receptors and initiate a signaling cascade that culminates β-catenin (CTNNB1), translocation to the nucleus, binding of TCF/LEF family of transcription factors, and transcriptional activation of WNT target genes. Our lab has previously shown that WNT signaling is necessary for pancreatic cancer progression and that pancreatic fibroblasts, in the tumor microenvironment, secrete WNT ligands and express WNT target genes, evidence of pathway activation. We hypothesize that pancreatic fibroblasts deficient in β-catenin have an altered gene signature and response to cancer cell-derived signals. Fibroblasts from a Pdgfrα-CreERT2; Ctnnb1fl/fl (PC) genetically engineered mouse, allowing conditional inactivation of the Ctnnb1 gene upon administration of tamoxifen, were optimized for β-catenin deletion by performing a time-course treatment using 4-OHT, a tamoxifen derivative. Our data preliminarily shows decreased β-catenin Day 0-1 post-treatment. However, there appeared to be no difference in β-catenin levels by Day 6, indicating that cells that escaped recombination outgrow recombined cells over time. We will repeat this initial experiment and at peak β-catenin loss, treat PC or control cells with conditioned medi

PEPTIDE ENGINEERING OF EXTRACELLULAR VESICLES FOR DEVELOPING TUMOR TARGETED DRUG DELIVERY USING A BIOLUMINESCENCE REPORTER PLATFORM

Presenter(s): Anika Babel (Michigan State University)
Cell Biology Genetics and Genomics
Mentor(s): Assaf Gilad (College of Engineering), Masamitsu Kanada (College of Human Medicine)

Breast cancer affects approximately 609,360 people annually in the United States (as of 2022). Extracellular vesicles (EVs), cell-derived structures that transport biomolecules between cells, have emerged as promising carriers for targeted drug delivery. EVs can cross biological barriers, including the blood-brain barrier, making them ideal for therapeutic delivery. Our research uses a bioluminescent protein-based EV reporter, PalmReNL, to screen for cancer cell-binding peptides. By incorporating PalmReNL into EVs, we developed a high-throughput screening system to identify peptides with high affinity for breast cancer cells, potentially enhancing EV cargo delivery efficiency and targeting specificity. Previous studies from our lab showed that EVs engineered with the urokinase plasminogen activator receptor (uPAR)-binding peptide, a 13 amino acid sequence, exhibited the highest cancer cell binding activity among several tumor-binding peptides. We generated 24 scrambled versions of the uPAR-binding peptide and assessed their binding to breast cancer cells in vitro. Interestingly, some of the scrambled peptides significantly improved their breast cancer cell binding activities, while others lost their binding capacities, with some exhibiting an almost 2 fold increase. We explore the potential of EVs to deliver chemotherapy drugs, particularly those facing resistance in traditional treatments, such as methotrexate (MTX). By engineering EVs with peptides showing enhanced binding,

IDENTIFYING GENE DRIVERS OF LIVER METASTASIS IN A NEW MOUSE MODEL OF BREAST CANCER

Presenter(s): Theresa Kiki-Teboum (Duke University)
Cell Biology Genetics and Genomics
Mentor(s): Eran Andrechek (College of Human Medicine)

Breast cancer is the most diagnosed cancer in women, and about 90% of related deaths are associated with distant metastasis. Human breast cancer shows an organ-specific pattern of metastasizes (tropism) with brain, liver, lung, bone, and lymph nodes as the most common sites of invasion. Despite advances in the identification of genetic mechanisms driving this tropism, the understanding of breast cancer liver metastasis is limited. The small number of genetically engineered mouse models showing spontaneous metastasis to the liver is an important limitation. We generated a mammary-specific knockout of the transcription factor E2F5 that showed defects in mammary gland development and spontaneous tumors with distant metastasis in the liver. Transplantation of these tumors back to the mammary gland resulted in the generation of a lineage that primarily shows liver metastasis with 50% penetrance. Previous experiments have shown metastasis to the liver in mice models begins in the center of the liver, before proliferating toward the lobules. This differs from humans in that tumors can seed and invade the lobules. My project seeks to understand the biological mechanisms for the tumors growing in the center of the liver of the mice models. We hypothesize that differences in the expression of genes do not allow for proper proliferation in the lobule microenvironment. Several genes have been associated with the progression of breast cancer liver metastasis such

CHANGES IN SURVIVAL CHANCE & REGULAR GROWTH PATTERNS CAUSED BY EDN2 IN ZEBRAFISH

Presenter(s): Jacob Gray (Michigan State University)
Cell Biology Genetics and Genomics
Mentor(s): Julia Ganz (College of Natural Science)

The endothelin system is important for regulatory processes in the cardiovascular and pulmonary system, as well as vertebrate-specific neural crest cell population development. In most vertebrate there are three different genes in this system, though in zebrafish there are four genes that produce similarly structures 21-amino acid peptides. Though zebrafish are descendants of the teleost duplication, causing their genome to be duplicated. In the endothelin system, the genes edn2 and edn3 were duplicated into edn2a/edn2b and edn3a/edn3b. EDN2 has been known to be expressed in ovarian and intestinal epithelial cells in mice and humans, playing a role in the protective layer of cells that surround organs. Though this hasn't been modeled in zebrafish, nor has there been and distinction made between the difference in functionality; or the lack of said differential, amongst edn2a & edn2b. By modeling this in gene in zebrafish we can better understand the functionality this has to protecting organs and preventing damage. This paper follows fish who were born with the edn2a or edn2b mutation and compares the development of different morphological traits to that of a fish that doesn't carry this mutation.

Chemical Engineering & Materials Science

ENGINEERING PROTEINS WITH HIGH FUNCTIONALITY AND SPECIFICITY USING LIBRARY DESIGN

Presenter(s): Camille Shooltz (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Daniel Woldring (College of Engineering)

Our research group focuses on protein engineering, particularly within the realm of plant immunology. Yeast cells are favored over other expression systems due to their affordability, ease of genetic modification, and high protein yield capabilities. This study addresses the urgent need for improved plant proteins, essential for food security, by leveraging yeast as an expression system. Citrus Greening, caused by Candidatus Liberibacter asiaticus [1], has severely impacted orange production in the US. Orange trees lack efficient immune defenses against this bacterium. We hypothesize that engineering yeast can enhance the yield and stability of heterologously expressed plant proteins. Specifically, we are developing a novel immune-version of RIXI, a xylanase inhibitory protein, to bolster orange tree defenses. Our experimental design includes: E. coli transformations to create numerous transformants, Miniprep to store large amounts of DNA, Whole plasmid sequencing to confirm genetic alignment, EZ yeast transformation followed by induction, Cytometry to assess binding and expression levels, These steps ensure efficient production and evaluation of our engineered proteins. By improving the secretion and binding efficiency of RIXI in yeast, we aim to develop robust plant proteins that can be scaled up using yeast fermentation systems, thereby contributing to enhanced pathogen defense and food security. Our findings could pave the way for using yeast to produce other critical pla

PERFLUOROOCTANOIC ACID-INDUCED DNA DAMAGE IN HEPATOCELLULAR CARCINOMA CELLS

Presenter(s): Samantha Zaloudek (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Christina Chan (College of Engineering)

Per- and Polyfluoroalkyl substances (PFAS) are a group of anthropogenic carbon chains widely used in manufacturing due to their stability. However, these "forever chemicals" have accumulated in the environment and are found in the serum of almost all humans. PFAS congregate in protein-rich tissues and have been linked to numerous health problems, including cancers and liver disease. While they have been shown to trigger ER stress and DNA damage, the underlying mechanisms are poorly understood. To elucidate the effects of PFAS in individuals with cancer, HepG2 liver cancer cells were treated with IRE1 inhibitor and PFOA. Western blots measured expression of proteins on the IRE1 pathway, and H2A.X and yH2A.x to evaluate DNA damage. Comet assays were used to measure DNA damage directly. It was found that inhibiting IRE1 reduced H2A.X expression and increased DNA damage in PFOA-treated cells. A possible mechanism is that HUWE1, a ligase that tags H2A.X for degradation, is transcriptionally regulated by XBP1s, which forms upon IRE1 activation. Furthermore, with less H2A.X available for phosphorylation, DNA repair is limited. This suggests that IRE1 plays an important role in cancer propagation, and that individuals with cancer are particularly vulnerable to the effects of PFAS.

LOW-COST LASER WELDING FOR RAPID PROTOTYPING OF MICROFLUIDIC, LAB-ON-A-CHIP, AND MICROPHYSIOLOGICAL MODELS

Presenter(s): Dhruv Singh (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Brian Johnson (College of Veterinary Medicine)

Rapid prototyping tools and techniques have the potential to speed up the development of human-based cell culture devices, offering a viable alternative to animal models in drug and chemical testing. Computer numerical control (CNC) machining devices directly into ANSI/SLAS polystyrene (PS) microplates is one promising approach to creating throughput-compatible microfluidic devices that integrate directly into existing infrastructure and avoid incompatible materials. To create closed fluidics, devices milled into the bottom of well plates require effective sealing. While dedicated laser welding or ultrasonic systems are available, they are often inaccessible to laboratories seeking to employ microfluidics in their research. To address this and maintain an easily translatable manufacturing process, our research focused on utilizing a relatively inexpensive and widely available 10.6μm, 60-watt carbon dioxide (CO_2) laser-cutting machine to weld PS cell culture plates to clear PS sheets. Employing a systematic experimental approach, we explored the optimal settings for laser power, speed, and density, as well as effects of plasma treatment and thickness of PS sheets, to achieve functional welds. We characterized these welds through a series of tests to quantify their integrity and understand the physical and chemical changes taking place. This methodology allowed us to identify 26 different parameter combinations that produce reliable welds. Our initial work has demonstrated the

ACOUSTOPLASTICITY IN COPPER

Presenter(s): Rahul Gopalakrishnan (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Carl Boehlert (College of Engineering), Oktay Yigit (College of Engineering), Sunil Kishore Chakrapani (College of Engineering)

In many industrial applications, ultrasonic vibrations are used in metals to form or shape them. This ultrasonic deformation is otherwise termed as acoustoplasticity. Researchers have begun to analyze the acoustoplastic effect of metals after undergoing ultrasonic deformation to better understand the mechanical properties of these metals that are used in ultrasonic applications. The goal of this study is to characterize acoustoplasticity in copper and titanium. Separate copper and titanium plates will be acoustically deformed by an ultrasonic roller with varying parameters such as power, downforce, and speed. The parameters chosen are ones that are often used in ultrasonic welding. The microstructure and mechanical properties of these deformed samples will then be analyzed through methods such as grain size analysis and microhardness testing to determine the effects of acoustoplastic deformation. The results from this study can be used to better understand how applications that use ultrasonic vibrations can change or modify the microstructure and associated mechanical properties of metals.

THE ELECTROCHEMICAL PROPERTIES OF CHEMICALLY MODIFIED CARBON SURFACES

Presenter(s): Jonah Guerrero (Central Michigan University)
Chemical Engineering and Materials Science
Mentor(s): Greg Swain (College of Natural Science)

The formation of a diazonium molecular adlayer on a glassy carbon electrode, a mimic for carbon fiber reinforced epoxy composite materials, was investigated as a surface treatment. The purpose of the surface treatment is to reduce the extent of galvanic corrosion on a trivalent chromium process (TCP) conversion-coated aluminum alloy when mechanically joined with a composite as is common in aircraft structures. The adlayer functions to reduce the rate of dissolved oxygen reduction on the more noble carbon thereby reducing the rate of galvanic corrosion on the more active metal alloy. In this work, the diazonium salt, Variamine Blue (VB), was grafted to a glassy carbon electrode using an (i) electrochemically-assisted process and (ii) spontaneously by immersion under open circuit conditions for 24 h. We sought to learn if this diazonium molecule can be grafted to carbon surfaces from both organic and aqueous solutions. The surface modification was performed using a 5 mM diazonium salt dissolved in an organic and an aqueous electrolyte solution. Cyclic voltammetry was used to investigate the effect of the adlayer on the voltammetric background current in 0.5 M Na2SO4 (pH 5-6) as well as the oxygen reduction reaction kinetics in the same electrolyte solution under natural aeration conditions. Additionally, the ferri/ferrocyanide redox couple in 1 M KCl was used to probe for the presence of the adlayer. The results demonstrate that VB can be effectively grafted to the

COMPREHENSIVE ANALYSIS OF THE STRUCTURE AND SOLVATOCHROMIC CHARACTERISTICS OF MONOHYDROXY- AND MONOMETHOXY-COUMARINS

Presenter(s): Yejin Chung (Calvin University)
Chemical Engineering and Materials Science
Mentor(s): Mark Muyskens (Calvin University)

Coumarins are bioactive molecules consisting of a bicyclic benzene and pyrone ring. Some coumarins are used as laser dyes for their strong fluorescence. Monosubstituted coumarins, especially monohydroxy- and monomethoxy-coumarins were studied to deepen our understanding of how the substitution in different locants can change the photochemical and physical properties of coumarins. Solvatochromic analysis was done by collecting the wavelength of the absorbance peak of coumarin in various solvents and arranging the peak wavelengths according to the polarity of the solvent. HPLC and GC methods were used to collect the experimental data on the structure of the coumarins in the ground state, and modeling methods were used to get structural information.

EFFECTS OF DANGLING CHAIN DEFECTS ON INTEGRITY OF ELASTOCALORIC MATERIALS

Presenter(s): Nayan Mallya (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Shaoting Lin (College of Engineering)

Solid state cooling offers a wide array of new solutions to the traditional vapor cooling systems, while also providing a more efficient, environmentally conscious approach. However, current issues with solid state cooling (such as electrocaloric cooling) involve significant challenges with managing the strength and integrity of materials which ware due to mechanical fatigue and limited material knowledge. This hinders the long term performance of said materials and how the technology can be scaled. In this study, topological defects and delayed fracture of elastomers were tested in both hydrogels and elastomers by controlling dangling chain defects in order to improve the efficiency of electrocaloric performance. Our findings show that with proper maintaining of these defects, mechanical stress resistance and caloric effects of elastic materials can be improved. This data is promising to create a new frontier of more durable and efficient cooling solutions, which may be able to impact societal energy conception while also improving theoretical understandings of polymeric mechanics, offering new insight and guidelines to maximize efficiency of material design.

SYNTHESIS AND CHARACTERIZATION OF THERMOELECTRIC MATERIALS FOR ENERGY CONVERSION

Presenter(s): Cixian Yang (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Alexandra Zevalkink (College of Engineering)

Thermoelectric materials are semiconductor-like devices with high electrical and low thermal conductivity which can create an electric potential by the temperature difference or a temperature difference (Peltier coolers) by an electric current. This study involves complex procedure of synthesization and characterization of chosen thermoelectric materials, as well as search and compilation on elastic modulus, sound velocity, and mechanical properties of superionic conductors for the potential understanding of correlation between sound velocity and thermal conductivity. Synthesizing of the thermoelectric material includes sample preparation and the use of machines such as furnace and Spark Plasma Sintering (SPS). Characterizing the thermoelectric material comprises X-ray diffraction (XRD), ZEM-3, and Resonant Ultrasound Spectroscopy (RUS) for the sample's thermal, electronic, and elastic properties and analysis of the produced data. The result of this study can be used to identify and optimize compositions and prove strategies to achieve higher energy conversion efficiency.

UTILIZING YEAST SURFACE DISPLAY TO ENGINEER PROTEINS AGAINST CITRUS GREENING

Presenter(s): Asmaa Hasbini (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Daniel Woldring (College of Engineering)

The Huanglongbing (HLB) disease, also known as citrus greening, was first identified in Florida in 2003 and currently does not have a cure. HLB affects all citrus varieties and is caused by *Candidatus Liberibacter* bacteria, which reside in the phloem and are spread by two species of citrus psyllids: the Asian citrus psyllid (*Diaphorina citri*) and the African citrus psyllid (*Trioza erytrae*). This study proposes a method to enhance plant defense using yeast surface display and flow cytometry by investigating the expression of three defense proteins: Thioredoxin Peroxidase B (PRXIIB), Polygalacturonase Inhibitory Protein (PGIP2), and Xylanase Inhibitory Protein (RIXI). Each protein's plasmid is first transformed into *E. Coli* to study possible mutations in the vector, then transformed into *S. Cerevisiae* and induced in various growth media. Flow cytometry, specifically the BD Accuri C6, is used to analyze potential protein expression and binding. Following the workflow for all three proteins and their ancestors, we observed positive protein expression through flow cytometry analysis. The next step in this research is to investigate the possible binding of each protein to its target molecule so that the proteins can possibly combat the HLB disease in the future.

UTILIZATION OF DYNAMIC LIGHT SCATTERING (DLS) TO CHARACTERIZE CELL-SECRETED NANOPARTICLES

Presenter(s): Princess Kandji (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): S. Patrick Walton (College of Engineering)

Secreted nanoparticles play a critical role in cell function and have the capacity to be used as drug delivery vehicles for exogenous cargo such as RNA. The discovery of novel particles offers significant potential for advancements in the pharmaceutical and biomedical fields. A recently identified nanoparticle, termed exomere, is a non-membranous carrier of proteins, lipids, and nucleic acids that shows promise for transporting such therapeutic cargo. The primary goal of this research is to develop reliable methods for characterizing exomere morphology. To achieve this, we employ dynamic light scattering (DLS) to measure particle sizes, enabling the differentiation and isolation of samples with high exomere concentration at high purity. It is anticipated that this methodology will yield promising result, supporting the hypothesis regarding efficacy of these nanoparticles and contributing to improved drug delivery systems.

KAGOME LATTICE MATERIALS: MAGNETIC PROPERTIES AND QUANTUM PHENOMENA

Presenter(s): Rodrigo De Leon (College of the Holy Cross)
Chemical Engineering and Materials Science
Mentor(s): Greg Swain (College of Natural Science)

The honeycomb and related triangular lattices present a growing study within quantum materials due to their structure promoting magnetic frustration, which can lead to interesting quantum properties such as spin liquids and unconventional superconductivity. A new honeycomb lattice compound has been discovered with the formula $Tb_2Ni_{2.5}Zn_{0.5.}$ $Tb_2Ni_{2.5}Zn_{0.5}$ crystallizes in the trigonal P3ml space group with lattice parameters a=4.05120Å c=4.919Å. The compound shows layers of the puckered honeycomb lattice with Ni atoms in between, stacked along the *c* axis. Preliminary magnetic measurements show this compound has an antiferromagnetic ordering at around 30 K, while transport measurements are ongoing. Anisotropic magnetic measurements will dictate the role of the layering on the physical properties. Aluminum doping into the loading composition of $TbNi_6Zn_{20}$ also yielded a new orthorhombic $Tb_3Ni_{5.5}Al_{18.5}$ compound. It crystallizes in the Cmcm space group with lattice parameters a=4.08029Å, b=15.9779Å, and c=26.9882Å. Further magnetic and transport measurements are being performed. Loading compositions of pure zinc and Al flux yielded different results, which indicates a relationship between the amount of Al doping into the loading composition and the resulting structure. This will serve as a study into a new honeycomb lattice compound as well as the role of aluminum doping in the pure zinc loading composition.

EFFECTS OF COLD DEFORMATION ON THE CRYSTALLINITY, MECHANICAL, AND BARRIER PROPERTIES OF POLY (L-LACTIC ACID)

Presenter(s): Phuong Do (Dickinson College)
Chemical Engineering and Materials Science
Mentor(s): Juncheng Zheng (College of Engineering), Shiwang Cheng (College of Engineering)

Polymers are a big field in materials science for their universal impact, such as packaging, construction, electronics, etc. Therefore, engineering work to tune the desired properties of polymers is incessantly investigated to accommodate our demands in different applications. Cold deformation, a common metalwork technique, has been studied for a while on several petrochemical-based polymers as an approach to improve the materials' mechanical properties; however, such research on Poly(L-lactic acid) (PLLA), the most widely used biodegradable polymer, is still currently limited, especially on their barrier properties. This work aims to apply both uniaxial and biaxial cold-roll milling on PLA to study the effects on the mechanical and barrier properties. We first prepared amorphous polymer films by hydraulic pressing, then applied cold rolling at room temperature to induce the deformation, and finally annealed the samples at crystallization temperatures for two hours to initiate the crystal growth process. Molecular structure, such as lamellar thickness and degree of crystallinity, is estimated using Temperature Modulated Differential Scanning Calorimetry (TMDSC). Mechanical tests (Dynamic Mechanical Analysis and Tensile Test), permeability performance with oxygen and water vapor, and optical microscopy are conducted. Regardless of the rolling approach, cold-roll milling enhances the mechanical and optical properties of the annealed PLA while maintaining their barrier propertie

UNDERSTANDING FACTORS INFLUENCING CONSUMER'S DECISIONS TOWARDS SOLAR PV ADOPTION AND MODULE SELECTION

Presenter(s): Debosmita Saha (Novi High School)
Chemical Engineering and Materials Science
Mentor(s): Preeti Nain (College of Engineering)

The PV systems adopted by households, typically as rooftop installations - has grown rapidly in the US recently. However, adoption is unevenly distributed between different counties and regions. It is essential to understand the adoption motives of residents and the factors influencing their decisions. This study evaluates the factors influencing consumers' perspectives toward buying a module. For example, what motivated users to install solar panels, and what module attributes are consumers willing to pay extra for? Why is one type/brand module installed more than the other? Does it matter if modules are made in the US or if they have environmental certification? Do consumers evaluate the initial investment required for installing solar PV systems and weigh it against long-term savings on energy bills? Do tax credits and rebates significantly influence consumer decisions? Overall, the goal is to investigate how residential solar adopters' decisions differ based on income, education, location, price, module warranty, incentives, environmental consciousness, aesthetics, solar brand reputation, and trustworthiness. Understanding these factors and their interplay can help solar industry stakeholders tailor their product offerings, customer engagement approaches, and educational campaigns accordingly to effectively target different consumer segments and facilitate greater consumer acceptance and adoption of solar PV systems.

DESIGN OF OBLONG SHAPE CUTOUTS FOR VENTILATED CORRUGATED PACKAGING

Presenter(s): Yuvraj Shah (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Amin Joodaky (College of Natural Science)

Extending Produce Shelf life through Optimized Ventilated Packaging Design Protecting the postharvest quality of fruits and vegetables during transportation and storage is paramount for extending shelf life. Ventilated packaging, particularly corrugated boxes, is essential in the postharvest supply chain, facilitating air circulation to minimize spoilage and, in some cases, including ergonomic handling features to ease distribution. However, ventilation cutouts can compromise the package's structural compression strength, increasing the risk of mechanical damage to the produce and shortening its shelf life. This study aims to find a balance between enhanced air circulation and robust package strength, thereby directly extending the shelf life of produce. Our analysis of geometric variations in oblong-shaped cutouts on corrugated paperboard plates, through experimental buckling tests and Finite Element Analysis (FEA), reveals that the orientations and dimensions of cutouts significantly impact the plates' buckling strength. One preliminary observation indicates that vertical oblong cutouts preserve a greater amount of the box's compression strength, although they are less ergonomic than horizontal alternatives. The optimal design, therefore, involves an oblong cutout angled to balance ergonomic handling with structural integrity. This research provides actionable insights for creating more resilient ventilated packaging, leading to safer transportation and storage conditions f

BRUSHY NANOPARTICLE POLYMER ELECTROLYTES FOR LITHIUM ION BATTERIES

Presenter(s): Andrea Ligocki (University of Minnesota - Twin Cities)
Chemical Engineering and Materials Science
Mentor(s): Robert Ferrier (College of Engineering)

In a world with an ever-growing demand for renewable energy, efficient energy storage systems are required. One such system is high energy density lithium-ion batteries, for which the development of solid-state electrolytes are necessary. Two candidate materials for these electrolytes are polymers and ceramics, however, neither meet stability or ionic conductivity requirements. Combining nanoparticles with an ionic-conductive polymer matrix to create a composite polymer electrolyte results in a material with enhanced conductivity and stability. Unfortunately, in a battery cell, the nanoparticles aggregate and the beneficial properties of the electrolyte are lost. Polymer brushes grafted to the surface of the nanoparticle modulate the interactions between the polymer matrix and the nanoparticle, theoretically improving the properties of the composite material, though the behavior of these interactions is not well understood. Thus, this work investigated the effect of the presence of (Li) salt on these brushy nanoparticle composite systems. Aluminum-based initiator molecules were grafted on the surface of aluminum oxide nanoparticles (AlNP) from which epichlorohydrin chains were polymerized. Multiple molecular weights of the grafted polyepichlorohydrin (AlNP-PECH) ranging between 5 and 400 kg/mol were synthesized through a surface initiated ring opening polymerization of epoxides. The AlNP-PECH particles were then combined with a polyethylene oxide matrix. The behavior of these

THE STRETCHING OF PEG-BASED HYDROGELS AFFECTING ENZYMATIC DEGRADATION AND DIFFUSION

Presenter(s): Adolfo Lopez (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Xinyue Liu (College of Engineering)

Hydrogel degradation is the deterioration of its linkable bonds, changing its physical properties as the bonds break. The physical properties vary depending on the type of bond, the degradation time, and the concentration of the deteriorator. To better understand the effects of biological degradation, proteinase k is used to break down PEG-NH2 + PEG-NHS hydrogel, due to its peptide-like bonds. To establish an accurate mathematical model, we experiment with the degradation of the degradable and undegradable bonds at different proteinase k concentrations and test its mechanical properties by continuous uniaxial stretching. Another experiment performed was testing the diffusion through the hydrogel under degradation. We propose that the degradation of the hydrogel lowers its strength, while not affecting its diffusion. This proposed theory is supported by molecular analysis and physical experiments.

FRACTURE BEHAVIOR OF PATTERNED GELS

Presenter(s): Aditya Ketkar (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Caroline Szczepanski (College of Engineering)

Polymer gels are crosslinked networks that can absorb large amounts of solvents, such as water. Like other soft materials, gels possess a variety of interesting properties, such as viscoelasticity and a high swelling capacity. Patterned gels have a unique fracture behavior; by varying the geometry of a lattice structure, catastrophic fracture in the form of a running crack is replaced by random quasi-static breaking of struts. Here, we create patterned gels of different stiffness using photopolymerization. Stress-strain data of photopatterned, PEG-based gels, obtained via Dynamic Mechanical Analysis (DMA) reveals how bulk mechanical behavior is impacted by macroscopic patterning. We show that as the crosslinker fraction (i.e. stiffness) in the sample increases, the gel fractures at a lower strain, indicating a loss in flexibility. We also highlight how perforations can be used to create new modes of deformation compared to a continuum sheet of material. We observe that as hole size increases and strut size decreases, the material loses strength but gains elasticity. Using the geometrical lattice parameters, a theoretical Young's modulus is calculated and is found to underpredict the actual modulus, as measured by DMA, of the samples with smaller strut sizes and overpredict that of the samples with larger strut sizes. These results contribute to our understanding of the relationship between geometry and fracture mechanics of soft materials, and will aid in developing robust, t

RING OPENING POLYMERIZATION OF PROPYLENE CARBONATE FOR THE MODIFICATION OF ISOSORBIDE

Presenter(s): Conrad Schug (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Hugh MacDowell (College of Engineering), Ramani Narayan (College of Engineering)

A design of experiment was proposed to optimize the loading of a dual catalytic system used to induce ring opening polymerization of propylene carbonate (PC) initiated by Isosorbide in a 2.5:1 molar ratio of PC to Isosorbide. Various ratios of 1,8-Diazabicyclo(5.4.0)undec-7-ene (DBU) to Lithium Chloride (LiCl) to PC were investigated from a maximum of 1:5:250 molar ratio to a minimum of 0.1:0.5:250 molar ratio to generate a full factorial design. PC and Isosorbide were reacted with varying amounts of LiCl and DBU in a round bottom flask under constant stirring initially purged with nitrogen gas at 190? for 3 hours. Samples of the uncatalyzed mixture of PC and Isosorbide were collected and compared against the final product using Fourier Transform Infrared Spectroscopy (FTIR) to calculate the extent of reaction using area under the curve between 1680 - 1880 cm-1, assumed to be the carbonate peak from unreacted PC at 1780 cm-1. Additional analysis of the product was conducted by TGA and NMR to determine structure and properties of the modified Isosorbide. The data from the full factorial design was analyzed in Minitab software generating an extent of reaction surface for all catalyst loadings in the design space. The results indicated that suboptimal reactions occurred with catalyst molar ratios below 0.5:3:250 with more detailed analysis shown in the extent of reaction curve. This information will help guide future designs to further improve dual catalyst loadings to cre

SYNTHESIS OF SUSTAINABLE BIODEGRADABLE POLYESTER MONOMERS WITH BICYCLIC ACETAL MOTIF VIA DIRECT FUNCTIONALIZATION OF BIOMASS-BASED XYLOSE

Presenter(s): Denis Sibrian (North Carolina Central University)
Chemical Engineering and Materials Science
Mentor(s): Qiang Yang (College of Natural Science)

Polyesters are widely used in various industries such as packaging, fibers, elastomers, coatings, and medical devices due to their versatility. Biomass-based polyesters, derived from renewable sources like specific sugars and acids, not only emit significantly less carbon compared to those made from fossil fuels but also offer novel properties that fossil-based polyesters cannot achieve. Emerging biomass-based cyclic acetal monomers (including mono-, bi-, and tri-acetals) exhibit distinct characteristics. These monomers provide higher rigidity, increased volume, a higher ratio of oxygen to carbon, and feature dynamic covalent chemistry. They are stable against bases and can be controlled in their hydrolytic degradation, offering a solution to the trade-off between material properties and biodegradability. Incorporating these monomers enhances the thermal stability, mechanical strength, oxygen barrier properties, chemical recyclability, and biodegradability of resulting polyesters, known as poly(ester-cyclic acetal)s. Utilizing the acetalization reaction involving alcohol-aldehyde (or ketone) combinations, cyclic acetal monomers will be synthesized by reacting polyols such as galactitol, mannitol, pentaerythritol, glucitol, threitol, and xylose with either 1) aldehydes or ketones (e.g., formaldehyde, acetone) or 2) aldehydes or ketones containing hydroxyl or carboxylic acid groups. The expected outcome of this research and development effort is the creation of polyesters

FIBER REINFORCED CONCRETE USING LUNAR AND MARTAIN SAMPLES

Presenter(s): Connor Smith (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Matias Leon (College of Engineering), Qingxu Jin (College of Engineering)

ECC or Engineered Cementitious Composites is a type of reinforced concrete mix designed to get stronger under cracking otherwise known as strain hardening. This material consists of fibers that bridge cracks letting the concrete keep it's strength. In regular ECC a percentage of the cement used in the concrete is replaced with a SCM or supplementary cementing materials. This project attempts to use both Martian and Lunar samples as SCM's to explore the use of ECC on future Lunar or Martian expeditions.

QUANTIFYING EXTRACELLULAR VESICLE UPTAKE IN TRIPLE NEGATIVE BREAST CANCER CELLS USING ENGINEERED PROTEIN-STUDDED VESICLES

Presenter(s): Kylie Maxton (Michigan State University)
Chemical Engineering and Materials Science
Mentor(s): Assaf Gilad (College of Engineering), Masamitsu Kanada (College of Human Medicine)

Extracellular vesicle (EV)-mediated uptake and transfer of various biomolecules plays a vital role in intercellular communication and may eventually improve targeted drug delivery.

Civil & Environmental Engineering

LONG-TERM PARTICULATE MATTER EVALUATION IN RURAL ALASKAN HOMES

Presenter(s): Jordan Jacques (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Kristen Cetin (College of Engineering)

Given the extreme cold temperatures in Alaska experienced during much of the calendar year, and the high energy burden experienced by rural Alaskan homes, Native Alaskan communities face the challenge of trying to reduce energy costs while maintaining acceptable indoor air quality in their homes. This challenge is exacerbated by electricity and fuel oil costs being 2-5 times higher than the lower 48 states, as well as houses being older, and generally less energy efficient. While ERVs and HRVs have been utilized in some homes in rural communities to support improved ventilation, previous research and ongoing discussions on the challenges of ensuring homeowner utilization of mechanical ventilation systems suggest that these systems may not be being used as intended, if at all. Lower mechanical ventilation utilization, combined with smaller homes and higher occupant densities, leads to potential concerns of poor indoor air quality. Currently, however, there is not much long-term data on indoor air quality conditions in rural Native Alaskan homes. As such, this research focuses on year-long, continuous evaluations of particulate matter (PM), specifically PM 2.5 and PM 10, in 20 homes in the western Alaska coastal communities of Nome and Unalakleet. Indoor air quality sensors were placed in each of these homes in a central living area, with data collection completed at 10 minute intervals. Results suggest that while some homes remain within the recommended levels suggested b

ACUTE TOXICITY OF LANDFILL LEACHATE DUMPED WITH SOLAR PANELS

Presenter(s): Michael Wholihan (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Annick Anctil (College of Engineering), Preeti Nain (College of Engineering)

Solar energy is the fastest growing form of energy production in the world. As a result. solar panel waste also grows exponentially. Solar panels generally last about 30 years in operation. This means that around 2050, there will be hundreds of tons of solar panel waste. A problem arises because there has yet to be a proper disposal technique discovered. Tossing panels into a landfill is much cheaper than trying to recycle the parts and is currently favored over other types of disposals. A simulated landfill column study was performed to understand the potential danger of solar panels and their leachate on the environment. Solar panel cells were manually ground up to remove the glass encapsulation and were placed with a mixture of sand and clay, varying in each column. The leachate produced was then used in an acute toxicity test with the species Daphnia Magna. Results from this test bring insight to the effects of different kinds of solar cells on the environment and be able to predict what would happen in a real landfill situation. It is expected that the results would reflect that there are toxic metals in the leachate, but not with high enough lethal concentrations for them to be considered unsafe. Given the timeline of the project, it could be assumed that a higher concentration would be achieved if the column study were to last a longer duration.

IMPACTS OF WATER USE ON THE COLORADO RIVER WATER SUPPLY

Presenter(s): Maria Basaldua Del Cid (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Yadu Pokhrel (College of Engineering)

Precipitation deficits and rising temperatures have caused a decline in the water supply in the Colorado River Basin. At the same time, water demand, coming from multiple states in the American Southwest, has continued to increase. With climate change affecting water resources and human activity resulting in rising demands, hydrological studies are needed to achieve water security. In this project, hydrological data will be used to analyze the impacts of consumptive uses and losses, including water diversions, on natural river flow. This method involves collecting and analyzing data on water uses such as irrigation, livestock, exports, and water in reservoirs to obtain an overall picture of the amount of water exiting the basin. By processing this data using statistical techniques (e.g., trend analysis), long-term patterns and changes during dry and wet periods will be examined. This should demonstrate the scale of the impact of water use, including diversions, on the declining water availability in the Colorado River basin. Results will inform modeling of water use in the basin and provide a baseline for future predictions.

AERIAL EMISSION OF ANTIBIOTIC RESISTANT GENES DURING MANURE PRACTICES

Presenter(s): Zoe Linko (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Kaisen Lin (College of Engineering)

Farm animals are often given antibiotics to promote growth and good health. However, a majority of these antibiotics will develop antibiotic resistance under pressure and elevate the level of antibiotic resistant genes (ARGs) in livestock fecal matter. The prevalence of ARGs surrounding farmland areas has the potential to cause negative health effects in its workers when inhaled. When manure is relocated/handled to be brought to a compost facility or fertilizer application, the spread of ARGs on the surrounding air can be a concern due to resuspension. ARG transport in similar situations has been tested through water sampling, but is highly unidentified in aerial transport. In this study, we aim to identify and quantify the emissions of airborne ARGs as a result of manure hauling in order to estimate the health risk to farm workers. Air samples will be taken at Michigan State University's South Campus Animal Farms, using pumps to collect the ARG-carrying particulate matter during manure hauling. Samples will be collected both inside and outside (as control) of the compost building. Samples will then be subjected to DNA extraction and qPCR assay to determine the types of ARGs and their concentrations. By identifying and quantifying the ARGs present during manure hauling, the consequences of aerial ARG prevalence in manure handling practices on farm workers will be better known.

DEVELOPMENT AND APPLICATION OF A WEB-BASED TOOL FOR PREDICTING PAVEMENT PERFORMANCE AND LIFE EXPECTANCY USING ASHTOO 1993+ METHODOLOGY

Presenter(s): Fadi Shehada (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Muhammed Kutay (College of Engineering), Syed Haider (College of Engineering)

This research introduces a web-based tool designed to predict pavement performance and life expectancy. Utilizing the ASHTOO 1993+ methodology, the tool calculates the layers coefficient and employs a specific formula for ΔPSI (Pavement Serviceability Index) to enhance accuracy. Users can manually input project details, configure pavement layers with varying thicknesses and characteristics, and enter traffic information. The tool calculates cumulative Equivalent Single Axle Loads (ESALs) and PSI over a 20-year period, considering both standard traffic growth and additional ESALs due to detours. Key features include graphical representations of PSI trends, highlighting the impact of additional traffic loads on road life expectancy. Users can specify the duration and intensity of extra ESALs, allowing for detailed predictions of pavement conditions. The tool's calculation of the AC layer coefficient based on the temperature at the road location and the equivalent loading frequency provides greater precision compared to traditional methods, which often assume a constant value of 0.44. Additionally, the innovative approach to ΔPSI calculation offers an innovative way to assess the loss of service life. Our hypothesis is that using the ASHTOO 1993+ methodology and specific ΔPSI calculations will provide more accurate predictions of pavement performance and life expectancy compared to traditional methods. The tool aims to improve pavement performance analys

REMOTE ELECTRICITY AND OIL CONSUMPTION DATA COLLECTION USING LORAWAN PROTOCOL AND SENSORS

Presenter(s): Andrew Compton (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Kristen Cetin (College of Engineering)

Rural Alaskan households face high electricity and heating fuel costs, resulting in a substantially higher energy burden than much of the U.S. While energy efficient technologies exist to reduce energy burden, higher costs and shipping limitations reduce the accessibility of these technologies for many rural households. As a result, there is an "energy efficiency gap" between available and implemented technologies. Standard retrofits implemented in Alaskan homes include increasing wall and attic insulation, air sealing, heat recovery ventilators (HRVs)/energy recovery ventilators (ERVs), and replacing single-pane windows with double or triple pane. However, there are limited measurement and verification efforts (M&V) to evaluate the impact of these retrofits on energy use. Rural Alaska is particularly challenging due to limited in-home WiFi, the high cost of cellular internet connectivity, limited available service providers, and long distances across which data needs to be wirelessly collected. Thus, This research focuses on developing a modular energy data collection system. Among available protocols, LoRaWAN (low-power, long-range wide area network) is chosen primarily because data can be transmitted at a more extended range than other methods, such as WiFi, Bluetooth, or ZigBee, to a central hub. A low-flow, non-intrusive ultrasonic flow sensor for oil use (heating/water heating) and current transformers (CTs) for electricity use were connected to LoRaWAN-enabled puls

ENVIRONMENTAL TOXICITY OF POST-RECYCLING SOLAR PHOTOVOLTAIC WASTEWATER

Presenter(s): Om Nair (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Annick Anctil (College of Engineering)

With growing energy demand, solar photovoltaic (PV) module installations are increasing rapidly, and so is the end-of-life PV waste volume. The environmental implications of PV waste concerning metals like silicon, lead, etc. need to be investigated. This study investigates the acute toxicity of metal present in PV recycling wastewater using Daphnia Magna in a 48-hour bioassay. Mechanical recycling procedures for two PV modules, a semi-flexible monocrystalline silicon module and a polycrystalline silicon module, were replicated at a laboratory scale. Acute toxicity tests were conducted to simulate Daphnia Magna exposure to a natural water body, assessing the impact of wastewater on aquatic ecosystems. This research provides valuable insight into the environmental implications of PV disposal and recycling, highlighting the importance of proper disposal practices to minimize negative environmental effects.

BIOLOGICAL BUILDING BLOCKS: MYCELIUM'S ROLE IN SHAPING FUTURE STRUCTURES

Presenter(s): Kyla Zhao (Michigan State University), Soham Inamdar (Michigan State University)
Civil and Environmental Engineering
Mentor(s): Jinxing Li (College of Engineering), Khoi Nguyen (College of Engineering)

The concrete industry is one of the largest contributors to the growing climate crisis. In recent years, the push to find a replacement material comparable in strength and sustainability has been growing. The usage of engineered living materials (ELM) combining mycelium grown on lignocellulosic materials and other biodegradable deposits has been proposed as a solution for their ability to self-heal, form complex networks and structures, and moldability. However, the challenge of building complex, sturdy structures using these biocomposites remains unresolved. In this study, we report new methods of implementing and manipulating the molding process to build small-scale, self-healing models of various structures through the method of modular assembly. Formulas using mycelium and various deposits were created and packed into molds to form interlocking joints that were assembled and left to grow to form a large complex structure. The formula's mechanical properties were determined using tensile and compression tests. Our results demonstrate the capabilities of biocomposite molding and the applications of mycelium on the development of ELM.

Computer Science & Engineering

ADVERSARIAL ATTACKS AND DEFENSES FOR PANOPTIC PERCEPTION MODELS IN AUTONOMOUS DRIVING

Presenter(s): Ann Ubaka (Jacksonville University), Harrison Haviland-Longo (University of Detroit Mercy)
Computer Science and Engineering
Mentor(s): Lanyu Xu (Oakland University), Yunge Li (Oakland University)

Autonomous vehicles (AVs) leverage machine-learning perception models to detect and classify critical objects such as road signs, vehicles, lane lines, hazards, and pedestrians, enabling self-driving functionalities. With the nationwide proliferation of AVs, the demand for safe, secure, accurate, and rapid driving perception models has surged dramatically. Panoptic perception models have been proposed to offer advanced object detection and segmentation capabilities for AVs. This work explores the robustness of panoptic perception models against adversarial attacks, focusing on the YOLOP (You Only Look Once for Panoptic Driving Perception) model. To comprehensively evaluate the safety of panoptic perception models, we subject the model to various adversarial attacks, including the Fast Gradient Sign Method (FGSM), Jacobian-based Saliency Map Attack (JSMA), Color Channel Perturbations (CCP), and Universal Adversarial Perturbations (UAP), to assess their effects on model performance. Subsequent defenses, including image pre-processing techniques and the deployment of a Defense Generative Adversarial Network (GAN), are implemented to mitigate attack effects. Our findings reveal deprecated performance post-attack implementation, with only marginal improvement in the performance of models post-defense application. These results suggest the necessity for further research into more effective defense mechanisms

PROFIT MAXIMIZATION IN SHORT-TERM FINANCIAL INSTRUMENT TRADING WITH TRANSFORMER VALUE FORECASTING

Presenter(s): Ian Keefer (Oakland University), Jacob Chunn (Oakland University)
Computer Science and Engineering
Mentor(s): Mahdi Moghaddami (Oakland University), Mohammad-Reza Siadat (Oakland University)

Unpredictability in short-term financial instrument trading is often a barrier for humans who wish to make profit. In response, day-traders utilize automated trading systems that perform high-frequency trading based on ongoing market condition analyses. Existing trading strategies have the potential to be enhanced by the capabilities of Transformers, which have proven to be capable time-series forecasters. Previous research in financial trading with Transformers often simplifies predictions to binary stock price movements or provides forecasts with low granularity. These simplifications restrict the domain of possible trading strategies, ultimately limiting the discovery of potential means of profiting. This issue is addressed by dividing the trading process into two distinct parts. First, Transformer-based models, including specialized versions like the Informer and Autoformer that excel at sequence forecasting, are trained for short-term time-series sequence forecasting based on recent prices and rates of various financial instruments with the aim of predicting their future values. Additionally, a novel loss function that assesses volatility by considering the difference in standard deviation between predictions and actual sequences is evaluated as part of this training process. Next, a trading algorithm is applied to these short-term forecasted values, determining the optimal times to buy and sell the financial instruments for profit maximization. The trading algorithm'

RAISING USER AWARENESS OF AI PROFILING

Presenter(s): Alexander Simon (Oakland University), Amy Yu (Scripps College)
Computer Science and Engineering
Mentor(s): Steven Wilson (Oakland University)

Data mining and artificial intelligence tools have proven capable at inferring likely user attributes and personal information such as age, sex, and location based on data collected from people's everyday online interactions. As a result, members of the general public can unknowingly expose sensitive or private information about themselves through these interactions. Beyond the information that is directly shared, user data can be exploited through AI tools for people to infer more additional information beyond what many people may be aware of. This information may be used to personalize user experiences and advertisements, but also for more harmful purposes such as identity theft or surveillance. Our objective is to build an interactive simulated online experience with integrated AI tools to spread user awareness of AI and its applications in user profiling. In this interactive, users can take actions similar to those that they would everyday: make a post to share with their friends, update the user profile, and view and like other posts. After the user's time on the platform, AI tools will process the data that users will generate through these interactions to make inferences on various personal attributes such as age, gender, and location. Once the users finish their experience, they receive a report generated based on which types of personal attributes were inferred throughout the experience through which actions. Through this project, we aim to increase AI literacy and e

TRANSFORMER-ASSISTED BUG DETECTION AND DIAGNOSIS IN DEEP NEURAL NETWORKS

Presenter(s): Abdul Haq Ayantayo (Wayne State University), Muhammad Anas Raza (Oakland University)
Computer Science and Engineering
Mentor(s): Mohammad Wardat (Oakland University)

Deep neural networks (DNNs) are increasingly used in critical applications like autonomous vehicles and medical diagnosis, where accuracy and reliability are crucial. However, debugging DNNs is challenging and expensive, often leading to unpredictable behavior and performance issues. Identifying and diagnosing bugs in DNNs is difficult due to complex and obscure failure symptoms. To address this, we propose a method that combines transformer models for feature extraction with deep learning models for classification to detect and diagnose bugs in DNNs. Our approach involves using a pre-trained transformer model, which has been trained on programming languages, to extract semantic features from both faulty and correct DNN models. We then use these extracted features in a separate deep learning model to determine whether the code contains bugs. If a bug is detected, the model further classifies the type of bug. By leveraging the powerful feature extraction capabilities of transformers, we capture relevant characteristics from the code, which are then used by a deep learning model to identify and classify various types of bugs. This combination of transformer-based feature extraction and deep learning classification allows our method to accurately link bug symptoms to their causes, enabling developers to take targeted corrective actions.

ENHANCING LLM CODE REPAIR USING RAG AND STACK OVERFLOW POSTS

Presenter(s): Elijah Mansur (Ohio State University), Johnson Chen (Rochester Adams High School)
Computer Science and Engineering
Mentor(s): Mohammad Wardat (Oakland University)

Identifying, localizing, and resolving bugs in software engineering is challenging and costly. This research enhances Large Language Models' (LLMs) capabilities for bug localization and code repair using Retrieval Augmented Generation (RAG) based on dynamically collected Stack Overflow posts. These posts are searchable via a Question and Answer Knowledge Graph (KGQA). We evaluate our method on the HumanEvalFix benchmark for Python using relevant closed and open-source models. Our approach facilitates error resolution in Python coding problems by creating a searchable, embedded knowledge graph representation of bug and solution information from Stack Overflow, interlinking bugs, and solutions through semi-supervised graph construction methods. We use cosine similarity on embeddings based on LLM-synthesized summaries and algorithmic features describing the coding problem and potential solution to find relevant results that improve LLM in-context performance. Preliminary results indicate that our system enhances small open-source models' ability to effectively repair

code, particularly where these models have less parametric knowledge about relevant coding problems and can leverage non-parametric knowledge to provide accurate, actionable fixes.

COUNTING EDGE COVERS OF CHAIN GRAPHS

Presenter(s): Ethan Woudwyk (Grand Valley State University)
Computer Science and Engineering
Mentor(s): Brian Drake (Grand Valley State University), Feryal Alayont (Grand Valley State University)

In this project we study the sequences formed by counting edge covers of graph families. An edge cover of a simple graph is a subset of edges that cover every vertex. For example, the number of edge covers for the cycle graph family follow the Lucas numbers. We consider the number of edge covers for a new family of graphs, the chain graphs. A chain is obtained by joining copies of a graph at distinct edges. We count edge covers for the chain graphs using the transfer-matrix method and investigate their recurrence relation properties.

DNA SEQUENCE GENERATION AND CLASSIFICATION WITH SYMBOLIC DOMAIN KNOWLEDGE USING THE DOMIKNOWS FRAMEWORK

Presenter(s): Sifatul Anindho (Michigan State University)
Computer Science and Engineering
Mentor(s): Parisa Kordjamshidi (College of Engineering)

The generation of DNA sequences and further classification of them into specific gene categories is an important task in bioinformatics, with significant implications for genetics, medicine, and biotechnology. In this research, we aim to do this by taking advantage of symbolic knowledge, relevant to DNAs, which is expressed by experts in this field. We use the DomiKnowS framework, which is a tool designed for integrating symbolic domain knowledge into deep learning models. This framework provides both a Python library for the utilization of its modules and a website interface that, through step-by-step interactions with the user, creates a knowledge graph that incorporates the domain knowledge. This framework requires the definition of a knowledge graph, machine learning modules, and training methods. As such, we begin by declaring domain knowledge about DNA sequences, including the nucleotide bases and their arrangement rules, and the classification criteria for six distinct gene categories which forms our knowledge graph. This domain knowledge is then integrated into various machine learning models implemented in PyTorch. These models are trained on a DNA sequence dataset sourced from Kaggle. The performance of the DomiKnowS models is evaluated and compared against baseline models lacking domain knowledge integration. The results provide insights into the benefits of integrating symbolic knowledge in deep learning for bioinformatics applications.

GENERATING SYNTHETIC VOCAL IDENTITY SIGNALS FOR BIOACOUSTICS ANALYSES

Presenter(s): Arlena Cross (Smith College)
Computer Science and Engineering
Mentor(s): Grace Smith Vidaurre (College of Natural Science)

Vocal learning may be used to communicate identity information, such as individual or group identity, in ways that are essential for survival. Understanding the social conditions that favor different forms of vocal identity encoding can contribute to our knowledge of the evolutionary dynamism of learned vocal communication systems. However, the nimbleness of these individuals makes them difficult to study in the wild, which in turn affects researchers' ability to infer how learned vocalizations are used to communicate identity information. To address these challenges, simulations of synthetic animal groups can be used to test how different social conditions may favor signaling either individual or group identity information. These simulations must include synthetic individuals that produce communication signals encoding identity information. I developed a pipeline to generate synthetic animal vocalizations by converting character strings to directional changes in pitch using Parsons code. I then used edit distances among strings to create individually or group-distinctive vocalizations. These functions are being developed into an R package, and will be used in an agent-based modeling framework to link social conditions to learned identity signaling. Traditional bioacoustics methods, such as Spectrographic Cross-Correlation (SPCC) and Dynamic Time Warping (DTW), will be used to assess whether these synthetic signals produce the patterns of acoustic variation expected for group

IDENTIFYING CO-AUTHOR CONNECTIONS FROM ASTROPHYSICS LITERATURE

Presenter(s): Grayson Tvrdik (Bowling Green State University)
Computer Science and Engineering
Mentor(s): Vincente Amado Olivo (College of Natural Science), Wolfgang Kerzendorf (College of Natural Science)

From 1990 to 2023, research co-authorship in physics papers increased significantly, with the average number of authors per paper rising from 3.02 to 6.67. This growth prompts an investigation into the evolution of team science and how factors such as location and research type impact international scientific collaboration. Utilizing the NASA Astrophysics Data System (ADS), a vast digital library in physics, we will explore the developing practices of scientific collaboration across the global physics research community through data science techniques. The resulting data and methodology will facilitate the development of a machine learning based method to analyze researcher associations over time. An important step in analyzing co-authorship connections is the accurate identification of the location of publications. In preliminary work, the NASA ADS has been found to contain erroneous author-affiliation associations across publications, prompting the examination of both the comprehensiveness and accuracy of the digital library. Consequently, we will develop a methodology to group affiliations by country location and interpret the changes that have occurred in co-authorship distances over time. In preliminary results, we implemented a machine learning method using keyword specified topics to aid subfield identification to further assess the connections. The resulting groupings displayed inconsistencies, but will create a baseline for further development. The resulting algorith

PHYSICS-INFORMED MODELING OF COMPLEX DYNAMIC SYSTEMS FROM DATA

Presenter(s): Scott Zhao (Wake Forest University)
Computer Science and Engineering
Mentor(s): Huan Lei (College of Natural Science)

Predictive modeling of agent dynamics in various physical systems is an important research problem across many disciplines. From small-scale interactions of macromolecules to the orbits of objects in space and even extending to the movement of people and ideas in society, learning the governing equation can give us a greater understanding of the physical insight. However, it can be difficult to compute or analytically solve for the exact underlying interaction law controlling a system's behavior. The goal of this research is to develop an effective way to infer interaction laws governing an agent system. For this project, the researcher first simulates the dynamics of ordinary differential equations in order to synthetically generate time-series trajectory data with a chosen interaction law. Using this data and principles developed from deep learning neural networks, an interaction kernel function can be calculated to estimate the interaction law governing the observed paths. The researcher hopes that such a data-driven estimation can not only accurately predict interaction laws, but can also ensure numerical convergence and adaptivity. Ultimately, this technique can hopefully be used on observational data to deduce information about an unknown kernel and gain a scientific understanding of an agent's complex dynamic behaviors.

SAFEGUARDING AGING INFRASTRUCTURE USING DRONES, MACHINE LEARNING, AND PROACTIVE INSPECTIONS

Presenter(s): Khang Nguyen (Michigan State University)
Computer Science and Engineering
Mentor(s): Surya Sarat Chandra Congress (College of Engineering)

This research addresses the critical need for improved inspection methods to ensure the safety and longevity of aging transportation infrastructure in the USA. Traditional inspection techniques, although effective, rely on human judgment, making them time-consuming and susceptible to missing crucial details. Recent advancements in drone technology and machine learning offer an opportunity to revolutionize infrastructure inspections. Drones equipped with high-resolution cameras allow safe and efficient data collection from hard-to-reach areas, capturing detailed images and videos for further analysis. This research hypothesizes that the combination of drones and machine learning can provide more timely and comprehensive assessments of infrastructure health compared to traditional methods. By training deep neural networks on extensive drone datasets, this study aims to develop automatic systems to detect defects such as cracks, corrosion, and misalignments, providing qualitative and objective assessments. Furthermore, the research experiments with and develops advanced 3D reconstruction techniques, focusing on innovative techniques such as Neural Radiance Fields (NeRF) and 3D Gaussian splatting. The research aims to facilitate the development of detailed 3D models for in-depth infrastructure analysis. These comprehensive methods allow for both qualitative (visual inspection of the model) and quantitative (defect identification by ML) assessments, providing a more holistic view

VIRTUAL REALITY VISUALIZATION OF BESFEM SIMULATIONS OF A LITHIUM-ION BATTERY

Presenter(s): Sean Gibson (Oregon State University)
Computer Science and Engineering
Mentor(s): Robert Termuhlen (College of Natural Science)

Battery technologies are essential for everyday life. Electrode designs currently rely on trial-and-error approaches, and there is a need for additional, more efficient approaches in battery development. Consequently, a robust, open-source, long-term software toolkit named BESFEM is being developed for simulating complex multiphysics phenomena in battery electrode microstructures. This will enable rapid testing and examination of electrochemical processes in digitally represented electrode microstructures. The current work focuses on the development of a virtual reality visualization tool to provide an immersive experience to observe the electrode electrochemical processes for the participants. The rendering of the battery electrode was created using the game engine Unity, a software that specializes in 3d interactive simulations. The user has the option to visualize the microstructure and streamline paths through their own custom battery electrode models. Some example battery electrode microstructures are also provided. The tool also has the ability to display the BESFEM simulation results by animating the change in lithium ion concentration.

DYNAMIC 3D VISUALIZATION TOOLS FOR ADVANCED BATTERY SIMULATIONS

Presenter(s): Sanika Kapre (Michigan State University)
Computer Science and Engineering
Mentor(s): Dirk Colbry (College of Natural Science), Hui-Chia Yu (College of Engineering)

The research involves complementary expertise and overlapping interests in materials science, numerical methods, and software engineering. A long-term sustained software toolkit called BESFEM is being created to address the grand challenge of simulating a wide variety of multiphysics materials science phenomena in complex microstructures. This tool is expected to be specifically useful in areas of battery simulation and design and may transform everything from phones to electric vehicles. This research project focuses on creating a 360-degree visualization using Blender, eased by a python script to automate various tasks. A 3D model object file is used to make the battery configuration, camera paths through the microstructure follow streamlines obtained by simulation, with coordinates processed from a file. A Python function moves the camera and lights through the scene, using keyframe animation for smooth transitions. The rendering settings for the animation are adjusted to produce high-quality output for panoramic viewing. The method includes thorough checks to ensure accurate results and metrics to measure how effectively the automation scripts meet project goals. This approach highlights the integration of advanced 3D modelling, scripting, and rendering techniques to streamline the creation of immersive 360-degree visualizations.

DANCE ANALYSIS WITH YOLOV8

Presenter(s): Mia Kunath (Michigan State University)
Computer Science and Engineering
Mentor(s): Dirk Colbry (College of Natural Science), Lyrric Jackson (Spelman College)

This project explores new AI driven techniques to analyze movement patterns to distinguish regional dance styles, offering a greater understanding of cultural dance forms. This interdisciplinary approach allows for a more nuanced understanding of dance and allows us to better explore the connections between movement and culture. The YOLOv8 AI Library is employed for data collection using motion capture features to model intricate body movement patterns which helps us better understand and interpret the art of dance. Utilizing YOLOv8's pose detection capabilities, we can pinpoint key points on the body, such as shoulders, hips, and crucial facial features, in static images. When this technology is applied to video footage, it tracks the changes in these key points frame by frame, enabling us to model variations in motion. The temporal variation of these key points can create a kind of "dance signature" which can be used to quantify different dance parameters such as "energy", "range of motion" and "pacing" which in turn can be used to understand how dance changes with region and culture.

EXTENDING THE GENERAL-PURPOSE OPTIMIZATION LIBRARY (GPOL) BY INTEGRATING LINEAR GENETIC PROGRAMMING (LGP)

Presenter(s): Binh Nguyen (Oberlin College)
Computer Science and Engineering
Mentor(s): Illya Bakurov (College of Engineering), Wolfgang Banzhaf (College of Engineering)

Swarm and Evolutionary Computation often face challenges like missing source code, different programming languages, and diverse APIs, making it hard to integrate algorithms. The General-Purpose Optimization Library (GPOL) helps by providing a unified interface in Python for multiple optimization algorithms, such as Local Search, Particle Swarm Optimization, Differential Evolution, Genetic Algorithms, and Tree Genetic Programming (TGP). This project aims to improve GPOL by adding Linear Genetic Programming (LGP). This addition will make GPOL

more useful and easier to use for a variety of optimization problems. We will integrate LGP, compare its performance with other algorithms, and test it in different scenarios. The expected result is a more versatile and powerful GPOL, benefiting researchers and practitioners by simplifying the use of multiple optimization algorithms.

TOWARDS A MORE ROBUST DISCRETE FOURIER TRANSFORM FOR SPARSE SIGNALS

Presenter(s): Jean Paul Sadia (Rutgers University)
Computer Science and Engineering
Mentor(s): Mark Iwen (College of Natural Science), Rafael Chiclana Vega (College of Natural Science)

The Discrete Fourier Transform (DFT) provides the Fourier coefficients of a given function from a sample of observed data. It is one of the most important and widely used algorithms in computer science, with applications ranging from signal processing to audio and image compression. In this work, we consider the scenario where a known sparse signal is sampled, but the sample may contain up to t fake values. Our primary goal is to recover the Fourier coefficients of the given signal. Specifically, in cases where the Fourier coefficients are sparse-meaning most of them are zero-we aim to develop algorithms that are faster than the classical Fast Fourier Transform (FFT).

PERSONALIZED MRI EXAM SCHEDULING FOR LOW-GRADE GLIOMA PATIENTS

Presenter(s): Isabelle Wagenvoord (Colorado College)
Computer Science and Engineering
Mentor(s): Adam Alessio (College of Engineering)

Isocitrate dehydrogenase (IDH)-mutant gliomas, a type of brain tumor, are incurable and have an average life expectancy of a few years. In current practice, patients are monitored with MRI exams every 3 months, which is suboptimal for patients who would benefit from more frequent surveillance or for patients whose brain tumor progression is delayed. This work seeks to develop methods to support personalized prescription of a IDH-mutant glioma MRI monitoring schedule to identify early progression and/or save expense of unnecessary MRI exams. Deep learning methods based on 3D U-Net architectures can be used to segment and identify in MRI images areas of brain tumor growth and predict progression to personalize MRI exam scheduling for each patient. However, automated segmentation of post-treatment gliomas is an understudied problem, with only 2.7% of studies on glioma segmentation having used post-treatment data. By fine-tuning state of the art pre-operative brain tumor segmentation models and employing successful techniques in medical image segmentation, we anticipate developing a computer vision algorithm for providing accurate segmentations of post-surgery low grade glioma growth in MRI images. This deep learning effort will rely on publicly available MRI images of glioma patients from the Brain Tumor Segmentation (BraTS) 2024 challenge, along with a custom dataset of 56 MRI exams from Henry Ford Health. Predictions from the final model will be evaluated with vi

DETECTION OF MILD COGNITIVE IMPAIRMENT USING LANGUAGE AND FACIAL EXPRESSION

Presenter(s): Bao Hoang (Michigan State University)
Computer Science and Engineering
Mentor(s): Jiayu Zhou (College of Engineering)

Mild Cognitive Impairment (MCI) is the prodromal stage of dementia, including Alzheimer's Disease (AD). Early identification and accurate assessment of MCI are critical for clinical trial enrichment as well as the early intervention of AD. Digital makers offered a unique opportunity for ecologically valid and affordable early detection approaches. Language markers extracted from verbal communications have shown diagnostic efficacy in detecting early MCI. Recent studies have shown that in addition to semantic and syntactic information in dialogues, emotions in communication can also be helpful in early MCI detection. A joint analysis of language markers and emotion indicative of facial expression is thus of great interest. Features from emotion could have additional predictive benefits to language markers. One general challenge of digital biomarkers is that feature distributions are very distinct. We hereby conduct a multi-modal analysis of language and facial expression, combined with different harmonization.

DEPLOYING A DEEP LEARNING TOOL FOR PEDIATRIC RIB FRACTURE DETECTION

Presenter(s): Ishita Kokil (Michigan State University)
Computer Science and Engineering
Mentor(s): Adam Alessio (College of Engineering)

Detecting rib fractures, which are predictive of non-accidental trauma in children, is critical and challenging for expert radiologists. Previous studies have demonstrated that up to 2/3 of fractures can be missed by experts on initial interpretation. This project aims to deploy a web-based tool using a machine learning model to improve fracture detection in pediatric chest radiographs. The tool uses a previously developed model based on RetinaNet and YOLOv5 architectures, enhanced by an "avalanche decision" scheme to increase sensitivity. The web-tool, built in Python using Flask and PyTorch, allows users to upload DICOM files and receive PNG images with bounding boxes around detected fractures. Performance is evaluated against a custom dataset of 1109 pediatric chest radiographs labeled by seven radiologists. The majority of this project will focus on creating the web-tool and deploying it on a cloud-based server for public use. We anticipate that our web tool will serve as a co-pilot to expert radiologists to either reduce the overall interpretation time and/or increase diagnostic performance. The output images will clearly highlight fracture sites, aiding rapid identification by medical professionals. The web tool will improve the efficiency and accuracy of rib fracture detection in pediatric radiographs, providing a valuable resource for healthcare providers.

DAM3D: A MULTI-MODEL APPROACH TO GENERALIZATION IN 3D OBJECT DETECTION

Presenter(s): Hoang Le (Michigan State University)
Computer Science and Engineering
Mentor(s): Abhinav Kumar (College of Engineering), Xiaoming Liu (College of Engineering)

Monocular 3D detection remains a crucial task in 3D scene understanding, and involves predicting 3D bounding boxes using a single, 2D RGB image. Recent advancements in AI models and high-quality datasets have significantly boosted performance in this area. The current state-of-the-art (SOTA) model, Cube R-CNN, achieves impressive results with 3D average precision (AP3D) scores of 33 and 51 on the KITTI and Objectron datasets respectively. However, Cube R-CNN suffers from limited generalization. This translates to poor performance on new datasets not encountered during training. Our paper proposes a multi-modal approach to address this issue. Constructing a 3D bounding box requires determining the 3D center (x, y, z), 3D dimensions, pose and class of the object. Our method leverages SOTA models for various tasks: 2D segmentation, depth estimation, and object pose estimation. We hypothesize that using SOTA models for each individual task will enhance generalization. This is because these models have been trained on diverse data compared to Cube R-CNN. Our oracle experiment supports this hypothesis, demonstrating that the SOTA depth estimator generalizes better than Cube R-CNN's on unseen datasets. Our approach holds promise for improving AP3D scores on new datasets, making in-the wild monocular 3D object detection truly feasible.

BENCHMARKING PARALLEL CODE USING R

Presenter(s): Naamna Modi (Michigan State University)
Computer Science and Engineering
Mentor(s): Craig Gross (Research and Innovation)

R is a programming language that can run a wide array of tasks involving data and statistics. The application of R can be enhanced using the supercomputer provided by the Institute for Cyber-Enabled Research (ICER), here at MSU. Certain packages within R also bring useful tools to assist in tasks or use alternate methods to solve problems. Not only is R a good candidate for fast computing due to its multitude of vectorized operations, but a package called "Future" in R can help speed up the execution of resource-intensive code. Future allows code to be 'parallelized' by splitting up tasks between 'workers' and conducting these computations at the same time. This decreases the cumulative time elapsed and makes any particular script more efficient. Where a regular computer may be capable of running around 4-8 tasks simultaneously, the supercomputer is made up of a series of large computers which can each run up to 128 tasks at once. This means we can run code in many more places at the same time, which heavily speeds up the process when compared to similar procedures on an average computer. In this project we benchmark parallel code using different datasets such as "gapminder" and evaluate different methods within the "Future" package.

ANOMALY DETECTION THROUGH COMPUTER VISION

Presenter(s): Andrew Root (University of Wisconsin Eau Claire), Souleymane Sono (Oakalnd University)
Computer Science and Engineering
Mentor(s): Darrin Hanna (Oakland University)

Performing anomaly detection in real-time, in a dynamic environment is far from trivial. By exploring this problem through multiple methodologies, traditional computer vision and deep learning, we aim to better understand the challenges of anomaly detection, and potentially contribute to the detection of anomalies in a real-world setting using embedded devices. We put a special emphasis on deep learning despite its tendency for computational complexity and the necessity for large amounts of training data. The scope of our problem is considerably complex and modern embedded devices are becoming more suitable for such an approach. Notably, we explore techniques such as homography and temporal feature aggregation in our efforts to utilize reference frames. The availability of reference frames is due to the fact that we intend to perform detection in a confined area (e.g. an airport).

CAMERA SYSTEMS IN COMMERCIAL SWINE FARMS FOR INDIVIDUAL TRACKING AND MONITORING APPLICATIONS

Presenter(s): Benjamin Smith (Michigan State University)
Computer Science and Engineering
Mentor(s): Daniel Morris (College of Natural Science)

Being able to track multiple pigs while keeping track of their identity can improve animal welfare and improve the efficiency of commercial swine farms. One of the most explored methods for tracking swine is the use of camera systems and computer vision as it is non-invasive and easy to maintain. Other methods such as drawing physical marks on the swine. The challenge of using computer vision comes from setting up a reliable camera system that can successfully monitor the whole pen while also providing useful information about the swine. Another aspect that makes camera systems difficult is finding a method to store data in an efficient way so it can be easily analyzed. To tackle these challenges a 2D RGB camera and a 3D depth camera were installed to monitor the swine. This system combined with a selective data collection system successfully saved live, relevant data in a ROS2 bag file. With this data simple tests were conducted to see if simple object detectors such as YOLOv10 would function with the selected save format. With the implemented system farms would be able to easily monitor swine and help improve the swine's quality of life as well as the food output of the farm.

REVOLUTIONIZING RESEARCH WITH AI

Presenter(s): Lawpan Toe (Michigan State University)
Computer Science and Engineering
Mentor(s): Dirk Colbry (College of Natural Science)

This project aims to streamline the research process by tackling common pain points in literature searches. The project introduces a chatbot that delivers the top 5 research papers based on user queries, helping researchers overcome challenges such as time consumption, finding relevant papers, and managing large amounts of data. The chatbot's functionality includes data preprocessing, user query input, text data preparation, TF-IDF vectorization, cosine similarity calculation, and result sorting. Recommendations for optimizing the chatbot focus on enhancing the user interface, improving NLP capabilities, integrating advanced analytics, and prioritizing data privacy.

Electrical & Computer Engineering

DRAG RACE: AUTONOMOUS VEHICLE STRATEGY FOR MULTI-OBJECTIVE GAMES

Presenter(s): Ben Toaz (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Shaunak Bopardikar (College of Engineering)

Autonomous vehicles (AVs) are being deployed in increasingly unpredictable scenarios where they must take efficient and decisive action to best achieve their goals. Decision making must often balance between multiple conflicting objectives, such as travel time and safety. For instance, AVs must move in concert with other vehicles on the road, where each agent must balance the desire for the shortest trajectories through space and the risk of collision with other vehicles. This applies to both regular civilian traffic scenarios and competition. This work attempts to answer the following question: In a drag race scenario, what strategies strike the most effective balance between safety and racing position goals? Finding a solution that leads to the best outcome for every vehicle on the road can be facilitated by modeling vehicle interactions as a discrete time dynamic game with vector payoffs. Optimal sequences of actions within the drag race were calculated using the game theoretic concepts of mixed Nash equilibrium and Pareto frontiers in a modified cost-to-go algorithm. This framework was validated in simulation with the intent to deploy in physical races. The formulation of the drag race game yielded vehicle behavior that closely resembled human racers and was customizable for different priority levels of each objective.

THE SECRET TO SAFE AND RELIABLE PERMANENT MAGNET MOTORS FOR ELECTRIFIED TRANSPORTATION SYSTEMS

Presenter(s): Alana Bell (Dillard University)
Electrical and Computer Engineering
Mentor(s): Shanelle Foster (College of Engineering)

Electric transportation systems rely heavily on permanent magnet synchronous motors (PMSMs) for efficient and reliable operation. However, even fault-tolerant PMSM designs can fail; therefore, it is critical to monitor the health of PMSMs. A common failure, interturn short-circuits, can lead to high circulating current which increases operating temperature and allows quick fault propagation. This project aims to detect and mitigate interturn short-circuit faults in PMSMs without the use of additional sensors. In this work, variations in measured signals under faulty conditions are evaluated to identify trends. Finite element analysis is used to model the PMSM and mimic fault scenarios. Signal processing techniques help to visualize trends that indicate the presence and severity of interturn short-circuit faults. The identified fault trends will be used to develop a detection algorithm facilitating early detection before faults fully develop. The resulting fault detection algorithm will provide increased safety by minimizing negative impacts of faults in safety critical applications. The findings of this research will direct the development of more resilient and dependable motor drives.

ANALYSIS AND PERFORMANCE OF MODULAR STATOR PERMANENT MAGNET MOTORS USING ORIENTED STEEL

Presenter(s): Adam Jaraki (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Shanelle Foster (College of Engineering)

Oriented steel offers superior magnetic properties in its rolling direction compared to non-oriented steel. Therefore, using oriented steel in a segmented permanent magnet synchronous machine (PMSMs) can reduce losses and improve efficiency. The improved efficiency and performance of segmented PMSMs with oriented steel stators can directly benefit the electric vehicle industry in a cost-efficient way by reducing raw material waste. However, segmentation can lead to an undesirable increase in core loss due to the increased number of cut edges. Consequently, strategic use of oriented steel is required to ensure improved machine performance. This project utilizes experimental measurements to investigate the combined impact of adopting segmentation and oriented steel by comparing the loss performance of non-modular non-oriented steel stators to that of modular oriented-steel stators. The experimental setup includes a dual-sensor setup for controlled flux injection in the stator. The measurements are recorded using calibrated current and voltage sensors. Experimental measurements confirm that the strategic use of oriented steel in the construction of PMSM stators can lead to significant improvement in motor efficiency.

ADVANCING DATA SCIENCE RESEARCH WITH GENERATIVE AI

Presenter(s): Abdi Kusata (Lafayette College)
Electrical and Computer Engineering
Mentor(s): Dirk Colbry (College of Natural Science)

This study introduces two innovative methods using Generative AI to advance data science research. The first method employs Generative Adversarial Networks (GANs) to automate the process of semantic segmentation, which involves identifying and labeling parts of an image. Our approach, based on the UVCGAN-v2 model, combines Vision Transformers (ViT) and U-Net architecture to capture detailed and broad features in images effectively. To enhance performance, this project pre-trains the model's generator using a self-supervised technique that teaches the model to fill in missing parts of images. The model is then tested on the Carvana dataset of car images, with results compared to those from the well-known U-Net model. The Intersection over Union (IoU) and Dice Coefficient measures are used to evaluate accuracy. Although initial results do not surpass U-Net (88% vs 99%), the model shows significant promise, especially in simplifying the manual labeling of images. This study sets a strong base for future improvements by demonstrating the effectiveness of combining new deep-learning methods and the importance of adjusting model settings. The second method explores the use of advanced open-source Large Language Models (LLMs) for rubric-based grading. Focusing on the Meta LLaMA-3 model, we plan to fine-tune it with student papers from introductory Physiology classes at Michigan State University. Our goal is to leverage modern LLMs to enhance evaluating efficiency and quality. T

OPTIMIZING ENERGY EFFICIENCY IN A PORTABLE ENVIRONMENTAL MONITORING DEVICE: THE LUNCHBOX PROJECT

Presenter(s): Kartik Pillai (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Andrew Mason (College of Engineering), Samuel Lobert (College of Engineering)

In today's world, air pollution poses a significant threat to public health and the environment, leading to respiratory issues and other serious health problems, sometimes even fatal. Despite the need for real-time, localized environmental monitoring, existing solutions often lack portability and efficiency, leaving communities vulnerable. Recognizing this, research has been focused on the "Lunchbox" - a unique, compact, portable solution engineered to offer real-time insights into air quality through precise analysis of air samples. The Lunchbox is a battery-powered smart device powered by an ARM-Series CPU, featuring an integrated air pump, liquid pump, and bespoke fluidic system for seamless sample collection, alongside a custom graphical user interface (GUI) for intuitive control. The primary objective is to attain optimal power efficiency, allowing the Lunchbox to function for up to two weeks on a single charge. Various empirical methods were employed to attain this efficiency, including optimizing the Lunchbox's operational modes, refining the circuitry for minimal power loss, and rigorously testing different embedded power management strategies. Efforts on the Lunchbox bring the solution closer to addressing the issue of portable air monitoring. By providing real-time air quality data, the Lunchbox enables communities and individuals to make informed decisions to protect health and gauge atmospheric quality. Advancements in power efficiency set a precedent for future e

DESIGN OF A PYTHON-BASED GRAPHICAL USER INTERFACE FOR PLOTTING AND SIMULATING TCAD DATA

Presenter(s): Nathan Quadras (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Nicholas Miller (College of Engineering)

The growing demand for smaller, faster, and more efficient electronic components necessitates the need for advanced simulation tools to design and optimize semiconductor devices. Technology Computer-Aided Design (TCAD) is a critical piece of software commonly used in the semiconductor industry for simulating and analyzing the behavior of semiconductors. This Python-based user-friendly Graphical User Interface (GUI) was developed to streamline the processing and visualization of TCAD data. By utilizing a myriad of Python libraries such as PyQt, Pandas, NumPy, and Matplotlib, this GUI generates detailed insights into semiconductor behavior. The GUI offers a multitude of key functionalities, including remote server connection, directory traversal, file selection, and data processing and handling. Additionally, the GUI enables users to plot data on a graph or simulate it on a 3-D interface. For data visualization, a variety of plot types are provided to accommodate different data sets. These features aid in the interpretation of complex datasets. This tool can be particularly beneficial for researchers, engineers, and students involved in the semiconductor industry.

CODECONTEXT: INTEGRATING EXTERNAL CONTEXT FOR ENHANCED SOURCE-CODE MODEL PERFORMANCE IN SOFTWARE DEVELOPMENT

Presenter(s): Mohammad Arjamand Ali (Eastern Michigan University)
Electrical and Computer Engineering
Mentor(s): Siyuan Jiang (Eastern Michigan University)

In the ever evolving field of software development, understanding and maintaining complex codebases is crucial. Existing source-code machine learning models help in this, but they often overlook an important factor: the code's context. Our research focuses on leveraging external contextual information to enhance source-code model performance. We've developed a data pipeline that utilizes CodeQL to extract contextual information from the CodeSearchNet dataset and developed CodeContext, a transformer model that aims to integrate context with code in an effective manner. This approach promises to enhance code comprehension and maintenance, marking a significant advancement in software development tools.

EVALUATING HUMAN-ROBOT TEAM DYNAMICS IN SEARCH AND RESCUE OPERATIONS: A VIRTUAL EXPERIMENT APPROACH

Presenter(s): Dhruv Kekin Toprani (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Vaibhav Srivastava (College of Engineering)

The interaction between humans and robots is highly relevant in many application domains. A key research question across prevalent literature is how we can best utilize the combined capabilities of human-robot teams. One particular avenue where leveraging their heterogeneous skill sets could lead to paramount improvement is in operations involving complex and unpredictable environments. Within the context of search and rescue (SAR), the focus of this project is to evaluate human-robot team dynamics across a range of strategies adopted by the robot. Using various, mixed-integer linear programming (MILP)-based strategies, the robot can determine the optimal order and allocation of tasks for the entire team in which robotic assistance is either reactive or proactive. The experimental environment features teams of humans and robots, with a unique set of skills. The team's goal is to work in synergy to navigate an unknown environment, locate victims, and administer necessary aid. Utilizing experimental data collected from human participants, we aim to understand the dynamics of human-robot teams. This understanding holds potential implications for enhancing the efficiency, cohesion, and overall performance of real-world SAR teams. In the future, the interface developed through this project can also serve as a platform for evaluating and refining heterogeneous multi-agent task optimization strategies in dynamic environments.

EARLOOP: ENHANCING COMMUNICATION DYNAMICS WITH REAL-TIME FEEDBACK FOR HEALTHIER CONVERSATIONS

Presenter(s): Tanay Reddy (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Andrew Mason (College of Engineering)

Misunderstandings and weak interpersonal connections in small groups and workplace teams often stem from overlooked body language and lack of attention. Subtle cues, such as head movements, restlessness, and gaze direction, play crucial roles in the outcome of interpersonal conversations. When these cues are missing or misunderstood, it can lead to negative discourse and reduced productivity. In professional settings, this can hinder collaboration, create conflicts, and negatively impact team performance. To address these challenges, our research has developed "Earloop," an intelligent, wearable device designed to enhance conversations by providing instant feedback on behavioral metrics. Consider: Earloop combines various sensors with an easily navigable user interface enabling each participant to monitor and analyze their own body language. The system collects raw data from these sensors and processes it using tailored algorithms to human readable behavioral metrics. Using data from orientation sensors, Earloop's onboard algorithms analyze the user's head movement and rotation to determine the attentiveness and focus of participants. The user interface displays this real-time information, allowing users to understand their communication patterns and make necessary adjustments. This feature prompts you to engage accordingly by highlighting moments of disengagement, allowing the user to re-engage into the discussion. Through rigorous testing and iterative design, Earloop has s

IDENTIFYING HUB NODES IN BRAIN NETWORKS USING GRAPH SIGNAL PROCESSING MODULE

Presenter(s): Duc Vu (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Selin Aviyente (College of Engineering)

The recent developments in the field of human functional connectomic research provides us the opportunity to enravel the topological characteristics of brain networks using graph-theoretic approaches. Contemporary research models the brain connectome as a graph where the nodes correspond to brain regions and edges to connectivity. Hub nodes are a key property of brain networks and refer to densely connected regions in large-scale human brain networks and play a crucial role in global brain communication. However, conventional methods to detect hub nodes, such as centrality methods, have been proven to favor nodes in localized networks rather than important nodes in the entire graph. In addition, hub nodes can be classified into two types: provincial hubs, which are important hubs in their own community, and connector hubs, which are important hubs for the entire brain networks. In this work, we developed a a graph signal processing based approach to identify connector hub nodes. The framework consists of learning a graph filter and scoring hub nodes for identification, combined with classifying hub nodes using participation index. We've applied our framework to 56 patients from the Human Connectome Project. The detected hubs show strong correlation with prior work. The results are

consistent across patients, and the hub nodes are crucial for maintaining small-world behavior of the brain.

MAGNETICALLY COUPLED RESONANT WIRELESS POWER TRANSFER FOR TIRE PRESSURE SENSOR BATTERIES

Presenter(s): Elise Wright (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Premjeet Chahal (College of Engineering)

An innovative embedded wireless power transfer (WPT) system for tire pressure sensing system (TPMS) batteries is presented. The design consists of two magnetically coupled resonant (MCR) coils. The transmitter coil receives power from an external AC voltage supply and induces a voltage in the receiving coil. The novelty of this design is its placement in the valve stem attached to the TPMS sensor. This design allows rechargeability and increased energy density of TPMS batteries which extends the lifetime of TPMS sensors. In turn, the sensor capabilities can be increased in the future without concern for more frequent battery replacement and maintenance.

MINIATURE UNCREWED SURFACE VEHICLE FOR ACOUSTIC TELEMETRY APPLICATION

Presenter(s): Vu Phi (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Xiaobo Tan (College of Engineering)

Acoustic telemetry is a commonly used method of studying fish populations. Fish are tagged with a transmitter that transmits a unique ID code, and receivers decode the signal and log the time of detection. Predominantly receivers are anchored at fixed points in waterways and must be retrieved later to view the telemetry data. Thus, mobile telemetry platforms, using robotic gliders and Uncrewed Surface Vehicles (USVs), where the receiver is attached to a robotic platform, have been explored. This project focuses on the construction of a miniaturize USV that can be used for indoor tank study of the control strategies, as a basis for field deployment of USVs in the acoustic telemetry application.

OPTIMIZING ROBOTIC GRIPPERS FOR DIFFERENT OBJECT SIZES.

Presenter(s): Rajaun Ricketts (Benedict College)
Electrical and Computer Engineering
Mentor(s): Shaunak Bopardikar (College of Engineering)

The optimization of robotic grippers to handle objects of varying sizes and materials is crucial in advancing automation and robotics. This study aimed to address the challenge of efficiently operating robotic grippers across different target object dimensions and shapes, which is relevant to fields like manufacturing, logistics, and healthcare. A DJI Robomaster EP Core outfitted with camera grippers and a robotic arm was used as a test platform. To determine the optimal parameters for this robot, multiple gripping configurations were tested through manual and automatic grip tests on plastic, metal, and wood objects of varying sizes and shapes (cylindrical, cuboid, and irregular). The gripper parameters (list them here) were hand-tuned iteratively throughout the tests process until reaching a desired performance. Key variables such as gripping limits, ease of handling and speed of operation, were analyzed to determine the optimal set. The goal of this study was to improve the adaptability and efficiency of robotic grippers, promoting improved performance in real-world applications. The expected outcomes include establishing optimal gripping settings for a range of object classes and demonstrating the platform's adaptability. The parameter data set developed in this study could be used alongside additional sensors/computer vision to develop an adaptive grasping algorithm that can respond to its environment. The findings have far-reaching ramifications, including potential bene

INTEGRATING OPENREFINE ON ICER'S ONDEMAND

Presenter(s): Rohan Banerjee (Michigan State University)
Electrical and Computer Engineering
Mentor(s): Nicholas Panchy (Research and Innovation)

Before carrying out any analysis, it is crucial to perform data visualization and pre-processing to understand and format a dataset. Many tools exist to handle this raw data transformation, but technical and platform limitations can make them inaccessible to some users. To address these issues and provide an accessible option that integrates the extensive resources of the High-Performance Computing Cluster (HPCC), we plan to deploy OpenRefine, as a robust data cleaning tool, on ICER's OnDemand platform. Leveraging the robust computational resources of ICER's OnDemand through an accessible GUI interface, users can use OpenRefine to efficiently perform complex data transformations without moving their data between HPCC. This integration enables seamless data preparation within a high-performance computing environment, fosters collaborative efforts, and significantly enhances data processing speed and capacity. Preliminary results indicate notable improvements in both performance and user experience, positioning this integrated solution as an ideal tool for researchers and data scientists in the future.

Environmental Science & Natural Resources

THE PRESENCE OF ENDOCRINE DISRUPTING COMPOUNDS UPSTREAM AND DOWNSTREAM OF AN URBAN WASTEWATER TREATMENT PLANT

Presenter(s): Kyla Charlebois (University of Detroit Mercy)
Environmental Science and Natural Resources
Mentor(s): Eva Nyutu (University of Detroit Mercy)

The quality of urban surface waters such as the Detroit River has become an emerging concern due to the increased detection of Endocrine Disrupting Chemicals. Although concentrations of these chemicals are typically reported at low levels ranging from ug/L (parts per billion) to ng/L (parts per trillion), concerns have been raised about the potential impact on humans and aquatic organisms from long-term exposure to these chemicals if they remain unregulated. Most of these chemicals are released from the effluent of municipal wastewater treatment plants, which are not optimized to remove these organic compounds resulting in their discharge to the surface water. Water samples were collected in the summer from the upstream/influent and the downstream/effluent near the Detroit wastewater treatment plant to examine 16 Endocrine Disrupting Chemicals. Surface water was analysed for pharmaceuticals, personal care products and pesticides. Of the 17 target substances analysed 7 were not detected in any of the samples, while 10 were detected this included sucralose, iohexol, caffeine, acesulfame K, acetaminophen, sulfamethoxazole, Bisphenol A, carbamazepine, atenolol and gemfibrozil at concentrations ranging from 4.5 to 4000 ng/L. Measuring Endocrine Disrupting Chemical levels near the Detroit wastewater treatment plant effluent will help identify at-risk watersheds and serve as a benchmark for future contaminant reduction strategies and remediation efforts.

CHEMICAL ANALYSIS OF LEACHATE FROM E-CIGARETTES IN AQUATIC ENVIRONMENTS

Presenter(s): James Brook (Michigan State University)
Environmental Science and Natural Resources
Mentor(s): Masako Morishita (College of Human Medicine), Zachary Klaver (College of Human Medicine)

The rapid rise in e-cigarette usage over the past two decades has been accompanied by an increase in electronic litter, with very few studies on the consequences of this complex and novel type of waste once it enters the environment. An estimated 12 million disposable e-cigarettes are sold in the US each month, more than doubling since 2020, and a large portion of these are improperly disposed of, with 10% of users admitting to littering. Frequent consumption and reckless disposal trends call for e-cigarette chemical leachate behavior analysis to be performed as soon as possible to gain a better understanding of environmental risks and possible mitigation strategies. The concern about e-cigarette waste in the environment is twofold: regarding the lithium-ion batteries contained in each device and the e-liquid that gets aerosolized, known as vape juice. We performed an experiment to identify and characterize the toxic metals of highest concern that leach out of intact and deconstructed disposable e-cigarettes over five days, one and a half months, and three months. The metals we will be testing for are aluminum, barium, chromium, cobalt, copper, lead, lithium, nickel, thallium, iron, and zinc. Our presentation explains the methods and findings from the experiment, discusses the risks associated with the contaminants, and proposes mitigation strategies and further research opportunities.

EVALUATING SAMPLING METHODOLOGIES FOR MACROINVERTEBRATE MONITORING: A CASE STUDY WITHIN THE FRAMEWORK OF INVASIVE RED SWAMP CRAYFISH IMPACTS

Presenter(s): Charlotte Caldon (Michigan State University)
Environmental Science and Natural Resources
Mentor(s): Brian Roth (College of Natural Science), M. Benbow (College of Natural Science)

As part of an ongoing project focused on evaluating the spread, effects, and control of invasive Red Swamp Crayfish (Procambarus clarkii) in Michigan aquatic ecosystems, we have conducted a long-term study assessing invasion impacts on aquatic macroinvertebrate community assemblages. The primary goal of this project was to explore differences in the Ponar grab and D-frame sampling methodologies for use in biomonitoring of macroinvertebrate community structure in wetland and pond habitats. We will evaluate if there are observable differences in macroinvertebrate monitoring efficacy across the two different sampling methodologies - Ponar grab and D-frame dipnet - used to understand associations of P. clarkii and macroinvertebrate communities. Ponar grab sampling utilizes a metal grab to sample a standardized area of sediment underwater, while D-frame dipnet sampling utilizes manual sweeping of a semi-standardized underwater area and microhabitat. One potential advantage of Ponar grab sampling is the greater degree of standardization of the area sampled allowing for highly quantifiable data (i.e., benthic macroinvertebrate densities), while its potential disadvantages are the high technology and labor costs associated with its consistent use. For this reason, investigating whether there are observable differences in sampling efficacy across D- frame dipnet and Ponar grab methodologies is important, as results can be used to inform future research and decisions about which approa

THE EFFICACY OF INVASIVE MAMMAL TRAPPING IN PUKERUA BAY, NEW ZEALAND

Presenter(s): Kendall Kindzierski (Michigan State University)
Environmental Science and Natural Resources
Mentor(s): Jeanette McGuire (College of Natural Science)

New Zealand flora and fauna have evolved in the absence of terrestrial mammal for centuries. However, with human colonization came an influx of mammals, negatively impacting native and endemic species, including the extinction of over 50 bird species. To protect the unique ecosystem, the government has initiated a "Predator Free 2050" program to provide guidance and resources to decrease populations of pest mammals. Despite showing promising results, these control efforts can experience diminishing returns over time. Our study served to evaluate the efficacy of trapping regimes in two locations in Pukerua Bay, New Zealand, where coordinated community trapping efforts include both residential and protected areas. Our goal was to provide critical data to understand the current state of mammalian communities in active trap areas. Adaptive management and trapping strategies are essential on a global scale for the protection of native species, and this experiment has proven that certain practices may need to evolve to prevent invasive-species-caused destabilization.

GRANTING LEGAL PERSONHOOD TO NEW ZEALAND GLACIERS: HOW INDIGENOUS PERSPECTIVES CAN COMBAT CLIMATE CHANGE

Presenter(s): Jack Garrison (Michigan State University)
Environmental Science and Natural Resources
Mentor(s): Jeanette McGuire (College of Natural Science)

Climate change is widely accepted as the largest environmental challenge facing humanity; impacting food security, biodiversity, health, the economy and nearly every facet of our lives. To the indigenous Maori people of Aotearoa New Zealand, climate change will spell the loss of important physical features that play a huge role in the culture and lifestyle. Glaciers represent not only a critical source of freshwater storage, but are also represented in many stories that speak of bravery, love, and grief, and tie directly to an individual's whakapapa (genealogy). The glaciers of New Zealand have experienced dramatic net losses over 35% in the last 50 years, largely attributed to anthropogenic climate change. The unique tie to their environment presents an opportunity for a legal framework to bolster protection of these critical resources. Using publicly available data from the National Institute for Water and Atmosphere (NIWA), we first document climate change and glacial retreat of New Zealand Glaciers. We then construct a legal framework based on the relationship between the Maori people and these natural resources to argue for legal recognition. A precedent for legal personhood of ecological features was established for the Whanganui River in 2017 and represents a now growing global movement. This project aims to 1) provide evidence for why the Franz Joseph Glacier should be granted personhood under the law, and 2) to establish how this framework can

ASSESSING URBAN LAKE ACCESSIBILITY AND QUALITY ACROSS THE CONTERMINOUS UNITED STATES

Presenter(s): Abigail Lippert (Michigan State University), Zoe Naylor (Michigan State University)
Environmental Science and Natural Resources
Mentor(s): Kendra Cheruvelil (Lyman Briggs College), Patricia Soranno (Research and Innovation), Patrick Hanly (College of Natural Science), Xinyu Sun (College of Natural Science)

Urban lakes provide numerous ecosystem services to urban areas such as drinking water, recreation, natural habitat, climate control, and aesthetic enjoyment. Lakes have been shown to reduce stress and provide physical health benefits such as decreased risk of cardiovascular issues, obesity, and cancer. Previous studies on environmental justice (EJ) have shown that there is unequal access, quality, and monitoring of lakes in communities of color. However, limited EJ research has been conducted in the area of urban lakes, and urban lake research as a whole is limited on a larger scale. Using an urban lakes dataset that we developed from the LAGOS-US research platform, National Land Cover Database, and US Census Bureau population data, we are able to study urban lakes across the conterminous US. We combined this dataset with 2010 US Census Bureau demographic data to determine the demographic and racial background of the communities surrounding 32,405 urban lakes across the conterminous US. We then assessed the accessibility of the lakes using lake perimeter and public boat launch access and the quality of the lakes using Secchi depth and total phosphorus levels. We also examined spatial patterns of the data across NEON zones. We found that urban lakes across the United States are less accessible and have decreased quality in communities with greater POC populations, and are less accessible for recreational use in communities with greater Hispanic populations. This research i

URBAN LAKES ACROSS THE CONTERMINOUS UNITED STATES: EXAMINING CLASSIFICATIONS AND LAKE FEATURES USING THE LAGOS DATABASE

Presenter(s): Abigail Lippert (Michigan State University), Zoe Naylor (Michigan State University)
Environmental Science and Natural Resources
Mentor(s): Kendra Cheruvelil (Lyman Briggs College), Patricia Soranno (Research and Innovation), Patrick Hanly (College of Natural Science), Xinyu Sun (College of Natural Science)

Urban lakes are an important component of urban blue-green infrastructure as they provide essential ecosystem services, such as opportunities for recreational activities and the amelioration of climatic fluctuations, and are valued in a socio-cultural context. However, urban lakes are generally understudied, and often only examined in isolation for local management purposes. With the LAGOS database, which contains data on 479,950 lakes and their watersheds across the conterminous U.S., and supplemental geographic information system (GIS) data from the U.S. Census Bureau in conjunction with the National Neighborhood Data Archive's (NaNDA) land cover dataset, we synthesized classification methods for urban lakes at several spatial scales, categorizing them via surrounding land cover types (e.g., low, medium, and high density development) for analysis of human influence, physical characteristics, and water quality. Using land cover and metropolitan area data, we initially classified lakes into urban and non-urban lakes, followed by further refining urban lakes into additional categories based on each lake's primary urban land cover type. Ultimately, we will combine this urban lake classification system with environmental justice data from the Environmental Protection Agency (EPA) to bolster our understanding of the relationship between the two and where gaps in access and management may exist.

WHOLE TREE HARVESTING

Presenter(s): Kandy Pierre (Medgar Evers Collage)
Environmental Science and Natural Resources
Mentor(s): David Rothstein (College of Natural Science)

The growing interest in forest biomass extraction for energy to combat climate change has led to increased consideration of whole-tree harvesting, which involves removing nutrient-rich treetops and twigs alongside trunks. This contrasts with traditional stem-only harvesting methods but raises concerns about sustainability due to greater nutrient removal from the soil. This study investigates the impacts of such practices by analyzing soil samples collected from two distinct forest sites: one aged 60 years and untouched by harvesting, and another aged 30 years with two or three previous harvest cycles. Each site provided two soil samples: one transported to the lab immediately and another left on-site in a clear bag for two months to simulate natural conditions. Upon retrieval, both preserved and freshly collected samples underwent rigorous laboratory analysis, including soil sieving, precise weighing, and nutrient extraction assays. These methods aimed to assess changes in soil nutrient dynamics and availability over time.Michigan, post-whole-tree harvest scenarios, especially involving pine trees, typically result in initially reduced soil nutrient levels due to minimal debris left on the forest floor. However, this approach promotes the regeneration of healthy pine forests and fosters a diverse ecosystem, crucial for sustainable forest management. The harvested biomass serves multiple purposes such as timber production, pulpwood, and energy generation,

USING SPOTTED GAR AS THE OUTGROUP TO UNDERSTAND NERVOUS SYSTEM EVOLUTION AFTER WHOLE GENOME DUPLICATION IN TELEOST FISHES

Presenter(s): Grace Urban (Michigan State University)
Environmental Science and Natural Resources
Mentor(s): Ingo Braasch (College of Natural Science)

A whole-genome duplication (WGD) event leads to a full duplication or polyploidization of an organism's genome. Throughout evolution, the bony vertebrate lineage has undergone two WGDs. Additionally, lineage-specific WGDs are also observed such as in the ancestor of the teleost fishes (Teleost Genome Duplication, TGD), the most species-rich group of vertebrates. WGD-derived extra copies of genetic elements have been proposed to provide the raw material that can seed evolutionary and developmental innovations, adaptation, and speciation, for example in the vertebrate nervous and sensory systems. Genome-wide, around 80% of the extra gene copies from the TGD have been lost (non-functionalization) in teleosts during their rediploidization process. However, for those genes that have been retained as duplicates, regulatory changes or coding mutations may generate complementary expression patterns and/or protein functions among duplicates (sub-functionalization); and/or gene duplicates may acquire new expression patterns and/or protein functions (neo-functionalization). Yet, the extent of sub- and neofunctionalization following the TGD remains poorly understood. Therefore, my research training aims to use the closest living outgroup of the teleosts, the non-teleost fish spotted gar (Lepisosteus oculatus) as an outgroup for comparative analysis of gene expression to the teleost model organism zebrafish (Danio rerio). By characterizing brain morphology through developing gar brains an

Health Sciences

RETHINKING PATIENT EDUCATION IN PAEDIATRIC EMERGENCY MEDICINE

Presenter(s): Destiny Kanning (Michigan State University)
Health Sciences
Mentor(s): Hannah Bentley (MSU Hci Clinical Services)

Districts 1 and 5 of Michigan face high levels of overutilisation of emergency services, much like the rest of the United States. The overutilization of emergency services for non-emergency paediatric concerns is a significant challenge. This research addresses this issue by conducting a thorough investigation using both data analysis and survey data. By examining patterns of emergency service utilization and gathering insights from patient experiences, the study pinpoints areas of misinformation or lack of information among parents and caregivers regarding paediatric health needs. Through rigorous data analysis, the research has identified underlying factors contributing to the prevalent overutilization trend, including socioeconomic barriers and the effectiveness of current patient education initiatives. Additionally, the study has explored parental attitudes towards emergency services, primary care providers, and urgent care facilities in managing nonemergency paediatric health concerns. This research examines the roles of healthcare providers, policy makers, and educators in addressing identified gaps in paediatric healthcare knowledge and access. By disseminating findings to relevant stakeholders, the study advocates for targeted interventions and policy reforms aimed at optimizing resource allocation and enhancing patient-centered care for paediatric populations. By promoting informed decision-making and improving access to appropriate healthcare resources that meet

THE EFFECTS OF BLUE LIGHT ON THE EYES AND IF BLUE LIGHT FILTERING LENSES CAN RELIEVE DIGITAL EYE STRAIN SYMPTOMS WITHIN UNIVERSITY STUDENTS

Presenter(s): Paige Westergaard (Siena Heights University)
Health Sciences
Mentor(s): Jeffery Lake (Siena Heights University)

The constant use of digital devices like phones and laptops have caused excessive exposure to blue light. The blue light emitted by devices negatively affects the health of the eyes and can cause symptoms such as eye strain, fatigue, and overall discomfort. With the growing awareness of the effects of blue light, new technology has been created, such as blue light filtering glasses. With this new technology being created, more studies are being done on the effectiveness of blue light glasses and if they can relive eye strain symptoms and help with sleep. While there are currently multiple studies on the effectiveness of blue light glasses, very little to none of the studies are done on university students. This is important since university students are using computers, laptops, and phones several hours every day. The goal of this research proposal is to determine if blue light glasses can relieve digital eye strain symptoms among university students. The methodology of this study is a quantitative study, since participants will fill out a survey about their eye symptoms before and after using blue light glasses, and statistical analysis will be applied to the data. Each participant will wear either blue light filtering lenses or placebo clear lenses for a week, while using digital devices. Based on the literature, the general outcome of this study is that blue light glasses will relieve digital eye strain symptoms, however at a very minimal difference.

DOES DELETION OF AUTOIMMUNE REGULATOR INFLUENCE MALE MOUSE MATING BEHAVIOR?

Presenter(s): Katrina Halgren (Michigan State University)
Health Sciences
Mentor(s): Margaret Petroff (College of Veterinary Medicine), Soo Hyun Ahn (College of Veterinary Medicine)

Autoimmune regulator (Aire) is a transcription factor required for generating immune self-tolerance during T cell development in the thymus. Deletion of Aire causes autoimmune disease and can result in infertility. The vomeronasal organ (VNO) is necessary for pheromone sensing in rodents, which drives mouse mating behavior. We showed that the VNO and its surrounding glands are targeted by autoreactive immune cells in Aire-deficient (Aire-/-) mice. Further, Aire-/- males are sub-fertile compared to wild-types. Based on these results, we hypothesized that subfertility arises due to their inability to sense female pheromones, resulting in a lack of copulatory behavior. To determine if there were differences in the copulatory behavior between wildtype (Aire+/+) and Aire-/- males, we first analyzed the mating behavior of Aire+/+and Aire-/- males using Behavioral Observation Research Interactive Software (BORIS) program. The animals were video recorded for one hour, and BORIS was used to observe and code sexual behaviors and non-sexual behaviors. While the results were not significant due to a small sample size (n=3), there appear to be qualitative differences between the behavior of Aire-/- and Aire+/+ male mice. To determine if pheromone detection is altered, we performed conditioned place preference tests on Aire-/- and Aire+/+ male mice using estrus urine and male urine as odorants. Preliminary results indicate that Aire+/+ male mice show a greater preference towards estrus urin

A QUALITATIVE DESCRIPTIVE STUDY OF CISGENDER, FEMALE-BODIED EMERGING ADULTS PRECONCEPTION HEALTH DEFINITIONS

Presenter(s): Jaime Parker (Michigan State University)
Health Sciences
Mentor(s): Emma Schlegel (College of Nursing)

Women's emerging ages are a critical and sensitive period for preconception health. Before potential pregnancy, knowledge and inventions are diminutive. This study sought to understand how emerging adults define their preconception health, illuminating critical gaps in our expertise and offering a foundational step towards effective health interventions during a pivotal developmental stage. Methods: The findings presented are part of a more extensive, mixed methods study examining the relationships between emerging adults' sexual and reproductive health information source and their preconception health knowledge and health literacy. Emerging adults (18-25 years; n = 245) assigned female at birth were recruited from November 2022 via ResearchMatch and social media advertisements to complete a cross-sectional survey. A subset of survey respondents (n = 24) were randomly recruited between April and July 2023 to complete follow-up interviews on preconception health promotion preferences. Interviews were analyzed using a qualitative descriptive approach and inductive and deductive coding strategies. In this presentation, we analyze participants' definitions of preconception health. Results: Data analysis is ongoing. Conclusion: The findings of this study can be used to create effective interventions tailored to the needs and preferences of emerging adults, including sexual minorities. At crucial ages in cis-gender females' lifetimes, understanding their ideal preconception health

MICE ON THE NIGHT SHIFT: CIRCADIAN RHYTHM DISRUPTION AND ITS CONSEQUENCES ON REPRODUCTIVE HEALTH AND SOCIAL BEHAVIOR

Presenter(s): Kierra Jursch (Michigan State University)
Health Sciences
Mentor(s): Alexandra Yaw (College of Natural Science), Hanne Hoffmann (College of Natural Science)

Shiftwork is characterized by exposure to irregular light patterns and is linked to disruptions in circadian rhythms, which are biological processes that follow a 24-hour clock. In humans, circadian rhythm disruption is associated with mood disturbances and reproductive issues such as irregular menstrual cycles and pregnancy complications. In mice, irregular and nocturnal light exposure dysregulates estrous cycles, resulting in reproductive and behavioral issues. Previously, we found that when female mice were exposed to alternating light advances and delays, referred to as rotating lights (RL), 50% became acyclic, meaning they did not complete a full estrous cycle within two weeks. To explore the relationship among circadian rhythm disruption, reproductive dysfunction, and depressive-like symptoms, a group of female mice was exposed to RL, while a control group was exposed to standard lighting conditions. Vaginal lavage was performed after 6 weeks of RL to identify acyclic mice. We then conducted a sucrose preference test to assess anhedonia and a three-chamber social preference test to measure social behavior. No significant differences were observed in the sucrose preference test. The social preference test revealed a reduced preference for social interaction in the RL mice compared to controls. ($p<0.05$). No differences between cyclic and acyclic mice were observed. Mice were then impregnated and abnormal pregnancies were observed in mice exposed to RL. This experiment

ASSOCIATIONS BETWEEN MATERNAL HORMONES AND NEWBORN ANOGENITAL DISTANCE

Presenter(s): Ariana Eggleston (Michigan State University)
Health Sciences
Mentor(s): Rita Strakovsky (College of Natural Science)

Maternal hormonal fluctuations in pregnancy support pregnancy health and fetal development. One measure of fetal development at birth is anogenital distance (AGD) - a measurement between a person's genitals and anus. AGD is a sexually dimorphic biomarker that reflects prenatal hormone exposure, and irregular AGD lengths are associated with reproductive disorders. Therefore, we will evaluate associations of maternal circulating sex steroid and thyroid hormones with newborn AGD. The current study includes 399 women who enrolled into the Illinois Kids Development Study (I-KIDS) between 2013 and 2018, and who had available data on at least one hormone and one AGD measurement as well as all covariate data. Blood samples to evaluate maternal estradiol, progesterone, testosterone, free T4, total T4, and thyroid stimulating hormone were collected at median 17 weeks gestation. AGD was measured in newborns using a digital caliper within 24 hours of birth. We will perform multivariable linear regression analyses in SAS version 9.4 using PROC GLM to understand relationships between maternal hormones and AGD. In preliminary results, women in our study have a median age of 31 years and median pre-pregnancy BMI of 24.6 kg/m2. Most women are also non-Hispanic White (81.2%). Analyses to examine the exposure-outcome relationship are ongoing and will be reported in our poster as part of the conference. Understanding the underlying mechanisms of AGD development could help us to understand how va

ACL INJURY, SURGERY, AND RECOVERY: A PATIENT'S PERSPECTIVE

Presenter(s): Janelle Yao (Western Michigan University)
Health Sciences
Mentor(s): Yan Lu (Western Michigan University)

ACL injuries are tears/sprains of the anterior cruciate ligament, commonly occurring in contact sports, such as soccer, basketball, football, and lacrosse. The frequent pivoting by athletes in these sports makes the ACL more vulnerable to injury. These injuries can be career-ending and disproportionately affect young, female athletes. Surrounded by fluid, the ACL region receives minimal blood-supply, meaning that it does not heal itself after injury. Regardless of whether the injury is a sprain or tear, the most common treatment is ACL reconstruction (ACLR) surgery. The surgery process can vary depending on graft choice, age, and other surrounding injuries. Graft options include a patellar tendon autograft, a hamstring autograft, and an allograft. Although it varies from person to person, the average recovery time after an ACL surgery is nine months. Post-operative recovery often requires progressive physical therapy until the patient regains their normal level of daily (and athletic) activities. In this poster, we analyzed the gender-disparity of ACL injuries between male and female athletes and the reason behind the higher risk of ACL injuries on artificial turf as compared to natural grass. We also investigated the pros and cons of surgery vs non-surgery options and different grafts for ACL reconstruction. Finally, we discussed preventive measures to lower the risk of ACL injury, post-operative care, as well as post-operative exercises, from a patient's perspective.

PERSPECTIVES OF U.S. YOUTH ON FENTANYL ACCESS AND EXPOSURE.

Presenter(s): Trinity Amalraj (Michigan State University)
Health Sciences
Mentor(s): Tammy Chang (University of Michigan)

Introduction: Teen drug overdose deaths often involve the powerful synthetic opioid fentanyl. Despite the effect of fentanyl on youth, their perspectives are often absent, leading to ineffective policies. Purpose: We aimed to evaluate the knowledge, beliefs, and experiences of adolescents and young adults about exposure and access to fentanyl. Methods: The MyVoice nationwide text message poll was used to ask five open-ended questions to youth across the U.S. aged 14-24 years about fentanyl, specifically their current knowledge, beliefs on how youth get exposed/access, how youth can be protected, and thoughts on Narcan (Naloxone). Responses were coded using qualitative content analysis by four independent researchers, a codebook was created, and discrepancies in coding were reconciled by discussion. Results: Among 748 participants, 561 responded to at least one question (RR=75%). The average age was 20.3 (SD=2.6), 51.7% were female, 52.0% white, 11.2% black, and 24.4% reported low socioeconomic status by indicating their use of Supplemental Nutrition Assistance Program (SNAP) benefits. In preliminary analysis, 64.1% of youth in our sample reported exposure and/or access to fentanyl illicitly, 32.9% through medical means, 27.2% through unintentional exposure such as lacing and accidental exposure, 17.4% through associations such as friends, family members, and parties. Conclusion: Preliminary findings suggest that youth have varied experiences and knowledge about fentanyl,

DEEP LEARNING TECHNIQUES FOR PREDICTION OF IRON CONTENT FROM MAGNETIC PARTICLE IMAGING

Presenter(s): Tyrese Byrd (North Carolina A&T State Univeristy)
Health Sciences
Mentor(s): Ping Wang (College of Human Medicine), Saumya Nigam (College of Human Medicine)

Magnetic Particle Imaging (MPI) is a promising non-invasive imaging modality for precise 3D localization and quantification of superparamagnetic nanoparticle tracers within biological tissues with minimum background signals. However, the lack of standardized segmentation methods and observer bias affects its precision for image analysis. The current study proposes leveraging artificial intelligence (AI)-based frameworks to overcome these challenges and use deep learning (DL), to improve the precise quantification of iron from MPI images. This study investigates the application of Convolutional Neural Networks (CNNs) for the analysis of MPI-acquired images, aiming to establish a robust methodology for estimating iron content. CNNs were trained using 3D MPI images, where pixel intensities are directly correlated with iron content. Starting from the input layer, the CNN progressively extracted features such as edges and patterns through multiple hidden layers, enhancing the discernibility and reducing image complexity. This hierarchical feature extraction process enabled the network to interpret and simplify input data effectively. The CNN outputs a probability distribution reflecting the likelihood of various iron contents, validated against known values from the training images. The

discrepancies between predicted and actual values of iron were used to guide further optimization and training iterations. Leveraging deep learning capabilities, this approach offers a reliabl

INVESTIGATING THE SPATIAL RELATIONSHIPS BETWEEN GENTRIFICATION AND CHILDHOOD BLOOD LEAD LEVELS IN DETROIT, MICHIGAN

Presenter(s): Lana Stojadinovic (Howard University)
Health Sciences
Mentor(s): Sue Grady (College of Social Science)

Lead poisoning has permanent effects on children, stunting both their neurological development and physical growth. Previous studies found that, in the United States, low-income and predominantly black areas have the highest rates of lead exposure. Another phenomenon prevalent in these areas is gentrification: a process of neighborhood change that occurs over a period of time measured by compositional demographic shifts, increased property value, and physical signs of reinvestment. Detroit, a predominantly black city that has also experienced gentrification, has an excessively high rate of lead poisoning (≥3.5 mcg/dL) among children compared to other cities in Michigan and the United States. According to a previous study, gentrification in Detroit has shown to have a potential negative effect on the environment, specifically air quality. This study investigates the relationships between gentrification and environmental health by observing how childhood blood lead levels vary in non-gentrified, gentrified, and intensely gentrified areas in Detroit. Geographic Information Systems (GIS) are employed to map childhood blood lead level data and gentrification, while census data is utilized to measure gentrification levels. This study therefore hypothesizes that gentrified areas will have the highest rates of elevated blood lead levels because they are in the earlier stages of neighborhood change and are likely undergoing more significant changes in the built enviro

A LONGITUDINAL STUDY OF SERUM FATTY ACID PROFILES AND SOCIAL IMPACTS IN UGANDAN ADOLESCENTS AFFECTED BY PERINATAL HIV EXPOSURE/INFECTION

Presenter(s): Evan Nagy (Michigan State University), Isaac Abraham (Michigan State University)
Health Sciences
Mentor(s): Jenifer Fenton (College of Natural Science)

The lack of dietary polyunsaturated fatty acids (PUFAs) in the Ugandan diet may be associated with negative social experience among adolescents. However, this association in relation to perinatal HIV exposure/infection remains understudied. The objective of this study is to determine associations between serum fatty acid (FA) levels and the social experience of Ugandan adolescents and how they differ by perinatal HIV status. We hypothesize that low PUFA levels is associated with higher levels of self-reported anxiety, depression, and social stress; such, there may be a stronger association among HIV exposed/infected adolescents. 383 Ugandan adolescents aged 11-18 years were defined perinatally HIV infected (PHIV), HIV exposed/uninfected (HEU) and (HIV) unexposed/uninfected (HUU). Baseline serum FA levels were analyzed by gas-chromatography mass-spectrometry. The social experience of the adolescents was self-reported over four time points under an adapted model of the Behavioral Assessment System for Children Third Addition (BASC-3). Overall, lower T:T ratios were associated with higher levels of depression (ß=-3.705), anxiety (ß=-6.15), and social stress (ß=-4.00). However, this association was driven by HUU. Total n-6 PUFAs were associated with high anxiety in HEU. Low Mead acid, T:T ratio and high total n-6 were associated with high anxiety in HUU. Conversely, among HEU, high n-6 exhibits an inverse association with self-reported anxiety (all P< 0.05). Associations

UNVEILING MACROPHAGE DYNAMICS: A NEW PERSPECTIVE ON TYPE 1 DIABETES

Presenter(s): Manvir Bamrah (Michigan State University)
Health Sciences
Mentor(s): Ping Wang (College of Human Medicine), Saumya Nigam (College of Human Medicine)

Type 1 Diabetes (T1D) is a chronic autoimmune condition affecting nearly a quarter of the United States population. T1D pathogenesis is characterized by the destruction insulin producing beta-cells within the Islets of Langerhans - a feature of the pancreas. Macrophages, as hallmarks of immune regulation, play a multifaceted role in T1D pathogenesis. Macrophages are traditionally classified as pro-inflammatory, M1, and anti-inflammatory M2 phenotypes; but exist on a spectrum dependent on the stimulating factor. In T1D, M1 macrophages can contribute to disease development, and subsequent beta cell death, through the exacerbation of inflammatory responses via cytokines such as IL-1β. Conversely, M2 macrophages can stimulate a protective effect, resolving inflammation and promoting tissue repair through the release of factors such as IL-10 and TGF-β. The balance between these macrophage subsets is critical in determining the outcome of T1D. Therapeutically, targeting macrophage polarization presents a promising avenue for T1D intervention. Preceding therapies that leverage relative states is a need for greater understanding of macrophage involvement in the pathogenesis of T1D. This work addresses a significant shortcoming in the T1D literature, with the aim of establishing a timeline of macrophage-disease involvement and clarifying specific timepoints for maximum therapeutic efficacy. Macrophages are pivotal in the autoimmune cascade of T1D. Understandin

DEVELOPING A MEASURE OF PARENT'S KNOWLEDGE OF FOOD PROTEIN INDUCED ENTEROCOLITIS SYNDROME (FPIES) MANAGEMENT

Presenter(s): Chaitra Kommaraju (Michigan State University), Mitra Bijoy (Michigan State University)
Health Sciences
Mentor(s): Amy Nuttall (College of Social Science)

Food protein-induced enterocolitis syndrome (FPIES) affects 1.1 million US children (Nowak-Wegrzyn et al 2019). FPIES emerges in infancy with the introduction of solid foods (Nowak-Wegrzyn et al. 2017). FPIES manifests as an acute medical emergency characterized by repetitive, projectile vomiting that can lead to dehydration; treatment of acute reactions typically requires intravenous fluid resuscitation in the emergency room (Nowak-Wegrzyn et al. 2017). Home management consists of identifying trigger and safe foods, adhering to a restricted diet, and navigating acute reactions when they occur. Given poor knowledge of FPIES among general pediatricians (Feuille et al. 2017), parents often learn about FPIES and FPIES management from the internet, not physicians (Schultz & Westcott-Chavez, 2014). Therefore, there may be large differences between parents in their knowledge of FPIES. Developing a reliable measure to quantify parental knowledge of FPIES management is a critical first-step towards developing educational interventions that increase parental knowledge of disease management. In the broader food allergy literature, parents with better knowledge of food allergies also report less anxiety (Luke & Flessner 2020). In this study a new measure of parental knowledge was administered to healthcare professionals with expertise in FPIES to validate the measure. FPIES experts answered True/False to questions to ensure no ambiguities in the correct answers and rated how imp

VITAMIN D SUPPLEMENTATION: IMPACT ON THE GUT MICROBIOTA OF EXCLUSIVE AND PARTIALLY BREASTFED INFANTS

Presenter(s): Ananya Kamath (Michigan State University)
Health Sciences
Mentor(s): Sarah Comstock (College of Natural Science)

The infant microbiome plays a crucial role in early development, immune system maturation, and long-term health outcomes. Investigating the composition, establishment, and dynamics of the infant microbiome is essential for understanding its influence on various aspects of infant health and potentially identifying interventions to support healthy microbial colonization. It is understood that feeding practices in early infancy contribute to gut microbiota while the confounding factors are still left to be elucidated. This research project aims to shine light on one of these factors: Vitamin D supplementation. I plan to investigate the impact Vitamin D supplementation has on the gut microbiota of exclusively or partially breastfed 3-month-old infants by characterizing the microbial composition and diversity of the population. By identifying key microbial taxa and their functional roles within the gut environment, the impact supplementation has on other factors such as infant health. Feeding methods and nutritional supplementation can directly influence the microbial community structure and its dynamics. Moving forward, this study's results can be used to explore potential applications of the microbial profile in early intervention care.

INTEGRATING HEMATOLOGY TRAINING WITH HEALTHCARE PRACTICE FOR PRE-HEALTH PROFESSIONALS AT MSU

Presenter(s): Jeff Li (Michigan State University), Nicole Manzzullo (Michigan State University), Vrinda Khullar (Michigan State University)
Health Sciences
Mentor(s): John Zubek (College of Natural Science)

At Michigan State University, the Department of Physiology's lab course for pre-health professionals emphasizes laboratory exercises relevant to healthcare and data analysis, professional development, and problem solving skills. The goal of the hematology laboratory experience is to help students understand how hematology can be extended to other fields of medicine. This is achieved by exposing students to the collection of blood samples and related laboratory tests that are typical parts of a health screening, outside of the professional hospital setting. The activities in this lab focus on hematocrit, blood type, total lipid panel, PT-INR (international normalized ratio), and hemoglobin. The learning objectives include handling blood safely using Universal Precautions, the ability to describe and recognize typical versus pathologic values found in common blood tests, and to make connections to physiological concepts learned in the class lecture. The lab utilizes the "see one, do one, teach one" pedagogy that is often found in clinical settings. Additionally, the lab offers students real-world healthcare experience, fostering empathy by allowing them to take on the roles of both provider and patient. Even for students who do not become hematologists, it is important to maintain current knowledge of best testing practices to provide the highest quality patient care and understand how various blood disorders affect certain populations. It is crucial to learn the principles of

HIGH-FAT DIET-FED DAHL SALT SENSITIVE RAT AS A MODEL OF OBESITY AND PREECLAMPSIA

Presenter(s): Krystal Lopez (Pontifical Catholic University of Puerto Rico), Lauren Kim (Michigan State University)
Health Sciences
Mentor(s): Viviane Cristine Leite Gomes (College of Veterinary Medicine)

Preeclampsia is a leading hypertensive disorder of pregnancy. Obese women have a 3-fold higher risk of developing preeclampsia. Yet, the mechanisms linking obesity and preeclampsia remain poorly understood. The high-fat diet-fed (HFD) Dahl Salt-Sensitive (DSS) rat has been established as a model of dietary-induced hypertension. However, hemodynamic profile of HFD DSS during pregnancy has not been investigated. Herein, our goal is to elucidate gestational blood pressure and fetal outcomes in HFD DSS rats. We hypothesize that HFD DSS females will exhibit high blood pressure after mid-gestation, which will return to pre-pregnancy levels following parturition. Additionally, we expect smaller litter size and birth weight in HFD DSS females in comparison to age-matched controls. Virgin female DSS rats from Charles River Laboratory were randomly assigned to control diet (CD) or HFD groups at 3 weeks of age (n = 6/group). A normal salt diet (0.3% NaCl) containing either 10% (CD, D12450J) or 60% (HFD, D12492) of Kcal from saturated fat was given ad libitum throughout the study (Research Diets, Inc). Radiotelemetry transmitters were implanted in the femoral artery of all females at 11 weeks of age for continuous hemodynamic assessment (HDS10, PhysioTelTM). After one week of baseline measurements, females were bred to CD DSS males and blood pressure was monitored at every 10 minutes throughout pregnancy. Litter size and pup birth weight will be assessed at postnatal day 1 as indicators

NATURE-BASED AUDITORY MEDITATION FOR BEREAVED CANCER CAREGIVERS

Presenter(s): Alissa Thompson (Michigan State University)
Health Sciences
Mentor(s): Gwen Wyatt (College of Nursing), Rebecca Lehto (College of Nursing)

Bereavement is the period of grief and mourning following the death of a loved one. Informal cancer caregivers (CGs) experience the emotional, physical, and social toll associated with bereavement but often have limited access to supportive interventions. Additionally, limited research has addressed bereavement for cancer CGs despite the increased risk of prolonged grief disorder recognized in the DSM-5. The study aims to establish a nature-based auditory meditation protocol to support home-based cancer caregivers during early bereavement. This research is designed as a pre-post pilot study, recruiting bereaved cancer CGs who will complete a six-module program that integrates nature-based auditory scenes with gentle meditation exercises. Guided by the Bereavement Framework, the protocol utilizes nature scenes to create audio-meditations with nature imagery. During the nature solar system imagery, the participants will engage in focused and controlled breathing while completing a soothing body scan from head to toe. The imagery provided encourages participants to consider the sun and stars and the vastness of the solar system. Envisioning an expanded perspective, which may allow the weight of bereavement to lift as they float in space, thus supporting emotional and physical relaxation. Audio recordings are easily accessible and user-friendly for CGs facing bereavement, carrying potential to address grief through nature-based guided meditations. This intervention holds promise

THORACIC AORTA PERIVASCULAR ADIPOSE TISSUES' ANATOMICAL LOCATION ALTERS ADIPOCYTE PROGENITORS' RESPONSES TO ANGIOTENSIN-II

Presenter(s): Alyssa Shadowens (Michigan State University)
Health Sciences
Mentor(s): Andres Contreras (College of Veterinary Medicine), Javier Rendon Mora (College of Veterinary Medicine), Miguel Chirivi Gonzalez (College of Veterinary Medicine)

Hypertension (HTN), the most prevalent cardiovascular disease, is the leading cause of death worldwide. HTN alters the structure of vessels' layers intima, media, adventitia, and perivascular adipose tissue (PVAT). PVAT has vasoactive properties that are lost during HTN, however, the mechanisms driving these changes are unknown. PVAT surrounding the aorta (tPVAT) is distributed in three strips: one anterior (A) and two lateral (L). Adipocyte progenitor cells (APCs) in these locations have different embryonic origins, but it is unclear how they function differently. The purpose of this study was to determine the effect angiotensin-II (Ang-II) has on APCs that reside in tPVAT. APCs were isolated from anterior tPVAT and lateral tPVAT from Sprague-Dawley rats (n-6) and were exposed to: Control, Ang-II, and Yoda1. We seeded cells in 96 well plates at 1 x 102 cells/well and evaluated proliferation at three separate time points (24, 48, 96hr) using nonradioactive CyQUANT® Cell Proliferation assay (Thermo Scientific). Adipogenesis was determined using live cell imaging with Bodipy, a lipid stain, and triglycerides were measured using Triglyceride-Glo Assay. Proliferation was evaluated with the CyQuant . The data was analyzed using a mixed model with the random effect of animal and fixed effect of location, treatment, and time. Treatment had no effect on proliferation (P=0.18). When evaluating lipid accumulation, we observed an effect of location with L having a highe

RETRIEVING AREA-LEVEL SOCIAL VULNERABILITY TO PREDICT MISCARRIAGE

Presenter(s): Yashveer Singh (Michigan State University)
Health Sciences
Mentor(s): Alicynne Glazier-Essalmi (College of Human Medicine)

Miscarriage, pregnancy loss prior to 20 weeks of gestation, is the most common adverse pregnancy outcome, affecting approximately 1 in 5 of all clinically recognized pregnancies. Miscarriages can be attributed to a genetic cause in about 50% of cases, but the bulk of miscarriages occurring after the 6th gestational week remain unexplained. Demographic and socioeconomic factors operating at the ecological level may disproportionally act as external health stressors across marginalized communities resulting in social vulnerability that may contribute to increased risk of adverse pregnancy outcomes. CDC/ATSDR's Social Vulnerability Index (SVI) serves as a standardized, community-based measure of social vulnerability across diverse census tracts throughout the U.S. The SVI covers four major "Themes" of social vulnerability including 1) Socioeconomic Status, 2) Household Characteristics, 3) Racial & Ethnic Minority Status, and 4) Housing Type & Transportation. SVI Themes are also combined into a single value of overall social vulnerability, where higher SVI scores indicate a greater tract-level social vulnerability. Comprising pregnancy cohorts in Michigan and Massachusetts, this ongoing study will geocode prenatal residences by U.S. census tract to determine prenatal social vulnerability. Applying a combination of methods, census tracts of prenatal residences will be linked to tract-level geocodes for determination of SVI Themes

SENSE OF SMELL AMONG US FARMERS

Presenter(s): Niouma Semega (New York University)
Health Sciences
Mentor(s): Honglei Chen (College of Human Medicine)

This study assesses the prevalence, self-awareness, and risk factors associated with olfactory dysfunction among older adult farmers in the United States, leveraging both self-reported data and direct testing methods to enhance early detection, inform public health strategies, and improve quality of life. Initially, approximately 19,000 farmers self-reported their olfactory status in 2013-2015; by 2020-2021, about 2,500 of these were re-evaluated using the Brief Smell Identification Test (B-SIT) and further detailed smell tests as part of the PASS Study. The analysis employs Kappa statistics to check consistency between initial self-reports and PASS results, along with multivariate analysis to pinpoint risk factors, adjusting results back to the target population. Preliminary findings focus on the prevalence of olfactory impairments, adjusted to the original cohort, and examine the consistency of self-reports with post-test perceptions. The study also explores how exposure to occupational hazards like pesticides impacts olfactory function. By comparing self-reported perceptions with objective testing outcomes, the research provides crucial insights into sensory impairments among an aging agricultural workforce, aiming to inform policies on environmental standards and health screening protocols, thus enhancing occupational health and safety for farmers.

EXPLORING EXPERIENCES OF FIBROMYALGIA PATIENT CARE

Presenter(s): Autumn Cole (Siena Heights University)
Health Sciences
Mentor(s): Jean Ann Dean (Siena Heights University)

Fibromyalgia is a disease that is a chronic, painful, and debilitating condition. Of all the chronic pain disorders, fibromyalgia is characterized by widespread musculoskeletal pain, tenderness, and a constellation of associated symptoms. With the complexity and uncertainty of fibromyalgia, healthcare professionals may use less patient-centered approaches in people with fibromyalgia compared to conditions with visible physical conditions. Nurses will be interviewed using a survey/questionnaire to learn about their understanding of patient care for those with fibromyalgia. Information will be collected regarding their current knowledge of the pain scale and the differences between the analog pain (1-10) and the widespread pain index that is used by Rheumatologists. Open-ended questions will be utilized to gain an understanding of their knowledge and confidence in providing care for fibromyalgia patients. Keywords: Fibromyalgia; pain scale; nurses; knowledge; care

NEURAL DIFFERENTIATION OF ENDOMETRIAL VS HEALTHY CELL LINES FOR ENDOMETRIOSIS DETECTION

Presenter(s): Shreshta Sinha (Michigan State University)
Health Sciences
Mentor(s): Debajit Saha (College of Engineering), Simon Sanchez (Research and Innovation)

Endometriosis is a gynecological disease characterized by the presence of endometrial tissue outside the uterus. It affects approximately 15% of reproductive-age women and is associated with various non-specific symptoms. Definitive diagnosis is delayed an average of 7-10 years after the onset of symptoms due to the heterogeneity of Symptoms and the absence of specific Biomarkers. Currently, laparoscopic surgery is the only acceptable method for the diagnosis of endometriosis, and efforts to find non-invasive biomarkers have proved unsuccessful. The application of gas sensing technologies for the detection of endometriosis is rare but has been used to noninvasively detect other metabolically linked diseases through the analysis of volatile organic compounds (VOCs). Several studies have utilized gas chromatography-mass spectrometry for the analysis of VOCs however this method uses a component-wise identification approach that is suitable for the identification of specific biomarkers. Since specific biomarkers have not been identified in the diagnosis of endometriosis, we carried out a non-specific approach to analyze VOC gas mixtures which may indicate a diseased state within the body. Biological olfactory systems have evolved to detect minute differences in complex VOC mixtures in natural environments. Here, we address the challenge of detecting endometriosis non-invasively through a novel olfactory neuron-based sensor where we leverage the capacity of the entire biological o

Kinesiology & Nutrition

EXAMINING THE DOSE-RESPONSE RELATIONSHIP BETWEEN RESISTANCE TRAINING AND MENTAL HEALTH AMONG COLLEGE STUDENTS

Presenter(s): Ashley George (Eastern Michigan University)
Kinesiology and Nutrition
Mentor(s): Catherine Gammon (Eastern Michigan University)

Research indicates the benefits of resistance training (RT) for mental health, but the existence and shape of a 'dose response' relationship between RT and mental health is not well understood. This is particularly true for college students - a demographic with relatively high rates of mental health challenges. Understanding the dose response relationship between RT and mental health in college students may help develop effective wellness interventions. The purpose of this study was to examine the existence and shape of a dose response relationship between RT and mental health in college students.

PEAPOD-2: A WORK IN PROGRESS

Presenter(s): Melina Catenacci (Michigan State University)
Kinesiology and Nutrition
Mentor(s): Jean Kerver (College of Human Medicine), Sarah Comstock (College of Natural Science)

Fruits and vegetables provide nutrients important for a healthy lifestyle. It is especially important to increase the consumption of fruits and vegetables during pregnancy when a mother's nutrition is directly fueling the growth and development of their fetus. The Pregnancy Eating and Postpartum Development (PEAPOD)-2 study continues the original PEAPOD study. PEAPOD-2 aims to 1) develop local programs to help pregnant people eat more fruits and vegetables 2) test the efficiency of a diet high in fruit and vegetable intake in pregnant women by tracking data with surveys and bio specimen samples, and 3) narrow the gap between nutrition and physical applications for pregnant women facing food insecurity, obesity, or the risk of substance use disorder (SUD). PEAPOD-2 participants are recruited from an OBGYN office in Traverse City, MI with 21 participants enrolled. Each participant must meet the following eligibility criteria: 1) 18+ years of age, 2) currently pregnant and have their first study visit completed before 30 weeks of gestation, 3) have no major food restrictions. This one-arm trial collects data through 1) pre-intervention (baseline) surveys and 2) post-intervention surveys which includes the 3) biospecimen sample. Information including allergies, food intake, breastfeeding intention, and the mother's weight are collected from these surveys. Gift cards, smoothie kits including a Kitchenaid hand blender, chef prepared meals, recipes, nutrition information, and commun

THE EFFECTS OF PRENATAL STRESS ON CHILDHOOD MICROBIOME AND LATER HEALTH OUTCOMES: A WORK IN PROGRESS

Presenter(s): Alyssa Cosio (Michigan State University)
Kinesiology and Nutrition
Mentor(s): Sarah Comstock (College of Natural Science)

The human gut microbiome is filled with numerous microorganisms which play a role in digestion, immunity, and overall health. The microbiome changes from birth and is highly impacted by factors such as diet (breastfeeding or formula feeding), mode of delivery (vaginal or cesarean section birth), exposure to antibiotics, and the environment. The purpose of this study is to connect the child diet and microbes in their gut with health. Through participant completed questionnaires and stool samples collected from the participants' homes we are working to identify correlations in measures of maternal stress during pregnancy with the diversity of gut microbes in children aged four. Our study (PSS Tummy) is a substudy of the Prenatal Stress Study (PSS) which tracked information from the participants before age four. We currently have 26 questionnaires completed and we are continuing to recruit more participants. By studying the stool samples we are able to determine prevalent bacteria and other microbes found within the child's gastrointestinal tract. The questionnaire helps to give background information on each participant by describing several influential factors such as their child's typical diet and any exposure to antibiotics. This research is impactful towards identifying how to help the scientific community and most importantly, the general public in understanding what makes a healthy gut microbiome and how the gut microbiome contributes to child health outcomes.

FOLLOWING ACLR, HOW IS MUSCLE STRENGTH ASSOCIATED WITH THE ULTRASOUND ASSESSMENT OF THE INFRAPATELLAR FAT PAD?

Presenter(s): Christian Emonina (Alabama A&M University)
Kinesiology and Nutrition
Mentor(s): Matthew Harkey (College of Education)

This research paper investigates the relationship between muscle strength and the ultrasound assessment of the infrapatellar fat pad (IFP) post anterior cruciate ligament (ACL) reconstruction surgery. ACL injuries are prevalent in athletic populations and often require surgical intervention to restore knee stability. Following surgery, rehabilitation focuses on restoring muscle strength and function, which are crucial for long-term joint health. The IFP, located within the knee joint, plays a significant role in knee biomechanics and is implicated in the pathogenesis of osteoarthritis. Ultrasound assessment of the IFP provides valuable insights into its structural changes, including thickness and echogenicity, which may correlate with clinical outcomes post-ACL reconstruction. Muscle strength, particularly of the quadriceps and hamstrings, is integral to knee joint stability and function. Weakness in these muscles can lead to altered biomechanics and potentially impact the structural integrity of the IFP. Understanding how muscle strength influences IFP characteristics post-surgery is essential for optimizing rehabilitation protocols and improving patient outcomes. Through a comprehensive review of current literature and empirical data, this paper aims to elucidate the interplay between muscle strength and ultrasound-assessed IFP changes following ACL reconstruction. The findings will contribute to advancing clinical strategies in rehabilitation, potenti

HUMAN MILK OLIGOSACCHARIDE METABOLIZING GENE ABUNDANCE AND DIVERSITY IN INFANTS

Presenter(s): Neha Gopalakrishnan (Michigan State University)
Kinesiology and Nutrition
Mentor(s): Sarah Comstock (College of Natural Science)

This study aims to assess metagenomic diversity of human milk oligosaccharide (HMO) metabolizing genes in the infant gut microbiome and associate these gene patterns with infant diet and mode of delivery. It was predicted that the guts of human-milk fed infants will contain a greater abundance of HMO metabolizing genes compared to non-human milk fed infants. It was also hypothesized that mode of delivery will have no significant impact on gene concentrations in the infant gut. This study collected questionnaire responses and 1 and 3 month old infant fecal samples. All fecal samples underwent DNA extractions and quantitative PCR to analyze HMO-metabolizing gene abundance and diversity in relation to mode of delivery (1 month) or feeding practices (3 months). Statistical analysis was performed in R to correlate HMO metabolizing gene abundances between cesarean and vaginally delivered 1 month old infants, as well as between human milk v. non-human milk-fed 3 month old infants. The mean CT values of HMO metabolizing genes, including Sia, B breve, GH750, and gBif, were all found to have a non-significant difference between vaginal and cesarean deliveries. P-values were 0.1223, 0.4881, 0.7093, and 0.5438 for Sia, B breve, GH750, and gBif, respectively. Overall, this study provides valuable insight into how dietary habits modify the infant gut microbiome, as well as the potential beneficial effects of human milk in improving infant gut health.

RECREATIONAL AND COMPETITIVE SPORT AND THE DEVELOPMENT OF INTERPERSONAL SKILLS IN YOUTH

Presenter(s): Kordell Green (Morehouse College)
Kinesiology and Nutrition
Mentor(s): Leapetswe Malete (College of Education)

Engagement in sport and physical activity has been considered key to social integration and the development of interpersonal skills in youth. For instance, large media events such as the Worldwide Day of Play hosted by Nickelodeon, encourages children to go outside and be physically active given the perceived benefits of such activities for child and youth development. Outside of the physical health benefits derived from sport, understanding how the development of interpersonal skills can be harnessed through sport environments is important. To address this, the present study examined the role of sport environments in interpersonal skills development in children and youth. Using a scoping review, evidence from different studies covering mechanisms and processes utilized in different sport environments were examined. The studies were selected by conducting a broad search using PubMed, Google Scholar, and Michigan State University library database for peer-reviewed publications from 2005 to January 31, 2024. Findings from the literature indicate that interactive peer environments, autonomy-supportive coaching, and capacity to make social connections play a major role in the interpersonal skills development of children and youth. Children and youth sport environments that are structured to enhance these attributes and competencies are likely to offer pathways to enhancing interpersonal skills.

THE ROLE OF SPORT IN THE DEVELOPMENT OF YOUTH ENTREPRENEURIAL MINDSETS

Presenter(s): Zion Pettiford (North Carolina A&T State University)
Kinesiology and Nutrition
Mentor(s): Chelsi Ricketts (College of Education), Leapetswe Malete (College of Education)

Physical skills learned through sport are transferable to other life domains. Studies show that in addition to enhancing the development of physical abilities, participation in sport also leads to the development of several intangible life skills including entrepreneurial mindsets. The ever-expanding global economy and related challenges that mostly affect the youth population, make entrepreneurial ideation a highly valued life skill. However, research examining the relationship between skills developed from sport participation and entrepreneurial mindsets are scarce. The purpose of this cross-sectional study was to examine the relationship between life skills learnt from sport and entrepreneurial mindset in youth. A total of 146 youth aged 12-20 years from three African countries completed the Life Skill Scale for Sport and the General Measures of Enterprising Tendencies test (GET2). Result from regression analyses showed leadership as the only sport-specific life skill to significantly predict the entrepreneurial tendency of calculated risk taking in this study (B = 0.92, p = .02), controlling for age, sex, country and group (treatment vs control). Several covariates emerged as significant in specific models predicting the entrepreneurial tendencies. Findings suggest youth who perceive greater leadership development through sport were also likely to take more calculated risks. This is consistent with previous research identifying leadership a

SEX DIFFERENCES IN SCAT-6 PERFORMANCE POST-CONCUSSION

Presenter(s): Kate Ryan (Michigan State University)
Kinesiology and Nutrition
Mentor(s): Allie Tracey (College of Education)

The Sport Concussion Assessment Tool-6th Edition (SCAT-6) is the most updated version of the SCAT, which includes a symptom checklist (i.e., 22 symptoms graded on symptom severity, number of symptoms, and symptom factors of affective, cognitive-ocular, and migraine fatigue) and neurocognitive assessment (i.e., orientation, concentration, immediate memory, balance, delayed recall). While current literature indicates sex disparities in concussion outcomes (e.g., symptoms, neurocognitive impairments), sex differences in SCAT-6 outcomes have not been examined. A prospective cohort study of college-aged (n=38, woman=18, μage=20.82, SD=1.47) athletes (e.g. recreational, intramural, club, varsity) diagnosed with a concussion was conducted. Participants completed demographics, injury information, and the SCAT-6 within five days of sustaining injury. Independent samples t-tests with post hoc Bonferroni correction determined differences in SCAT-6 composite scores (i.e., total number and symptom severity of all symptoms and symptom factors, orientation, concentration, immediate memory, balance, delayed recall) between men and women ($p<0.05$). While no significant differences were observed between men and women for total symptoms and total symptom severity, women indicated significantly worse cognitive-ocular symptoms ($t(36)=1.38$, $p=0.001$, Cohen's $d= 0.45$) and more migraine-fatigue symptoms than men ($t(36)=2.07$, $p=0.001$, Cohen's $d=0.67$). Orientation was the only SCAT6 outcome that

Mechanical Engineering

OPTIMIZING THE PERFORMANCE OF A WAVE ENERGY CONVERTER THROUGH PHYSICAL AND MATHEMATICAL MODELING

Presenter(s): AnnaMaria Schneider (Michigan State University)
Mechanical Engineering
Mentor(s): Wei-Che Tai (College of Engineering)

The depletion of fossil fuels and the threat of global warming has led to a search for renewable, "green" sources of energy. Ocean waves have been found to have a higher potential energy than solar or wind power. Wave energy converters (WECs) convert this potential energy into usable, electrical power for commercial and consumer use. However, this energy source is more expensive and must be optimized in order to be competitive with current energy sources. This study proposes a mathematical model to understand an existing WEC, for which parameters and conditions will be analyzed for an optimal outcome. A shaker device will be used to physically simulate wave conditions on a scaled-down model of the WEC and sensors measure the WEC's acceleration and its generator's voltage output. The WEC's performance will be analyzed with wave profiles that mimic oceanic waves. The experimental data will be compared to the mathematical model.

OPTIMAL LOCATIONS OF PRESSURE SENSORS IN AN AUTOMATIC REPOSITIONING SEAT

Presenter(s): Colin Koot (Michigan State University)
Mechanical Engineering
Mentor(s): Tamara Bush (College of Engineering)

A significant challenge in healthcare settings is preventing pressure injuries in patients that remain seated for long periods of time. Patients need to be manually repositioned by nursing staff frequently to prevent pressure injuries, taking crucial time and resources. This also causes overuse injuries among nursing staff. Thus, a need exists for an automated repositioning system that moves based on pressure and time. The purpose of this research was to determine the optimal size and locations of pressure sensors on the seat back and seat pan of an automatic repositioning chair. A pilot study was conducted to collect pressure data across several regions of the body in an automatic repositioning chair during multiple activities of daily living, and data were analyzed to determine locations and size and location of pressure sensors needed in order to effectively monitor these activities. As a result of this work, the automatic pressure detection chair will effectively move and monitor patients, leading to a reduction in pressure injury risk in patients and allow nursing staff more time and resources to support all patients.

CHARACTERIZATION OF 3D PRINTED FUNCTIONALLY GRADED COMPOSITES

Presenter(s): Mahir Gandhi (Michigan State University)
Mechanical Engineering
Mentor(s): Carl Boehlert (College of Engineering), Sunil Kishore Chakrapani (College of Engineering)

Multimaterial printing using PolyJet technology involves jetting photopolymer droplets onto a build tray, layer by layer, and curing them with ultraviolet light to solidify. The Connex 350 is a printer that uses this technology, and its software does not allow granular control over the exact ratio of the constituent materials. Instead, it offers a range of pre-set digital materials that blend two or three base materials to produce materials with distinct properties. The present study aims to investigate 15 such composites with varying compositions of two constituent polymeric materials- TangoBlack+ (a rubber-like material) and Rigur (a significantly stiffer material). Characterization was carried out using destructive analysis, specifically optical microscopy. The samples were 3D-printed to bar-like geometry and further cut/sliced into smaller cubes with 10mm sides before being cold-mounted. The samples were further polished with grit paper and colloidal solutions up to 0.3 micrometers. The polished surfaces were then imaged under an optical microscope and the images were analyzed using ImageJ software to obtain the volume fraction of the two materials. The results from this study will help to correlate the material composition of the polymer to its mechanical properties and pave the way for a further ongoing study involving the embedding of spherical inclusions in cubes to investigate the 3D printing of multi-material composites.

LAMINAR BURNING VELOCITIES OF HYDROGEN AIR EGR MIXTURES

Presenter(s): Julio Dam Ferdinez (Michigan State University)
Mechanical Engineering
Mentor(s): Elisa Toulson (College of Engineering)

The use of Exhaust Gas Recirculation (EGR) has been proven to be an efficient way to control NOx emissions in gas turbine and internal combustion engines. The use of EGR helps lower the combustion temperature leading to lower NOx emissions. Different type of fuels can also be helpful when trying to lower the level of harmful emissions. Hydrogen is currently receiving a lot of attention as an alternative fuel as it does not produce CO2 emissions when combusted. The current study examines the flame propagation and burning velocity of hydrogen with exhaust gas recirculation. These combustion characteristics are important in understanding the combustion of hydrogen/air/EGR mixtures. These two characteristics of the combustion process are directly related to undesirable combustion phenomena such as Knock and flashback. Combustion processes ultimately have a fast flame speed helping maintain a stable process. In this study, a constant volume vessel is being used to investigate the laminar burning velocity of hydrogen/air/EGR mixtures at 1-3 bar, 373-473 K, equivalence ratio 0.5-1.2, and 0-50% EGR dilution. Additionally, ANSYS Chemkin, is used to compare the experimental results with existing chemical kinetic mechanisms.

WHY IS MY THUMB STILL WEAK? THE EFFECT OF CARPOMETACARPAL JOINT OSTEOARTHRITIS TREATMENT

Presenter(s): Rylie DuBois (Michigan State University)
Mechanical Engineering
Mentor(s): Tamara Bush (College of Engineering)

Treatment for severe osteoarthritis at the base of the thumb consists of joint replacement surgical intervention followed by physical therapy. Currently, clinical tools that measure the strength of the thumb include force measurements of the whole hand and multiple fingers, which do not directly measure the strength ability of the thumb. The goal of the study is to develop a technique to measure just the forces generated by the thumb and how that force is affected by osteoarthritis and surgery. Female surgical patients, all with diagnosed thumb carpometacarpal osteoarthritis, were asked to complete 24 unique isolated thumb force movements before and 6-months after surgical treatment. Healthy females free of symptoms and ≥40 years old were similarly tested as controls. On average, 21 of the 24 positions improved at 6 months post-op compared to pre-surgery, and an average of 7 of 14 participants improved in each position. A minimum of 1 participant and a maximum of 7 participants reached the healthy range depending on the force position. Only 1 osteoarthritic participant reached the healthy force levels in all 24 positions, and 5 participants did not achieve healthy force in any force position. Most patients are improving their average force generation in most force positions, but not quite to healthy levels. The postures that did not see improvement could indicate muscles that would benefit from targeted physical therapy and could inform future advances in surgical techn

DETERMINING THE RESILIENT MODULUS OF RECLAIMED ASPHALT PAVEMENT USING TRIAXIAL TESTING TO ENHANCE MDOT'S PAVEMENT DESIGN AND MAINTENANCE PRACTICES

Presenter(s): Fadi Shehada (Michigan State University)
Mechanical Engineering
Mentor(s): Faizan Lali (College of Engineering), Syed Haider (College of Engineering)

Pavement rehabilitation is a critical aspect of maintaining road infrastructure, ensuring safety, and extending the service life of pavements. One effective rehabilitation technique involves crushing and shaping (C&S) existing hot mix asphalt (HMA) materials. The Michigan Department of Transportation (MDOT) has commissioned our team to determine the resilient modulus (Mr) values of C&S HMA materials using the triaxial test. Currently, MDOT uses an assumed Mr value of 125 ksi based on literature, without actual testing for Michigan C&S materials. Our research aims to provide realistic Mr values for C&S materials through rigorous testing. Preliminary results show Mr values of 75 ksi for US-23 (C&S material mixed with virgin aggregate and stiffer binder) and 20 ksi for M-117 (purely crushed and shaped material with soft binder). Understanding the mechanical properties of C&S is crucial for optimizing its use in road construction, potentially leading to cost savings, environmental benefits, and improved pavement performance. We hypothesize that the Mr values obtained through our testing can differ significantly from the field FWD (Falling Weight Deflectometer) values, and that a shift factor can be established to correlate in-lab Mr values with field FWD values. This shift factor will help MDOT accurately determine the Mr of soils using FWD values. The resilient modulus (Mr) of C&S materials is determined using the triaxial test, which involves applyin

QUANTIFYING THE MECHANICAL EFFECT OF FUNCTIONAL MOVEMENT DISORDER ON PROPRIOCEPTION

Presenter(s): Joshua France (Michigan State University)
Mechanical Engineering
Mentor(s): Tamara Bush (College of Engineering)

Persons with Functional Movement Disorder (FMD) have erratic, hyperkinetic movements in their upper extremities. It is well documented that FMD patients have impaired agency (feeling of control over one's body), but it is unknown if their proprioception (a person's ability to know where their body is in space) is preserved. This study aims to analyze the proprioceptive abilities of patients with FMD both before and after a week of treatment. Marker-based motion capture data were collected for healthy, pre-treatment FMD, and post-treatment FMD groups during a cup lifting task. Participants completed a control trial, which involved lifting a cup to a guided height of eight inches, then were asked to repeat that motion as they remembered with their eyes closed. These data were analyzed in MATLAB to determine how far off participants were from the control trial (in the z-axis direction). On average, FMD participants were less accurate at reaching the eight-inch mark without vision after the week of therapy than they were before the week of therapy. However, their repeatability greatly improved, becoming almost equivalent to the healthy value. We hypothesize that this improved repeatability implies that proprioception is restored during therapy, and that the decreased accuracy is due to overcorrecting muscle force due to the newly restored proprioceptive input signals. The results from these data will better inform researchers about the impacts that FMD has o

WHEELCHAIR USERS: MEASURING FORCE NEEDED TO NAVIGATE THE ENVIRONMENT

Presenter(s): Rubben Jerome (Hope College)
Mechanical Engineering
Mentor(s): Tamara Bush (College of Engineering)

Wheelchair users have indicated that urban environments are not universally accessible, affecting their ability to take short trips to the grocery store, bus station, and other public spaces. One factor that contributes to this inaccessibility is the surfaces that require increased force to move over, such as gravel or grass. The purpose of this project was to collect and analyze data on the forces needed to initiate the movement of a wheelchair on six common types of flat surfaces and two inclined surfaces. An attachment was designed and manufactured to support the use of a force gauge to measure forces on the back of a wheelchair while motion was initiated. This attachment was used to measure the peak forces needed to initiate movement on different surfaces, five with level and two with inclined gradients. The data will be used to determine the amount of force needed to traverse urban environments, eventually helping wheelchair users safely navigate to their destinations. When made available to the public, this information will enable wheelchair users to consistently plan and execute trips outside the home with reduced uncertainty.

ADVANCED FEM SIMULATIONS FOR PREDICTING CUTTING TOOL FLANK WEAR IN AISI-1045 STEEL

Presenter(s): Aria Mahinfallah (Michigan State University)
Mechanical Engineering
Mentor(s): Patrick Kwon (College of Engineering)

Metal machining, a critical process originating during the Industrial Revolution, involves shaping materials via grinding, drilling, and cutting, with cutting being essential for creating precise components. Factors like chip type, cutting speed, and tool wear significantly influence cutting precision. High temperatures due to friction impact tool wear, affecting surface finish, surface integrity, and dimensional accuracy. Traditionally, characterizing tool wear involves extensive cutting tests under varying conditions (cutting speed, feed rate, rake angle, etc.), which is time-consuming and costly. Recently, the finite element method (FEM) has emerged as a successful alternative for simulating cutting processes. FEM can estimate process variables, such as tool temperature, that are not directly measurable using various material model equations. This research aims to predict the temperature of the tool's flank side. DEFORM software was utilized to run simulations, varying surface speed, rake angle, feed rate, and tool wear. The simulations employed a tabular material model to predict material behaviors and the Usui wear model, with a focus on the consistency of results rather than the specific model used. Simulations were validated by rerunning tests from other researchers and comparing the results. The findings will be used in generative AI to analyze simulation data and predict temperature and tool wear, optimizing the timing for cutting tool replacement to fully automa

QUANTIFYING AND FUNCTIONALIZING FLUID DYNAMICS IN MICROFLUIDIC DEVICESLAMINAR FLOW IN A MICROCHANNEL

Presenter(s): Vimbainashe Chado (Michigan State University)
Mechanical Engineering
Mentor(s): Brian Johnson (College of Veterinary Medicine)

Cell cultures lack many physiologically important features from their normal environment in vivo. More physiologically relevant new approach methods (NAMs) are needed to improve predictability for drug and chemical safety testing. Fluid flow influences cellular behavior in vivo and introducing flow to a micro-physiological NAM model can be accomplished in several ways including by adding pumps, incorporating hydraulic heads, rocking the devices, etc. but all of these add complexity, decrease throughput or otherwise interfering with analyses. Our work addresses this challenge by inducing flow in a technologically simple and throughput compatible manner within a microplate based array of microfluidic devices. We used fluorescent beads within the device channels to quantify fluid dynamics in real time using confocal fluorescence microscopy and quantified bead velocity using segmentation and image analysis. Results demonstrate that velocity vectors align in one direction, with longer vectors at the center and shorter ones at the channel edges indicative of laminar flow. Data analysis reveals a consistent trend: greater changes in X values are observed at specific Z positions within the total depth of 425μm. This demonstrates a correlation between the magnitude of velocity, the bead's position within the channel confirming the presence of central laminar flow. Future work will test device designs and their influence on flow velocity a

DEVELOPMENT OF SIMPLE & COST-EFFECTIVE FLUID LEVEL AND LOW-SPEED FLUID VELOCITY METHODS

Presenter(s): Berk Demirci (Michigan State University)
Mechanical Engineering
Mentor(s): David Olson (College of Engineering), Ross Cruikshank (College of Engineering)

The Turbulent Mixing and Unsteady Aerodynamics Laboratory at Michigan State University hosts several water tunnel facilities used to study various aerodynamic and bluff body problems. Current fluid flow measurement techniques, such as Molecular Tagging Velocimetry (MTV) and Particle Image Velocimetry (PIV), while highly accurate, are complex and costly for the simple task of monitoring mean tunnel speed over extended periods of time. It is also essential to monitor the fluid level as the mean velocity changes with the fill level of the water tunnel. This research aims to develop and test simple & cost-effective devices to monitor the fluid level and measure the velocity inside the water tunnels. These devices will aid in monitoring the water tunnel for long duration measurements. The fluid level sensor relies on a solid-state resistor that changes its resistance with submersion depth. The velocity measurement is achieved by calibrating the tunnel speed with the drag force on a submerged plate using a load cell. Key challenges include effectively filtering noise and minimizing hysteresis for both measurements. The development and testing of these devices, analysis of the experimental data and recommendations for the future will be discussed.

QUANTIFYING AND ANALYZING CNC CHIPS TO IMPROVE PLASTIC MICROFLUIDIC DEVICE CONSISTENCY AND QUALITY

Presenter(s): Evan Malbouef (Michigan State University)
Mechanical Engineering
Mentor(s): Brian Johnson (College of Veterinary Medicine)

CNC milling is a common practice in machining, due to its efficient and versatile nature. It can be extended to cellular biology, with micro milling channels into the bottoms of cell culture plates to create microfluidic features to culture cells. These features require tight tolerances to function as designed. One way to promote tight tolerances is optimizing feeds and speeds, which, when miscalculated, can lead to poor part quality or tool damage. A common baseline for feeds and speeds is following a recommended chip load for the given tool and material. Chip load is the thickness of each chip when the tool digs into the material. Another quantification method is Surface feet per minute (SFM), which is the linear length of material removed by the cutter in one minute. To develop a quality control process and determine if chip analysis is an effective means to monitor the plastic machining process we developed a method to physically analyze and quantify chips using light microscopy. Results from these studies will be used to produce a refined baseline of micro milling feeds and speeds settings for each machine. This will result in a streamlined machining process, with less time spent refining settings to create high quality parts.

THE CALCULATION OF PRECISION FOR A MICROCHANNEL PLATE DETECTOR USED FOR A TIME OF FLIGHT MEASUREMENT.

Presenter(s): Justin Luks (University of Maryland)
Mechanical Engineering
Mentor(s): Alfredo Estrade Vaz (Facility for Rare Isotope Beams), Hendrik Schatz (College of Natural Science)

The mass of specific elemental isotopes holds a great deal of importance in topics such as understanding atomic structure, mass models, physical properties, nuclear stability, stellar evolution and stellar fusion reactions, as well as medical applications. One typical technique for precision mass measurement is time of flight (TOF) calculations which is what was used in our research due to the low typical observation rate. The expected precision of TOF is between 10−4 - 10−5 δ?/? which led to the use of an analog-to-digital converter (ADC) circuit to increase precision. An ADC is utilized as it takes the amplitude of an incoming pulse and converts it into a digital value to be analyzed. Firstly, the ADC resolution is found with a pulser used as in input for the circuit. After connecting the MCP detector to the ADC circuit, resolution of the MCP can be determined as a background with no input. Upon determining resolution of background instances, an alpha source is added to determine the overall precision of the MCP with the TOF technique by aiming at a known position and analyzing each corner of the MCP to find amplitude of signal produced. Using a center of charge calculation, position of impact can be found which is expected to yield a precision of around 10−5 δ?/?. A TOF detector with this level of precision has not been created until now and will allow for more accurate mass calculations of isotopes that

Microbiology, Immunology, & Infectious Diseases

NITRO-CONTAINING COMPOUNDS THAT INHIBIT GROWTH OF MYCOBACTERIUM SMEGMATIS

Presenter(s): Priyanka Gadam (Michigan State University)
Microbiology Immunology and Infectious Disease
Mentor(s): Ifeanyichukwu Eke (College of Natural Science), Robert Abramovitch (College of Veterinary Medicine)

Nitro-containing compounds play a crucial role in controlling pathogenic Mycobacterium species, such as *Mycobacterium tuberculosis (Mtb)*. *Mycobacterium smegmatis (Msm)*, a non-pathogenic bacterium, serves as an important model for studying *Mtb* due to its rapid growth and significant sequence homology. A previous study's high-throughput screen identified HC2210, a potent nitrofuran-based prodrug inhibiting *Mtb* growth and affecting its non-replicating persistence. Unlike other anti-TB drugs, HC2210 requires F420 cofactor and possibly another F420-dependent reductase for activation. However, the exact inhibition mechanism remains unclear. Given HC2210's potential as a new TB drug, we initiated structure-activity relationship studies to test optimized analogs. While these analogs are currently being tested in *Mtb*, we conducted a follow-up study in *Msm* Our aim is to develop more potent analogs of HC2210. In this study, we screened 74 analogs and identified 10 candidates through inhibition assays in *Msm*. These were then tested against wild-type *Msm*, a *dprE1* mutant, and an *nfnB* mutant to assess the analogs' ability to kill these strains. *DprE1* and *nfnB* are crucial enzymes in mycobacteria. *DprE1* is involved in cell wall synthesis, while *nfnB* contributes to drug resistance by modifying nitro-groups. We chose these mutants as our lab aims to identify compounds e

OVARIAN HORMONE IMPACT ON VAGINAL EPITHELIAL IMMUNE RESPONSE TO GROUP B STREPTOCOCCUS INFECTION

Presenter(s): Joey Esparza (Michigan State University)
Microbiology Immunology and Infectious Disease
Mentor(s): Margaret Petroff (College of Veterinary Medicine)

Group B Streptococcus (Streptococcus agalactiae or GBS) is a gram-positive opportunistic pathogen with a reservoir in the rectovaginal tract. GBS emerged in the 1960s as a leading cause of disease in pregnant women and neonates - specifically neonatal meningitis, sepsis, and pneumonia. Serum progesterone and estrogen increase drastically throughout pregnancy, yet no studies have evaluated the impact of ovarian hormones on GBS infection. In this study, we show that vaginally colonized females clear GBS early in pregnancy. Additionally, we show that exogenous progesterone promotes GBS clearance and neutrophil trafficking into the vaginal lumen. Previous studies show that progesterone drives neutrophil trafficking by inducing vaginal epithelial production of IL-8, a chemokine that recruits neutrophils to the site of infection. In this study, we tested whether ovarian hormones alter IL-8 production from human vaginal epithelial cells (HVECs) in response to GBS infection. To do so, we pretreated HVECs with progesterone and estrogen and measured IL-8 production in response to GBS infection by enzyme-linked immunosorbent assay (ELISA). We found that physiologically relevant concentrations of both progesterone and estrogen enhanced production of GBS-induced IL-8 at MOIs of 0.1, 0.5, and 1. These results suggest that hormone action on HVECs can promote chemokines involved in leukocyte recruitment, which, in turn, assists in clearing infection. Further, these results will enhance

DISENTANGLING THE EFFECTS OF POPULATION SIZE, GENETIC BACKGROUND AND MUTATION RATE ON MAXIMUM POPULATION RESISTANCE TO ANTIBIOTICS.

Presenter(s): Max Halliday (Michigan State University)
Microbiology Immunology and Infectious Disease
Mentor(s): Zachary Blount (College of Natural Science)

The evolution of antibiotic resistance has been studied frequently since its discovery. However, in any given study, it can be difficult to control for more than one variable effectively, thus limiting the potential impact. Accurately comparing the effects of multiple variables on the evolution of resistance requires extensive controls to assure that adding multiple variables causes no confounding effects. Common complicating factors in these studies include: 1) population size, which affects the chances of resistance mutations occurring, 2) genetic background, which can substantially influence both the phenotypic and genotypic outcomes when evolving antibiotic resistance, and 3) mutation rate, which determines the population's ability to develop resistance mutations. Here, we lay out a method for how one could experimentally test the impact of these factors during resistance evolution. To look at the individual and combined effects of these on the maximum resistance of populations, we plan to use samples from the Long Term Evolution Experiment (LTEE) with E. coli. This system is ideal for disentangling the effects of the multiple variables because they can each be easily manipulated. In addition, multiple experimental replicates can be performed, leveraging the clonal nature of the E. coli, to better control variability between measurements.

ANALYSIS OF CELL DEATH AND INFLAMMATORY PATHWAY CONNECTIONS INDUCED BY A ST17 ISOLATE OF GROUP B STREPTOCOCCUS

Presenter(s): Emilie Poirier (Aquinas College)
Microbiology Immunology and Infectious Disease
Mentor(s): Rebecca Flaherty (Aquinas College)

Group B Streptococcus (GBS) is an opportunistic pathogen normally found in the bacterial flora of our gastrointestinal and reproductive tracts. It is known to cause serious complications in pregnancy and illness in neonates. Identifying biological targets that can effectively minimize the effects of GBS infection is the first step in developing drugs that can treat GBS disease. Based on prior findings identified by Flaherty et al., other student researchers at Aquinas, and other research groups, the goal of this research is to identify connections between GBS-induced responses in THP-1 macrophages. We hope to determine whether previously identified pathways are part of a single connected response or if they represent distinct responses to infection. The pathways we intend to explore include the PI3K-Akt pathway, which regulates cell survival and death, phagocytosis regulation, the NF kappa B and stress-responsive MAPK pathways which regulate cellular responses pertaining to cell death and inflammatory signaling, and the JAK-STAT pathway which regulates gene expression pertaining to inflammatory cell activation. We hope to find any possible connections between these pathways, as well as identifying the proteins involved in these connections. We anticipate that this work will provide useful information for drug development.

FINDING NEW ANTIBIOTICS USING INFORMATION DECOMPOSITION

Presenter(s): Dexter Bailey (Pennsylvania State University)
Microbiology Immunology and Infectious Disease
Mentor(s): Christoph Adami (College of Natural Science)

The theory of information decomposition has recently been shown to be a fast and effective way of classifying sequences based on function without the expensive overhead of standard machine learning methods. One of the applications of this technology is in the discovery of highly-active new compounds, but today we do not yet know whether information decomposition can recognize highly functional sequences if the sequence in the knowledge base are inferior. To test this capability, we will make use of a synthetic data set of extremely rare sequences of varying functions, and withhold those sequences with highest fitness from the knowledge base. Then, we will test various methods of synthesizing candidate sequences that will then be scored for function. Since our data set is complete (it contains all? active sequences), we will know whether the method correctly classifies out-of-sample sequences with higher fitness (it already accurately classifies sequences with lower fitness). If this method works, we will apply it to the search for highly active antimicrobial peptides (protegrins) based on a set of known such sequences. If we discover highly active sequences that are also inactive against human cells, such sequences would be able to enter drug trials for the next generation of antibiotics.

NEURODEVELOPMENTAL OUTCOMES IN UGANDAN PERINATALLY-INFECTED CHILDREN WITH HIV AT PRESCHOOL AGE WHO ARE NOT IMMUNE-COMPROMISED.

Presenter(s): Jenus Shrestha (Michigan State University)
Microbiology Immunology and Infectious Disease
Mentor(s): Itziar Familiar-Lopez (College of Osteopathic Medicine), Michael Boivin (College of Osteopathic Medicine)

Background: Neurodevelopmental delay and disabilities have been well documented in children living with HIV, especially living in more impoverished settings host to many risk factors. The present exploratory study compares a cohort of immunologically stable Ugandan preschool-age children living with HIV (prior to antiretroviral treatment initiation), to a comparable cohort of non-exposed or infected children matched for age and living situation. Method: Perinatally infected Ugandan children living with HIV (CLWHIV) (12 boys, 12 girls; mean age 4.6 yrs, SD 0.77) were compared to demographically similar non-exposed/non-infected children (14 boys, 17 girls; mean age 4.8 yrs, SD 0.78) using the Mullen Scales of Early Learning (MSEL) and the Color Object Association Test (COAT), an experimental measure for object placement immediate recall and learning. CLHIV children were immunologically stable in that all but one child was at WHO stage 0 or 1 and children included in this study had CD4% levels above 20 (mean 29.0 (SD-7.4). IRB approval was obtained by MSU BIRB #08-107; Makerere University Research Ethics Committee (REC REF No. 2008-101); and by the University of California - San Francisco Human Research Protection Program Committee on Human Research IRB " 10-02529, Reference #006441. Results: After adjusting for socio-economic status (SES), gender, age, and quality of caregiving and develop

EXPLORING THE RELATIONSHIP BETWEEN ENTEROPATHOGENIC E. COLI MOLECULAR MIMICRY AND GUILLAIN BARRÉ SYNDROME

Presenter(s): Paola G Figueroa Pratts (University of Puerto Rico Rio Piedras)
Microbiology Immunology and Infectious Disease
Mentor(s): Hinako Terauchi (College of Veterinary Medicine), Julia Bell (College of Veterinary Medicine), Linda Mansfield (College of Veterinary Medicine)

Guillain-Barré Syndrome (GBS) manifests with neuropathic symptoms such as numbness of extremities and ascending paralysis 2-4 weeks after an infection. It affects 100,000 new patients annually worldwide, with a 5% mortality rate, and 20% of patients are unable to walk independently one year after diagnosis. GBS is often triggered after an infection with the bacterial pathogen *Campylobacter jejuni*, although involvement of other pathogens needs to be investigated. The overarching hypothesis is that commensal bacteria in the gut of GBS patients can mimic nerve cell gangliosides, triggering an autoantibody response that attacks and damages peripheral nerves. Statistical analysis of fecal 16S rDNA V4 region gene sequencing of former GBS patients suggested enteropathogenic *Escherichia coli* may also contribute to the disease. As a short-term goal we focused on *E. coli* strains from feces of these patients to determine if these isolates carry sialic acid-bearing structures. After culturing on MacConkey agar, positive lactose-fermenting isolates will undergo motility tests in LB broth microscopically, Gram and capsule stained to identify candidate *E. coli* strains. We expect to see pink lactose fermenting colonies of Gram-negative rods, bacteria swimming due to flagellar motility, and capsules surrounding the cells. MALDI-TOF spectrometry will verify species. Screening by colony PCR

ANTIMICROBIAL RESISTANCE GENES IN THE GUT MICROBIOMES OF INFANTS IN MICHIGAN

Presenter(s): Anish Gogineni (Michigan State University)
Microbiology Immunology and Infectious Disease
Mentor(s): Madeleine Russell (College of Natural Science), Sarah Comstock (College of Natural Science)

Pathogen resistance to antimicrobial agents has been of great concern to both scientific and clinical communities. This is especially problematic during infancy because reservoirs of antimicrobial-resistant genes (ARGs) may form in the gut microbiota with antibiotic misuse during early development. To understand how the infant resistome changes with time, we quantified the ARGs of infants across the ages 1, 3, 6, 12, and 24 months. DNA from the gut microbiomes was isolated using the Qiagen PowerSoil DNeasy Isolation kit. AMR genes were quantified from the DNA using Takara SmartChip real-time quantitative PCR (qPCR) and a set of targeted primer pairs. The resistome data was cross-sectionally analyzed across time points. Alpha (within-sample) diversity was calculated using the Richness, Shannon, and Inverse Simpson indexes, and beta (within-community) diversity was calculated with the Sorensen and Bray-Curtis dissimilarity indexes. This univariate analysis will be followed by a multivariate analysis that account for covariates such as mode of delivery and infant diet. Next, I will longitudinally analyze the resistome data from two cohorts. The first cohort will span from 1 month to 6 months old, and the second cohort will span from 6 months to 24 months old. The results of this study will help the scientific and clinical communities understand how antimicrobial resistance changes in the infant gut microbiome over the first two years of life.

ANTI-MICROBIAL PAPER EFFECTS ON STRAWBERRIES

Presenter(s): Camille Pruitt (Texas Southern University)
Microbiology Immunology and Infectious Disease
Mentor(s): Eva Almenar Rosaleny (College of Natural Science)

Strawberries are highly perishable with a short shelf life due to their high moisture content and susceptibility to mold and bacterial contamination. Anti-microbial paper is a type of paper containing antimicrobial agents that inhibit bacteria and fungi growth. This helps with spoilage and extends the shelf life of strawberries. The paper can help regulate moisture levels around the strawberries, preventing them from becoming too dry or too moist. Overall, anti-microbial paper serves as a packaging innovation that helps maintain the quality and extend the shelf life of strawberries. Anti-microbial paper is important for dealing with strawberries because it enhances preservation, and spoilage, as well as, promotes food safety. In other words, the research's main objective is to evaluate whether anti-microbial paper can effectively reduce anti-microbial growth on strawberries, thereby preserving their quality and extending their shelf life. Its broader impact includes significant environmental benefits because the paper is biodegradable, economically efficient, and supports sustainable and healthier food systems.

INVESTIGATING THE ROLE OF TGF-B IN A NOVEL ALVEOLAR-LIKE MACROPHAGE MODEL

Presenter(s): Sydney Green (Indiana University)
Microbiology Immunology and Infectious Disease
Mentor(s): Andrew Olive (College of Osteopathic Medicine)

Alveolar macrophages (AMs), are resident immune cells within the alveoli of the lungs that play crucial roles in maintaining pulmonary homeostasis and responding to inhaled stimuli. However, AMs are challenging to model ex vivo. Our lab developed a new immune cell model known as fetal liver-derived alveolar-like macrophages (FLAMs) that exhibit similar characteristics to AMs offering a platform to investigate lung immune responses. For FLAMs to maintain long-term stable population of cells that are phenotypically and functionally similar to AMs they require the cytokines GM-CSF and TGF-β. Yet how TGF-β controls the AM-like state and alters inflammatory responses remains unknown. We aim to leverage FLAMs to understand how TGF-β is maintaining the AM-like state. Preliminary data suggest that TGF-β modifies the cytokine responses of FLAMs to pathogen derived stimuli, including changes in type interferon (IFN) and other pro-inflammatory cytokines. I hypothesize that TGF-β alters the inflammatory state of FLAMs and AMs. I cultured FLAMs with and without TGF-β and stimulated these cells with distinct immune activators. To examine changes in inflammation, I measured the expression and secretion of IFN and the cytokines TNF and IL6. To measure gene expression RNA extractions were performed from FLAMs and quantitative polymerase chain reaction (qPCR) was employed to determine the expression levels of target genes. In parallel, I used Enzyme-Linked Immunos

MICROBIOME DEVELOPMENT AND BIFIDOBACTERIUM INFANTIS: IDENTIFYING A HUMAN MILK METABOLIZER IN STOOL SAMPLES OF THREE-MONTH-OLD MICHIGAN INFANTS

Presenter(s): Meredith Swanson (Wellesley College)
Microbiology Immunology and Infectious Disease
Mentor(s): Sarah Comstock (College of Natural Science)

Bifidobacterium infantis is an early colonizer of the infant gut with the relatively unique ability to break down complex carbohydrates in breastmilk known as Human Milk Oligosaccharides

(HMOs). B. infantis metabolizes HMOs into molecules known as short-chain fatty acids (SCFAs), the presence of which has been demonstrated to support healthy immune development and prevent serious intestinal complications for premature newborns. Previous work has suggested a decrease in the overall abundance of B. infantis in resource-rich nations over the past century. This research hopes to quantify the presence of HMO metabolism genes to identify and quantify the prevalence of this microbial partner in a cohort of breastfed and formula-fed three-month-old Michigan infants and continue to refine the methods used to do so. The assays conducted this summer seek to gain further insight into this trend while distinguishing B. infantis from closely-related microbes that do not share its capabilities to digest HMOs.

Neuroscience

EXPLORING THE PHENOTYPE OF OXYTOCINERGIC NEURONS OF THE PARAVENTRICULAR NUCLEUS

Presenter(s): Cole Parker (Michigan State University)
Neuroscience
Mentor(s): Alexa Veenema (College of Social Science)

Oxytocin is a highly conserved neuropeptide known to regulate various social behaviors, including social investigation, sociosexual motivation, and social play. Synthesized in the hypothalamus, oxytocinergic neurons dominate the supraoptic and paraventricular nuclei. Despite the well-understood role of oxytocin, limited research exists on the characteristics and functions of these oxytocinergic neurons within the paraventricular nucleus. The proposed study aims to explore the phenotype of oxytocinergic neurons in this region, investigating whether they co-synthesize glutamate, the primary excitatory neuromodulator, and/or GABA, the primary inhibitory neuromodulator. In situ hybridization using RNAscope will be performed to detect the presence of vGLUT2 mRNA, a marker for glutamatergic transmission, or GAD1, a marker for GABAergic transmission. The identification of markers for glutamatergic and/or GABAergic transmission could elucidate alternative signaling mechanisms or shed light on the ability of oxytocinergic neurons to modulate other circuits within their axonal or somatodendritic projections if co-release occurs. This research holds promise for better understanding the complex neurobiology underlying social behavior regulation and may offer insights into the development of treatments for social deficits in neuropsychiatric disorders.

DEVELOPING A CODING SCHEME FOR ASSESSING EMOTIONAL REGULATION OF INFANTS IN A STUDY FOR ASSESSING THE GUT MICROBIOME AND CHILD BEHAVIOR

Presenter(s): Alexa MacKersie (Michigan State University), Kanal Patel (Michigan State University)
Neuroscience
Mentor(s): Ann Alex (College of Human Medicine), Rebecca Knickmeyer (College of Human Medicine)

Emotional dysregulation in early childhood is associated with anxiety or depression later in life as children have been unable to learn and apply healthy behaviors to cope with negative feelings and events. Previous research suggests a connection between the gut microbiome and cognitive and emotional development, but it is unknown yet how the composition of the gut microbiome affects emotional regulation in infants. The purpose of this study is to eventually determine whether the gut microbiome has a significant impact on the development and ability of infants to utilize self-regulation. Infants (1-year old) completed the mask task paradigm where they were placed in a high chair in the center of the room along with an experimenter and their mother. Another experimenter came into the room and changed into four different masks behind the curtain and the infants' reactions were assessed for gaze aversion, looks to mother/experimenter, and self-regulatory behaviors. The interrater reliability tests conducted to analyze consistency between both coders for gaze aversion, looks to mother/experimenter, and self-regulatory behaviors produced intraclass correlation coefficients of 0.95, 0.99, and 0.99 respectively. The mean values of the three variables were 0.087, 0.536, and 0.003 respectively. Therefore, we have determined that the most common regulation behavior displayed within the infants is looking towards the mother/experimenter. The quantitative data collected will be

ROLE OF LATERAL ENTORHINAL CORTEX PROJECTIONS TO THE NUCLEUS ACCUMBENS IN ENCODING A CONTEXTUAL FEAR MEMORY

Presenter(s): Grace Stys (Michigan State University)
Neuroscience
Mentor(s): Alfred Robison (College of Natural Science), Andrew Eagle (University of Texas Dallas)

The lateral entorhinal cortex (LEC) is a brain region important in associative memory. The LEC contains a subpopulation of neurons that project to the nucleus accumbens (NAc; LECNAc), a region important in reward, avoidance, and motivated behavior. Glutamatergic projections from other regions (e.g. cortex, amygdala) to NAc become hijacked in neuropsychiatric diseases like depression and addiction, however, the role of LECNAc neurons are unknown. Because LEC mediates associative memory and NAc mediates motivated behavior, we hypothesized LECNAc neurons may mediate associative memories underlying motivated behavior via activation during encoding and retrieval of a contextual memory. To investigate this, we inactivated LECNAc neurons using DREADDs during contextual fear conditioning (CFC), specifically during the learning (encoding) and test (recall) period. Additionally, we performed CFC in a separate cohort and collected LEC tissue 1 hour post learning to test for c-fos immunohistochemistry, which is a protein marker of high neuronal activity. Inactivation of LECNAc neurons impaired contextual fear learning, but didn't affect the recall, suggesting LECNAc neurons are necessary for the encoding, but not the recall, of a contextual fear memory. Quantification of c-fos expression in LECNAc neurons suggested these neurons are activated by a novel context, rather than specifically during encoding or recall. These findings elucidated a previously unknown role of this understudied ne

UNDERSTANDING RELAPSING PAIN: EXPLORING HOW BLOCKING OPIOID RECEPTORS AFFECTS PAIN AND INFLAMMATION

Presenter(s): Trevor Moran (Michigan State University)
Neuroscience
Mentor(s): Aaryn Edwards (College of Natural Science), Geoffroy Laumet (College of Natural Science)

Chronic pain is a debilitating condition that can affect an individual's physical, emotional, and social well-being. Often overlooked and undertreated, millions of individuals globally experience chronic pain and yet the underlying mechanisms of its conversion from acute pain remain largely unknown. Therefore, there is an urgent scientific imperative to better understand this phenomenon. The purpose of this study is to test whether inflammation at a surgical incision site relapses when post-operative pain relapses. Relapsing pain after remission from postoperative pain can be studied using a rodent model of pain vulnerability called latent pain sensitization (LPS). To investigate the immunological response, we assess cytokine expression in mice after a plantar incision. The behavioral level of LPS will be studied by reinstating hyperalgesia after remission by administering naloxone through intraperitoneal (IP) injection and pain sensitivity will be assessed using the von Frey method at different time intervals after injection. The immune response after remission will be studied by administering naloxone and naltrindole through IP injection followed by immediate tissue collection. Cytokine response will be analyzed using quantitative polymerase chain reaction. It is hypothesized that inhibition of opioid receptors during LPS will result in an increase of pro-inflammatory cytokines and a decrease in anti-inflammatory cytokines, thus contributing to pain experienced during LPS.

HISTOLOGICAL ANALYSIS OF OCTOPUS SKIN TO IDENTIFY CELLULAR DAMAGE CAUSED BY NEUROPHYSIOLOGICAL RECORDINGS

Presenter(s): Shaun Subbaiah (Michigan State University)
Neuroscience
Mentor(s): Galit Pelled (College of Engineering)

Recent research on octopus arms reveals that each can function somewhat independently of the brain through structures similar to the spinal cord. This, coupled with their muscular, flexible structure, allows for efficient movement due to which studying their neurological function has become important. Electrodes are an important part of understanding neurological function and since octopuses have soft, slippery skin, attaching electrodes becomes challenging without piercing the skin with implanted electrodes. A new adhesive enables electrode attachment without causing damage, offering a less invasive alternative to implanted electrodes. Given that its use for octopuses is relatively new, it is important to test the safety of this new adhesive, on octopus skin. To assess this, we will compare octopus skin treated with the adhesive to untreated skin to identify if signs of skin damage are present and if so the extent of the damage. Skin segments will be cryostat-sliced to a thickness of approximately 20 microns, stained with H&E dye, photographed with a microscope, and analyzed using a visual analysis software to detect visible cell death. The presence of cell death, indicated by damaged cells, will be quantified across the segments. Comparing these results with control trials will help determine the extent of cell damage caused by the application of the adhesive. This will give us an understanding of the safety of this newly developed adhesive, helping determine its safety

DOES VASOPRESSIN (AVP) FACILITATE THE TRANSITION FROM JUVENILE TO ADULT SOCIAL BEHAVIORS? A LINK WITH AUTISM SPECTRUM DISORDER (ASD)

Presenter(s): Lymelsie Aponte Ramos (University of Puerto Rico at Cayey)
Neuroscience
Mentor(s): Alexa Veenema (College of Social Science), Bridgette Weiss (Colleg eof Natural Science), Samantha Bowden (College of Natural Science)

Autism spectrum disorder (ASD) is characterized by lifelong difficulties with social interactions. Clinical studies in males with ASD demonstrated that increasing vasopressin (AVP) signaling in children while decreasing it in adults improved their social interactions. Research comparing juvenile and adult rats unveiled age-related structural changes in the brain's AVP system that influence age-specific social behaviors. Notably, juveniles have fewer AVP-immunoreactive cells in the bed nucleus of the stria terminalis (BNST) and medial amygdala (MeA) compared to adults. This study aims to determine whether AVP facilitates the transition from juvenile to adult social behaviors using juvenile and adult Wistar rats. We will specifically address two unanswered research questions: (1) whether opposite-sex preference, a proxy for sociosexual motivation, is an adult-specific behavior, and (2) whether the age difference in AVP-immunoreactive cell number corresponds with an age difference in AVP -mRNA+ cell number. We hypothesize that juveniles will not show an opposite-sex preference and will have fewer Avp- mRNA+ cells in the BNST and MeA compared to adults. We will employ the 3-chamber test to observe interactions of juvenile female and male rats with novel juvenile rats of both sexes. Additionally, we will use fluorescent in situ hybridization to quantify AVP- mRNA+ cells in the BNST and MeA of juvenile and adult rats. These findings may validate the 3-chambe

APOLIPOPROTEIN E EXPRESSION IN THE ENTERIC NERVOUS SYSTEM

Presenter(s): Lisandra Arroyo (University Ana G Mendez at Gurabo Puerto Rico)
Neuroscience
Mentor(s): Brian Gulbransen (College of Natural Science)

The enteric nervous system (ENS) is a dense network of neurons and glia in the gastrointestinal tract that commands gut functions. Enteric glia monitor synaptic activity and regulate the ENS functions. Astrocytes, an important glial type of the Central Nervous System (CNS), express apolipoprotein E (APOE), a protein responsible for regulating cholesterol and lipids. We hypothesize that the enteric glia expresses APOE, and this expression changes during gut pathology. We tested it using fluorescence immunohistochemistry (IHC) to label APOE, neuron, and glial markers in the myenteric plexus of the distal colon. Nine to eleven weeks old induced with dinitrobenzene sulfonic acid (DNBS) male wild-type mice were used as an animal model of gut pathology associated with inflammation and compared with Normal Handled (NH) male wild-type mice. Tissue was collected, fixed, and dissected to have circular muscle-myenteric plexus preparations. Whole-mount preparations were treated with primary and secondary antibodies. Photomicrographs were acquired using a fluorescence microscope. Preliminary results were inconclusive, as APOE expression in expected punctate patterns was not observed. These results are a baseline for identifying if NMS changes the APOE expression. Subsequent experiments will involve varying conditions, such as antibody dilution and different tissue preparation, to further investigate APOE expression in enteric glia under pathological conditions.

ROLE OF VENTRAL TEGMENTAL AREA NEUROMEDIN-S NEURONS ON NUCLEUS ACCUMBENS CELLULAR ACTIVITY

Presenter(s): Christian Canino (University of Puerto Rico at Cayey)
Neuroscience
Mentor(s): Cristina Marie Rivera Quiles (College of Natural Science), Michelle Mazei-Robison (College of Natural Science)

Millions of Americans are affected by substance use disorder, and despite recent advancements in pain-relieving medication regulation, a large fraction of overdose deaths are due to the misuse of opioids. Understanding the neurobiological mechanisms underlying opioid use disorder might uncover innovative treatment strategies. Dopaminergic (DA) neurons in the ventral tegmental area (VTA) play a vital role in reward, including for drugs of abuse. Our lab identified a sub-population of VTA DA neurons that express the neuropeptide neuromedin-s (NMS), and NMS gene expression is upregulated following chronic morphine exposure. Additionally, we found that chemogenetic activation or inhibition of VTA NMS neurons promotes and inhibits morphine responses, respectively. Interestingly, these neurons project to the nucleus accumbens (NAc), another brain region critical for reward. We hypothesize that activation or inhibition of VTA NMS neurons will promote or decrease cellular activity in the NAc, respectively, and that this regulation will occur both in the absence and presence of morphine. To test this, we will perform immunohistochemistry to stain for c-Fos (a marker of cellular activity) in NAc slices from NMS-Cre mice and perform cell counts. We expect increased VTA NMS neuronal activity to promote NAc cellular activity, in the presence or absence of morphine.

Conversely, we expect VTA NMS neuronal inhibition to decrease the number of c-Fos-positive cells in the NAc. Collectively, th

LOCUS COERULEUS INVOLVEMENT IN VASCULAR CONTRIBUTIONS TO DEMENTIA

Presenter(s): Gian S. Correa (Pontifical Catholic University of Puerto Rico)
Neuroscience
Mentor(s): Scott Counts (College of Human Medicine)

Vascular risk factors such as hypertension are increasingly appreciated as major contributors to the development of Alzheimer's disease (AD) and related dementias. For instance, hypertension can lead to small vessel diseases such as arteriolosclerosis, which can manifest as cerebrovascular lesions (e.g., strokes) that damage the neurovascular unit in cognitive brain regions and exacerbate the impact of AD neuropathology on cognitive decline. In this regard, the extent to which degeneration of central nuclei regulating neurovascular function, such as the noradrenergic locus coeruleus (LC), contributes to the severity of small vessel disease in AD is an underexplored area. To elucidate the specific interactions between LC degeneration and vascular contributions to dementia in the absence of potentially confounding AD lesions, such as amyloid pathology, we experimentally lesioned the LC in spontaneously hypertensive stroke-prone rats (SHRSPs). Frozen cortical brain tissue samples from control and LC-lesioned animals (n = 8/group) will be evaluated by enzyme-linked immunosorbent assays (ELISAs) to quantify the levels of several markers of cerebrovascular dysfunction including ICAM and VEGF, which regulate endothelial barrier function and angiogenesis, respectively; IL-6, which is associated with vascular inflammation; and fibrinogen as a marker for blood-brain barrier integrity. These studies will shed light on the possible role of LC deafferentation in driving small vessel disea

EVOLUTIONARY PROTEOMICS APPROACH TO IDENTIFY PROTEINS ASSOCIATED WITH AGGREGATED TAU PROTEINS: FROM C. ELEGANS TO HUMANS EVOLUTIONARY PROTEOMICS APPROACH TO IDENTIFY PROTEINS ASSOCIATED WITH AGGREGATED TAU PROTEINS: FROM C. ELEGANS TO HUMANS

Presenter(s): Andrea Garcia (Universidad Ana G Mendez)
Neuroscience
Mentor(s): Irving Vega (College of Human Medicine), Shreesh Sammi (College of Human Medicine)

Tau aggregation is a pathological hallmark of a group of diseases referred to as tauopathies, with Alzheimer's disease (AD) being the most studied among them. Despite decades of research, the biogenesis of pathological tau is still poorly understood. In vitro studies indicated that a nucleation factor or inducer is required to promote the formation of tau filaments. In vivo studies revealed that tau-associated proteins and posttranslational modifications contribute to changes in tau protein dynamics, leading to the formation of pathological tau species. However, the association of tau with other proteins in the course of the biogenesis of pathological tau remains unknown. Therefore, we used an evolutionary proteomics approach to identify proteins that co-purified with aggregated tau in aggregation prone tau variants at different stages of tau-mediated neurodegeneration in C. elegans expressing human tau, a tauopathy mouse model (JNPL3) and AD. A gene ontology analysis of the identified proteins will reveal their known molecular and biological function, which will serve as foundation to study their role in the biogenesis of pathological tau and contribution to neurodegeneration.

ANALYSIS OF COCAINE SELF-ADMINISTRATION BEHAVIORS USING SUPERVISED MACHINE LEARNING

Presenter(s): Leo Pereira Sanabria (Michigan State University)
Neuroscience
Mentor(s): Amy Arguello (College of Social Science)

Exposure to drug-associated stimuli can elicit craving for drug, despite long periods of abstinence (incubation of craving). Operant self-administration is used to examine several behaviors in rodents: lever responding that results in 1) intravenous cocaine infusion paired with an explicit cue or environment: cocaine-taking, 2) no reward, cocaine-paired cue or context: extinction, and 3) presentation of the cocaine-paired cue or return to a cocaine-paired context with no reward: cocaine-seeking. We provide methodology 1) to collect high-quality videos of operant self-administration behaviors, 2) to obtain pose estimation data using the supervised machine learning software DeepLabCut, 3) to compare lever press data vs lever quadrant time generated from pose estimation data, and 4) to visualize unique behavioral motifs associated with specific phases of behavior using supervised machine-learning predictive classifiers (Simple Behavioral Analysis, SimBA).We find video acquisition to be efficient with the largest amount of troubleshooting needed to set up network training conditions. Using pose estimation outputs from DeepLabCut, we recapitulated lever press behavior results with quadrant time. Future work aims to use behavioral segmentation software to probe for behavioral patterns that: precede or proceed cocaine intake or rewarded lever presses, are specific to early vs stable self-administration or extinction responding, distinguish seeking behaviors within an extinctio

INVESTIGATING THE ROLE OF NEUROTENSIN RECEPTOR 2 NEURONS IN THE VENTROLATERAL PERIAQUEDUCTAL GRAY FOR REGULATION OF OBESITY.

Presenter(s): Charlotte Schultz (Michigan State University)
Neuroscience
Mentor(s): Gina Leinninger (College of Natural Science), Grace Lee (College of Natural Science)

Obesity is projected to reach nearly half of the population by 203o, but there are few effective treatments currently. Neurotensin (Nts), a neuropeptide with varied physiology regarding feeding behavior and locomotion, activates neurotensin receptor 2 (NtsR2) throughout the brain. In previous studies, the Lateral Hypothalamic Area (LHA) Nts neurons were implicated in suppressing feeding behavior and increasing locomotion. These LHA Nts neurons project to the Ventrolateral Periaqueductal Gray (vlPAG) in the brain, which is also implicated in both feeding and locomotion behavior. However, previous lab data showed when vlPAG NtsR2 neurons were activated, there was no impact on feeding, drinking, and locomotion. So, to see if these these neurons are responsible for any change in feeding and locomotion, we inserted inhibitory Designer Receptor Exclusively Activated by Designer Drug (DREADDi) within the vlPAG NtsR2 neurons and treated the mice with vehicle (control) or a DREADD ligand, Agonist 21 (C21), to see any effects on body weight, feeding, and drinking. Our data suggests that when these neurons are inhibited by C21, there was no change in feeding, drinking, and locomotion, implicating these neurons are not involved in those behaviors. For future studies, the vlPAG NtsR2 are also known to be involved in pain, so by implementing the same techniques, we could see if there is any change in nociception. Our study enhances the understanding of Nts pathways regulating obesity, thus

BUTYRATE PRODUCED IN THE GUT EPIGENETICALLY DRIVES AGGRESSIVE BEHAVIOR IN MALES

Presenter(s): Sidney Retama-Candelario (North Carolina Central University)
Neuroscience
Mentor(s): Alfred Robison (College of Natural Science), Daniela Anderson (Universidad Ana G. Méndez)

Aggression is an evolutionarily conserved and rewarding behavior that is vital to many organisms' survival, but inappropriate aggressive behavior is associated with violence and neuropsychiatric disease. The mechanisms that regulate aggression vary widely and involve multiple brain regions including the basolateral amygdala (BLA) and the lateral habenula (LHb), which drive rewarding and emotional behaviors. Aggression may be influenced by the gut-brain axis, a bidirectional communication network between brain and gut. Previous work from our lab positively correlated butyrate-producing gut bacteria with aggression in male mice. Butyrate, a short chain fatty acid byproduct of microbial fermentation, can cross the blood brain barrier and act as a histone deacetylase (HDAC) inhibitor, potentially changing chromatin state and gene expression in the brain. We hypothesize that butyrate is driving aggression by promoting acetylation of histone 3 (H3) in the LHb and BLA, thereby upregulating gene expression and driving neuronal activity that causes aggression. To test this, male mice were screened for aggression using the resident-intruder paradigm. They were then treated with sodium butyrate and rescreened to identify any changes in aggression scores. Tissue from the LHb and BLA was analyzed to measure levels of total H3 protein and acetylated H3 protein and these modifications were correlated with each subject's post-screen aggression score. If higher levels of H3 acetylation correl

FROM SLEEPLESS NIGHTS TO MOLECULAR INSIGHTS: MAPPING THE PERIODIC TABLE IN THE BRAIN DURING PREGNANCY

Presenter(s): Joselynn Reyes (University of Texas at El Paso)
Neuroscience
Mentor(s): Alexandra Yaw (College of Natural Science), Hanne Hoffmann (College of Natural Science)

During pregnancy, women report exacerbated sleep disturbances which can compromise both immune function and cognitive performance. One prevalent example of these disturbances involves disruptions to the circadian rhythm, affected by sleep-wake cycles that interact with endogenous circadian rhythms. In the brain, the superchiasmatic nucleus (SCN) is the primary regulator of circadian timekeeping in the body, allowing timed release of hormones and synchronization of physiological functions. Behaviors regulated by the SCN, i.e., hormone release patterns and sleep-wake cycles, adapt to changing physiological needs during pregnancy. Our preliminary data in mice has identified changes in circadian timekeeping of the SCN during pregnancy, indicating a potential change in neuronal function. One contributor to neuronal function is ion and element concentrations, such as iron and manganese. Other trace elements (TE), such as zinc and copper, in excess amounts have been linked to adverse pregnancy outcomes, yet their function in the brain during pregnancy has not been fully evaluated. This project seeks to examine the level and location of TEs in the SCN in pregnant and non-pregnant mice utilizing untargeted laser ablation time-of-flight mass spectrometry (LA-ICP-TOF-MS), combined with immunohistochemistry to identify specific neuronal populations with TE changes. As a functional readout of changes in SCN function, we will complete functional studies in PER2::Luciferase SCN explants pla

EVALUATING THE EFFICACY OF AN ENHANCER TRAP CRE-ERT2 MODEL TO TARGET SEMILUNAR GRANULE CELLS

Presenter(s): Isabel Rivera Correa (UPR Cayey)
Neuroscience
Mentor(s): Jessica Lahr (College of Human Medicine), Michael Williams (College of Human Medicine)

The hippocampus is a brain structure that is involved in learning and memory. The dentate gyrus is a brain region within the hippocampus that conveys information from the entorhinal cortex to other hippocampus regions. The principal neurons of the dentate gyrus are the granule cells (GC). GC excitability is regulated by both synaptic input and intrinsic properties. The tight regulation of dentate gyrus GC excitability is essential to creating new memories therefore, dysregulation of GC excitability can lead to memory problems and can also produce seizures. One important regulator of granule cell excitability are semilunar granule cells (SGC). Although this rare subtype of cells is also excited by cortical input, SGCs transform this activation to broad and durable inhibition of GCs through the recruitment of interneurons. Therefore, SGCs are thought to be important regulators that prevent hippocampal hyperexcitability. Even though SGCs have been known for over 15 years, there are no tools that give us specific access to these cells in animal models to be able to study their roles in vivo. Using a tamoxifen inducible Cre mouse model in the presence of Cre-on fluorescent protein allele, we are trying to target SGCs but GCs. Variables such as dose administration and sex in adult animals are being evaluated to determine if they impact the accessibility to SGCs. Specific labeling of SGCs vs GCs is assayed here by their distinct morphology and distribution. We present the specific s

MOLECULAR RESTORATION OF CARDINAL TRANSCRIPTION FACTORS IN BRAF HYPERACTIVE CORTICAL GABAERGIC INTERNEURONS TO RESCUE CELL FATE PROPERTIES

Presenter(s): Xaymarie Serrano (University of Puerto Rico, Cayey)
Neuroscience
Mentor(s): April Stafford (College of Human Medicine), Daniel Vogt (College of Human Medicine)

GABAergic cortical interneurons (CINs) are a group of cells with multiple qualities that acquire their properties through genetic programming, local environmental cues, and cellular signaling processes. Cellular signaling involvement is a recently recognized event that may connect the two latter processes and/or be independent of each. In neurodevelopment, the balance between somatostatin (SST) and parvalbumin (PV) expressing interneurons is extremely important. Our results demonstrate that genetically hyperactivating the MAPK pathway leads to increased SST interneurons at the expense of PV expressing interneurons. Our findings suggest that this pathway may be involved in cell fate properties. We also found that hyperactivity of this pathway suppressed two cardinal transcription factors (TFs) involved in cortical interneuron development: *Lhx6* and *Arx*. To provide a better understanding of how *Lhx6* and *Arx* influence the fate of SST/PV neurons, we plan to employ lentiviruses to upregulate their expression levels and assess whether this intervention can restore the balance between SST and PV populations. I will explore this in both in vitro primary neuron cultures and in vivo using cell transplantation. These experiments may provide new insights into how these cardinal TFs could influence CIN development and cell fate properties.

NECESSITY OF NEUROTENSIN SIGNALING VIA LATERAL HYPOTHALAMIC AREA NEUROTENSIN NEURONS AND ITS IMPLICATIONS FOR OBESITY TREATMENT

Presenter(s): Shayna Wexler (University of Central Florida)
Neuroscience
Mentor(s): Gina Leinninger (College of Natural Science), Katie Thompson (College of Natural Science)

Obesity is caused by excess calorie intake yet there remain few treatments to suppress feeding and support weight loss. Understanding how the brain regulates feeding and body weight could suggest approaches to treat obesity. Activating Neurotensin (Nts)-expressing neurons in the lateral hypothalamic area (LHANts neurons) restrains feeding, increases movement, and activates dopamine neurons that leads to weight loss suggesting that LHANts neurons and the signals they release may be useful to treat obesity. However, LHANts neurons express multiple signals, including GABA, galanin, CRH, and Nts itself, any of which might mediate weight loss. We hypothesize that LHANts neurons support weight loss via Nts, and therefore, that depleting Nts will promote weight gain and disrupt regulation of dopamine and other neurons necessary for proper control of body weight. To investigate this, we injected adult Ntsflox/flox mice in the LHA with either AAV-eGFP (Controls with intact Nts) or AAV-creGFP (Depletes Nts from the LHA). We will compare body weight, food intake, and amphetamine-induced locomotor activity between control and Nts-depleted mice to determine if lacking Nts alters feeding, movement and obesity. Additionally, we will use immunohistochemistry to determine if Nts depletion disrupts expression of other feeding-modulatory signals including tyrosine hydroxylase (TH, rate-limiting enzyme of dopamine synthesis). Overall, these findings will indicate the necessity of Nts signaling v

USING INTRINSIC SIGNAL OPTICAL IMAGING TO IDENTIFY THE LOCATION OF A FUNCTIONAL BARREL COLUMN IN MOUSE PRIMARY SOMATOSENSORY CORTEX FOR SUBSEQUENT TARGETED VIRAL INJECTIONS

Presenter(s): Mya Sebek (Michigan State University)
Neuroscience
Mentor(s): Shane Crandall (College of Osteopathic Medicine)

Intrinsic signal optical imaging (ISOI) is a useful, minimally invasive tool to localize precise neocortical regions activated by sensory stimuli. Specifically, ISOI takes advantage of the different absorption properties of oxygenated and deoxygenated blood to measure local changes in the hemodynamic response related to sensory-evoked neural activity. Researchers often use this method to identify cortical areas of interest for targeted electrophysiology recordings or pharmacological manipulation experiments. However, utilizing this method to guide microinjections of optogenetic viral vectors into cell-type-specific Cre-driver mouse lines would enable powerful optical control of genetically defined neurons with high temporal and spatial precision. The mouse whisker somatosensory system can be used to initiate precise sensory-evoked neural activity due to the correspondence between individual whiskers and functional cortical columns called barrels. This study aims to optimize the ISOI method for subsequent viral injections into whisker-related barrel columns by taking advantage of the mouse whisker somatosensory system. If successful, this approach will allow for new circuit-level studies investigating the spatial and temporal interactions between neural populations within the sensory cortex and between the sensory cortex and other cortical or subcortical regions.

Pharmacology & Toxicology

ESTABLISHING THE REPRODUCIBILITY OF AN IMMUNOCOMPETENT MOUSE MODEL FOR PROSTATE SPECIFIC MEMBRANE ANTIGEN (PSMA)-TARGETED RADIOTHERANOSTICS

Presenter(s): Christine Butawo (Wesleyan University), Isadora da Cunha Timochenco (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Carolina de Aguiar Ferreira (College of Human Medicine)

Purpose: Prostate cancer is the second leading cause of cancer deaths in men. Prostate-specific membrane antigen (PSMA) is a transmembrane glycoprotein that is overexpressed in most prostate cancers and serves as a target for PSMA-targeted therapies. While these therapies have shown promising results, their efficacy is limited by the heterogeneous expression of PSMA. This study aimed to evaluate whether varying levels of RM1-PSMA expression alters tumor growth patterns and PSMA uptake in an immunocompetent mouse model. Mthods: 1x105 murine prostate cancer RM1 sublines expressing varying levels of human PSMA (PSMA++ and PSMA+) were injected into the right shoulder of C57BL/6 mice (4 mice/group) on day 0. Tumor growth measurements were monitored on days 7 and 9. To assess if the PSMA uptake can serve as an imaging biomarker of cell surface PSMA expression, the positron emission tomography/ computed tomography (PET/CT) scan was performed on day 10, 2 h post tracer (68Ga-PSMA - 300 µCi) injection. After PET/CT scans, the mice were euthanized, and the tumor and organs of interest were collected for ex vivo biodistribution. Results: No significant difference was observed in the tumor growth pattern. This study was unable to evaluate the PSMA tumor uptake, due to its elimination via kidneys and bladder by the time of the analysis. Conclusion: This is a preliminary study, and further investigations are needed to better evaluate whether the PSMA uptake varies according to

EVALUATING THYROID HORMONE DYNAMICS ACROSS 3D HEPATOCYTE CULTURE METHODS FOR IMPROVED CHEMICAL TESTING RELEVANCE

Presenter(s): Sophia Caron (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Brian Johnson (College of Veterinary Medicine), Keri Gardner (College of Engineering)

Thyroid hormones (TH) regulate cellular energy use, but this regulation is lost when cells are cultured. Environmental chemicals can disrupt TH balance by affecting TH synthesis, transport, reception, and metabolism. To develop an assay to identify chemical exposures that may disrupt TH signaling, we set out to identify culture conditions that enabled responsiveness to TH while still maintaining drug metabolic capacity and a screenable microplate format. We used hepatoma cell lines, HepG2 and HuH7, and found the utility of 384-well plates were optimal for uniform spheroid formation and throughput capability. We then moved to primary human hepatocyte (PHH) cultures, but consistent with the literature, TH activity was lost in culture. We then tested over 55 unique conditions (n≥3) per 384-plate including well-plate formats and supplements like 2-Mercaptoethanol and sodium selenite. We found conditions that facilitated TH and/or chemical induction of mitochondrial membrane potential, fatty acid uptake, mitochondrial density, and Cytochrome P450 activity, though not achieving all targets in a single condition simultaneously. In our future work, we will continue to focus on modeling TH dynamics (physiological function) and chemical disruption while optimizing experimental conditions and exploring various emerging culture techniques (e.g. co-culture with nonparenchymal cells). Our

long-term goal is to develop improved models that can inform risk assessment and prevent adverse

INSIGHTS INTO THE TOXICITY OF MOLYBDENUM IN AN INSECT MODEL (GALLERIA MELLONELLA) FOR APPLICATIONS IN ATHEROSCLEROTIC CARDIOVASCULAR DISEASE

Presenter(s): Brianna Hofman (Grand Valley State University)
Pharmacology and Toxicology
Mentor(s): Maria Kwesiga (Grand Valley State University)

Atherosclerotic cardiovascular disease (ACD) is the leading cause of death worldwide (Khan 2020). ACD causes narrowing of blood vessels which causes heart attacks that are treated through the insertion of a permanent stent implant (Jukema 2012), but metal components often lead to complications. In contrast, biodegradable stents can promote more physiological vascular healing (Oliver 2021). Molybdenum(Mo), a potential biodegradable stent material, has excellent mechanical and degradation properties (Sikora-Jasinska 2022), but there are toxicity concerns. Galleria Mellonella (G. Mellonella) has emerged as a toxicity model due to their innate immune system, which is similar to the mammalian immune system (Tsai 2016). Their malpighian tubules are homologous to mammalian kidneys and may show changes in autofluorescent signals when exposed to Mo alluding to possible metabolic changes. G. Mellonella were injected with 0.1 mg/kg to 1g/kg body weight of Sodium Molybdate and observed over a 24-72h period. A dose-dependent effect was observed at different Mo concentrations. The survival of Mo treated larvae was significantly different compared to the positive control (Dimethyl Sulfoxide) treated larvae. Survival data showed Mo is nontoxic at low concentrations. Confocal and two-photon microscopic imaging was performed on isolated malpighian tubules to investigate biochemical changes. Autofluorescence was present and indicated the presence of metabolic species (N

PPAR DELTA AGONIST AS PROMISING TREATMENT FOR FATTY LIVER DISEASE

Presenter(s): Emma Korhorn (Ferris State University)
Pharmacology and Toxicology
Mentor(s): Tracey Ward (Ferris State College of Pharmacy)

Non-Alcoholic Fatty Liver Disease (NAFLD) has emerged as a global health concern, characterized by the accumulation of triglycerides within hepatocytes in the absence of excessive alcohol consumption. NAFLD is closely associated with lipid accumulation and metabolism, leading to an imbalance between lipid uptake, synthesis, and oxidation within hepatocytes. A pivotal aspect of this pathology involves disruptions in beta-oxidation, crucial for breaking down fatty acids in mitochondria, and reduces visceral fat around the liver. The impaired beta-oxidation contributes to the accumulation of lipid droplets, that lead to hepatocellular damage, inflammation, and visceral fat build-up. There are currently no clinical drugs available to treat this disease. Peroxisome proliferator-activated receptors (PPARs) are transcription factors that modulate gene expression, influencing various downstream biochemical pathways crucial in lipid metabolism. PPAR-delta, a nuclear receptor involved in the regulation of lipid metabolism and energy homeostasis, plays an important role in the context of NAFLD. Molecular modeling software (MOE) was used to identify PPAR-delta agonists capable of enhancing beta-oxidation and lipid metabolism, thereby reducing hepatic visceral fat. Preliminary results show these compounds effectively promoted beta-oxidation, thus enhancing lipid oxidation and improving visceral fat accumulation around the liver.

EVALUATING THE CEREBROVASCULAR EFFECTS OF P2Y12 ANTAGONISTS IN THE CONTEXT OF HYPERTENSION

Presenter(s): Megyn McCoy (Purdue University)
Pharmacology and Toxicology
Mentor(s): Adam Lauver (College of Veterinary Medicine)

Hypertension affects about half of the American population aged 20 and older and is a significant risk factor for the development of arterial thrombosis. P2Y12 antagonists, such as clopidogrel and ticagrelor, are the most frequently prescribed anti-platelet drugs for the management of arterial thrombosis. Although effective, these drugs have been shown to increase the occurrence of cerebral microbleeds that can lead to hemorrhagic strokes. While it is commonly thought that bleeding is solely due to the inhibition of P2Y12 receptors on the platelets, a previous study conducted in our laboratory indicates that platelet inhibition may not be the only mechanism causing bleeding. Additional studies have demonstrated that hypertension impairs the cerebral vasculature, including impairment of cerebral blood flow and an increase in blood-brain barrier permeability (BBB). However, the effect of P2Y12 antagonists on the cerebral vasculature in the context of hypertension is not yet completely understood. Our study aims to assess the cerebral vasculature effects of P2Y12 inhibition in hypertension by treating hypertensive C57BL/6N mice with either clopidogrel or ticagrelor. Hypertension will be induced using Angiotensin-II filled micro-osmotic pumps. Then, vital measurements, such as tail cuff blood pressure and pial arterial blood flow, will be measured. Furthermore, BBB permeability will be assessed via 4kDa FITC-labeled dextran (FD-4). The overarching go

DETECTION OF TISSUE TRANSGLUTAMINASE IN PLASMA BY QUANTITATIVE WESTERN BLOT

Presenter(s): Alicia Taylor (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Adam Lauver (College of Veterinary Medicine), James Luyendyk (College of Veterinary Medicine)

Fibrinogen circulates in plasma and upon activation of the blood clotting cascade plays a key role in forming fibrin clots. The transglutaminase FXIII circulates in complex with fibrinogen in plasma and plays a key role in cross-linking fibrin clots. Another transglutaminase called tissue transglutaminase (TG2) can also cross-link fibrinogen, albeit at different sites than FXIII. Notably, TG2 plasma levels are typically very low. An increase in TG2 in the plasma could have profound impact on fibrinogen clotting function, but there are currently no validated assays for the detection of plasma TG2 outside of mass spectrometry. We hypothesized that plasma TG2 can be detected in plasma using a quantitative western blot. Various amounts of recombinant mouse TG2 (10-10,000 pg) will be separated under reducing conditions using SDS-PAGE, proteins transferred to PVDF membrane, and TG2 detected using a knockout-validated polyclonal rabbit anti-mouse TG2 antibody. We anticipate observing a single band representing TG2 around its predicted MW (78kDa) and increasing band intensity aligned with the amount of recombinant protein loaded. Subsequent validation using plasma samples from wild-type and TG2-/- mice will validate specificity and capacity to detect TG2 in plasma from both naive mice and mice with acute tissue injury. These results would suggest that quantitative western blots can be used in the future to detect the levels of TG2 in plasma.

TRANSFER OF A CONJUGATIVE PLASMID CONTAINING ESBL RESISTANCE FROM A UPEC ESCHERICHIA COLI STRAIN TO A GUT COMMENSAL E. COLI

Presenter(s): Natasha Borges (Universidad de Puerto Rico Recinto de Mayagüez)
Pharmacology and Toxicology
Mentor(s): Charles Whitehead-Tillery (College of Natural Science), Linda Mansfield (College of Veterinary Medicine)

Centers for Disease Control report that 50% of antibiotic-resistant cases in the US are due to Extended-Spectrum Beta-Lactamase producing bacteria (ESBLs). ESBL infections are often obtained in the hospital setting, however, they can also occur outside hospitals in the community. This is due to the interactions between humans, livestock and companion animals that carry ESBL-producing bacteria. We hypothesized that our human and dog derived *E. Coli* donor samples will transfer ESBL resistance to our recipient commensal *E. coli* derived from a human fecal sample via conjugation. We performed an in vitro study where we used a bacterial donor and a recipient. The donor was an *E. Coli* isolate with ESBL resistance derived from human and dog urine samples. The recipient is a commensal *E. coli* isolate from a human fecal sample transplanted into a mouse model. The recipient E. coli is without ESBL resistance, but contains a fluorescent marker called M-scarlet. We mixed the donor and the recipient together and placed them on an LB plate without any antibiotics so they could grow and interact. After 24 hours, we took samples from these plates to perform serial dilutions. Six tenfold serial dilutions were plated on antibiotic plates containing Cefotaxime and/or Kanamycin to isolate donors recipients and transconjugants from the original growth cultures. We verified these plates in a fluorescent microscope so we could see if the m-scarlet florescent protein

TISSUE TRANSGLUTAMINASE-INDUCED FIBRINOGEN CROSS-LINKING REDUCES FIBRIN CLOT TURBIDITY WITHOUT IMPACTING FIBRIN SOLUBILITY

Presenter(s): Riley Wimberley (Michigan State University)
Pharmacology and Toxicology
Mentor(s): James Luyendyk (College of Veterinary Medicine)

Activation of the blood coagulation cascade generates the coagulation protease thrombin. Thrombin cleavage of fibrinogen is the first step in formation of fibrin polymers, a key component of blood clots. Fibrin polymers are cross-linked by the transglutaminase coagulation factor XIII, which circulates in plasma in complex with fibrinogen. Extravascular fibrin(ogen) deposits are also subject to cross-linking by another transglutaminase, termed tissue transglutaminase (TG2). Unlike FXIII, TG2 cross-links fibrinogen monomer even in the absence of coagulation cascade activation. The impact of TG2 on fibrin clot formation is underexplored, and the impact of TG2-mediated fibrinogen crosslinking on the structural and functional properties of fibrin clots is not known. We determined the impact of TG2 on fibrin clot turbidity and fibrin(ogen) solubility using in vitro clotting assays. The turbidity assay measures clot formation by monitoring absorbance increase over time, indicating fibrin network formation. The solubility assay evaluates clot stability by measuring fibrinogen resistance to solubilization using antibodies and substrates. In the turbidity assay, TG2 significantly altered clot formation compared to clots formed by thrombin only. TG2 imposes a reduction in turbidity, suggesting a less dense fibrin network formation. Complimentary to this, in the solubility assay, thrombin induced clots formed in the presence of TG2 had a lower resistance to solubilization compared t

THE ROLE OF INFLAMMATION IN CHLOROPICRIN AND NITROGEN MUSTARD INDUCED DERMAL AND OCULAR INJURY

Presenter(s): Yasmine Cannon (Johnson C. Smith Univeristy)
Pharmacology and Toxicology
Mentor(s): Neera Tewari-Singh (College of Osteopathic Medicine)

Chemical warfare agents such as sulfur mustard (SM) also known as mustard gas, and chloropicrin (CP) are very toxic and have adverse effects on the body. These chemicals have been used in world wars and are known to damage the eyes and skin, resulting in severe ocular and skin irritation. The mechanism of SM and CP-induced ocular and dermal inflammation is poorly understood. Our studies have shown an inflammatory response after exposure to NM or CP and this experiment will further confirm that the neutrophils infiltrate during the chemical-induced inflammation in the eye and skin tissues. Using immunohistochemistry (IHC) and Qualitative Polymerase Chain Reaction (qPCR), we will test the hypothesis that there is an increase in neutrophils [myeloperoxidase (MPO) positive cells] after exposure to the chemical agents. The left eye of 4-6 weeks old male Balb/c mice was exposed to 10 % CP for 1 min, and eye tissue was collected at 6 hours, 7-, and 28 days post-exposure while control mice were exposed to DMSO only. For NM exposure, the shaved dorsal skin of 5-9 week-old male C57Bl/6 mice was exposed to either 0.5 mg of NM dissolved in 100 ul of acetone or acetone alone. Our results show that there was an increase in MPO-positive cells in both ocular and skin tissues after exposure, which indicates that there was an increase in the infiltration of neutrophils and expression of inflammation following exposure. We are further assessing inflammator

EFFICACY OF ANTI-IL-5 IMMUNOTHERAPY FOR OZONE-INDUCED RHINITIS IN DIABETIC MICE

Presenter(s): Nailah Frazier (Spelman College)
Pharmacology and Toxicology
Mentor(s): Jack Harkema (College of Veterinary Medicine), James Wagner (College of Veterinary Medicine)

Ozone is a common air pollutant that is produced by the reaction of volatile organic chemicals and ultraviolet radiation from the sun. Inhalation exposure to ozone can produce nasal and pulmonary airway irritation and is particularly harmful to sensitive populations. Epidemiological studies suggest an association of type 2 diabetes morbidity with ozone exposure. Using diabetic mice, we have previously described epithelial injury and remodeling in pulmonary airways that is accompanied by a robust and persistent infiltration of eosinophils. Intervention with an antibody directed against interleukin-5 (IL-5), a growth factor and chemoattractant for eosinophils, attenuates both eosinophilic inflammation and epithelial remodeling. The role of eosinophils and IL-5 in ozone-induced rhinitis has not been studied in diabetic mice. To test the hypothesis that ozone-induced airway injury in the nose of diabetic mice is dependent on eosinophils, insulin-resistant diabetic KKAy mice were exposed to 0 or 1 ppm ozone for 2 weeks (4h/day, 4 days/wk), and treated with control IgG or anti-IL-5 twice a week. Twenty-four hours after the last exposure mice were euthanized and nasal tissues were processed by histological and immunohistological methods. Morphometric evaluation of eosinophils and intraepithelial mucosubstances was conducted using QuPath digital software. Our results demonstrate that ozone induces site-specific lesions with eosinophil recruitment and increased epithelial m

A NOVEL MECHANISM FOR OBESITY-DRIVEN BREAST CANCER: IMPLICATIONS FOR DRUG RESISTANCE

Presenter(s): Helagenet Hailu (College of William and Mary)
Pharmacology and Toxicology
Mentor(s): Jamie Bernard (College of Human Medicine)

Tamoxifen is an endocrine therapy that is effective in blocking estrogen activity and slowing the growth of estrogen receptor positive breast cancer cells. However, it has been observed that a significant proportion of women with high-grade breast cancer who receive tamoxifen will eventually become refractory to the treatment, leading to tumor recurrence. Previous studies provide evidence supporting endocrine therapy, specifically tamoxifen, were less favorable in women with obesity. This suggests that obesity may play a role in altering the response to tamoxifen treatment. A recent study conducted by Wellberg et. al. found that when mice are fed a high-fat diet, mammary adipocytes release fibroblast growth factor (FGF)1, which drives estrogen receptor positive tumor growth through fibroblast growth factor receptor-1 activation even in the presence of tamoxifen. Our laboratory demonstrated that FGFs released from adipose tissue drive malignant transformation of estrogen receptor negative mammary epithelial cells through the activation of FGFR1. Collectively, these data support an estrogen-independent mechanism of carcinogenesis promoted by adipocytes. My aim is to determine how FGFs and/or FGFR activation contributes to tamoxifen resistance of estrogen positive breast cancer. Preliminary data demonstrates that FGF1 treatment induces kynurenine, an endogenous activator of the aryl hydrocarbon receptor (AhR), in tamoxifen-resistant estrogen receptor positive cells. Our lab has

OPTIMIZING TECHNIQUES TO VISUALIZE THE MICROTUBULE ARCHITECTURE OF THE BRAIN

Presenter(s): Vrinda Khullar (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Adriana Ponton Almodovar (College of Human Medicine), Sachi Horibata (College of Human Medicine)

Platinum-based chemotherapy drugs are important for treating ovarian cancer; however, they are associated with detrimental neurocognitive side effects, also known as 'chemo brain.' Recently, we discovered that platinum not only targets cancer cells, but also the microtubules and we know that microtubules are important architecture for the neuronal networks. This interaction could highlight the structural disruptions observed in the brains of patients undergoing chemotherapy treatment, which can potentially contribute to their cognitive decline. My project aims to develop and optimize imaging techniques to visualize these effects. By employing immunohistochemistry staining, we want to be able to visualize the localization and impact of platinum on the microtubular architecture of the brain. This research advances our understanding of the neuropathological effects of platinum-based chemotherapy and can set the stage for the development of targeted interventions to mitigate its side effects. Our findings hold significant implications for improving the quality of life and treatment outcomes for cancer patients.

ALTERATION OF BIO ISOSTERE LINKER OF SOLUBLE EPOXIDE HYDROLASE INHIBITORS IMPROVES EFFICACY AND BLOOD-BRAIN PENNETRATION

Presenter(s): Charlotte Krollman (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Kin Sing Lee (College of Osteopathic Medicine)

Soluble epoxide hydrolase (sEH) is an enzyme involved in the degradation of expoxy fatty acids (EEts) to less active, pro inflammatory diols. Alzheimer's data shows that SEH is at a higher concentration compared to healthy brains. The benefits of inhibition by knockout of sEH have shown to alleviate tauopathy and neuroinflammation in an animal model. Current candidates lack blood-brain barrier penetration and solubility.

IMPACT OF ADIPOGENESIS REGULATORY FACTOR ON ASTROCYTE QUANTITY AND ACTIVATION STATE IN THE CORPUS CALLOSUM OF MALE AND FEMALE MICE

Presenter(s): Taylor Lewis (University of Michigan - Ann Arbor)
Pharmacology and Toxicology
Mentor(s): Anne Dorrance (College of Osteopathic Medicine)

Hypertension, a major risk factor for vascular dementia, leads to chronic cerebral hypoperfusion by impairing the structure and function of cerebral arteries. As a potential mouse model of hypertension, we used Adipogenesis Regulatory Factor (ADIRF) mutant mice. The ADIRF gene regulates vascular smooth muscle homeostasis in humans, however it is not present in mice. We hypothesized that genetically modified ADIRF(+) mice will have decreased outer diameter, lumen diameter, and wall thickness in cerebral parenchymal arterioles (PAs), and increased quantity of astrocytes compared to wild-type(WT) mice. Pressure myography was used to structurally assess PAs in nine to ten-month-old male and female ADIRF(+) mice. PAs from male and female ADIRF(+) mice did not show reductions in outer diameter (WT: 30.95 ± 3.0, Male ADIRF(+): 41.15 ± 3.5μm, p=0.1347; WT: 34.95 ± 2.2, Female ADIRF(+): 38.57 ± 1.4μm, p=0.1911), lumen diameter (WT: 28.00 ± 2.81, Male ADIRF(+): 34.67 ± 3.26μm, p=0.1812; WT: 28.76 ± 2.3, Female ADIRF(+): 31.85 ± 1.5μm, p=0.2818), or wall thickness (WT: 3.38 ± 0.22, Male ADIRF(+): 3.24 ± 0.27μm, p=0.7157; WT: 3.23 ± 0.78, Female ADIRF(+): 3.42 ± 1.1μm, p=0.4174) compared to their age-matched wild-type controls. We are currently performing immunostaining experiments to assess the activation state and quantity of astrocytes in the corpus callosum of ADIRF(+) mice.

OVEREXPRESSION OF ENZYMES GLUTAMIC-PYRUVIC TRANSAMINASE 2 (GPT2) AND GLUTAMINASE (GLS) UTILIZE GLUTAMINOLYSIS FOR ENERGY PRODUCTION AND PROLIFERATION IN TREATMENT-RESISTANCE OVARIAN CANCER CELLS.

Presenter(s): Bella Morris (Spelman College)
Pharmacology and Toxicology
Mentor(s): Sachi Horibata (College of Human Medicine)

Background: Ovarian cancer is known to be one of the leading causes of cancer death among women. The malignant tumor cells localize in the ovaries and attack the surrounding reproductive organs of individuals causing metastatic growth, illness, and leading to death. According to the American Cancer Society, 1 out of 87 women is at risk for developing ovarian cancer while 1 in 30 is at risk of dying from his disease. This is credited to the fact that most individuals have poor prognosis and are diagnosed at an advanced stage. Current treatment for individuals is a platinum-based chemotherapy drug (Cisplatin or Carboplatin) combined with paclitaxel. However, patients who have grown resistant to platinum treatment have shown an overexpression of glutaminase (GLS) and glutamic-pyruvic transaminase 2 (GPT2) in their tumor cells. GLS is a critical enzyme in cell energy production, facilitating a conversion between glutamine and glutamate. GPT2 is another vital enzyme that catalyzes glutamate and yields alpha-ketoglutarate and contributes to glutaminolysis and the TCA cycle for cell metabolism. We hypothesize that the overexpression of GLS and GPT2 in ovarian cancer cells depicts an increase in metabolism in glutaminolysis, providing an ongoing supply of enzymes to the TCA cycle and enhancing resistance to platinum-based treatment.

THE ROLE OF OBESITY IN TAMOXIFEN-RESISTANT ER+ BREAST CANCER CELL GROWTH

Presenter(s): Vivian Morris (University of Toronto)
Pharmacology and Toxicology
Mentor(s): Jamie Bernard (College of Human Medicine)

Tamoxifen is a key therapeutic for estrogen receptor positive (ER+) breast cancers. One challenge with tamoxifen therapy is the development of resistance. Obesity has been shown to promote higher incidence of endocrine therapy resistance. Wellberg et al. published that adipose tissue-derived fibroblast growth factor (FGF)-1 supports breast cancer through FGF receptor-1 (FGFR1) activation. Our laboratory identified FGF2, another FGFR1 activator, as an adipose-derived growth factor that promotes malignant transformation of ER negative breast cancer cells. FGFR1 inhibitors have significant toxicity and drug resistance in humans, so uncovering downstream mechanisms of FGFR1 activity will reveal novel therapeutic targets. RNA-seq data demonstrated that FGF1 treatment of MCF7 and TAMR-7 cells stimulated angiopoietin-like 4 (ANGPTL4) gene expression. ANGPTL4 inhibits lipoprotein lipase, plays a role in attenuating fatty acid oxidation, and is associated with poor survival in breast cancer patients. Despite the promising RNA-seq data, our lab found that FGF1 and FGF2 did not induce ANGPTL4. We then hypothesized that peroxisome proliferator-activated receptor beta/delta (PPARβ/Δ), a nuclear hormone receptor that is known to activate ANGPTL4, may be responsible for adipocyte-induced expression of ANGPTL4 and growth. To test this hypothesis we cultured TAMR-7 cells with fat and a PPARβ/Δ antagonist, then evaluated the expression of ANGPTL4. Understanding the mechanisms b

IDENTIFYING THE MECHANISM OF CHLOROPICRIN AND NITROGEN MUSTARD-INDUCED FIBROSIS

Presenter(s): Shambhvi Ojha (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Neera Tewari-Singh (College of Osteopathic Medicine)

Chemical exposure to skin and eye tissues may result in injury, inflammation, and long-term effects, including fibrosis. Our preliminary data show that ocular exposure to the pesticide chloropicrin (CP) and skin exposure to the vesicating agent nitrogen mustard (NM) cause severe injury to these tissues in mice. Literature supports that scar tissue and excess collagen are indicative of tissue damage due to chemical exposures, leading to fibrosis. However, the occurrence and mechanisms of both CP-induced ocular and NM-induced dermal fibrosis have not been studied. Previous studies suggest that myofibroblasts (alpha-smooth muscle actin positive cells) play a critical role in the development of fibrosis. Here, we use quantitative polymerase chain reaction (qPCR) to quantify the expression of alpha-smooth muscle actin (α-SMA) in mice tissue with CP-induced ocular injury (male Balb/c mice) and NM-induced dermal injury (male C57BL/6 mice) where fibrotic features were observed via histology. To confirm the qPCR results, α-SMA protein expression was quantified using immunohistochemistry (IHC-P) analysis. The qPCR data suggests that with chemical exposure to the eye and skin tissues, there is an increase in the relative expression of α-SMA compared to control samples. These findings are supported by the IHC results. These results provide evidence that both CP and NM exposures can cause fibrosis, facilitating the identification of their long-term toxic effects and as

EXPLORING THE MECHANISM UNDERLYING PIEZO1-MEDIATED CALCIUM INFLUX AND EXTRACELLULAR VESICLE PRODUCTION

Presenter(s): Rozita Shafiq (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Masamitsu Kanada (College of Human Medicine), Najla Adel Saleh (College of Human Medicine)

Piezo1, a mechanosensitive ion channel, plays a critical role in various physiological processes, including mechanotransduction and cellular signaling. This research project hypothesized that activating Piezo1 would create a calcium influx, inducing extracellular vesicle (EV) production. We explored the potential therapeutic applications of EVs, aiming to increase their release. Using Yoda1, a known agonist for Piezo1, we sought to enhance Piezo1 activation and subsequently increase EV release. The study employed a combination of molecular biology techniques, alongside calcium influx assays and bioluminescence data analysis. Our findings provide insights into the mechanisms of Piezo1-mediated EV production and suggest potential strategies for developing new therapeutics based on enhanced EV release.

ROLE OF ANGIOSTATIN IN ACETAMINOPHEN-INDUCED LIVER INJURY

Presenter(s): Kevin Conzemius (Michigan State University)
Pharmacology and Toxicology
Mentor(s): Bryan Copple (College of Human Medicine)

Acetaminophen (APAP) overdose is a leading cause of liver injury in the United States. In a majority of patients, activation of liver repair leads to a full recovery. In a small fraction of patients, however, liver repair processes fail leading to the development of acute liver failure (ALF). The mechanistic basis for deficient liver repair in these patients remains largely unknown, although, findings from our laboratory suggest that this may result from disruptions to fibrinolysis. To examine this further, we determined the impact of ALF on levels of plasminogen, a key component of fibrinolysis. In mice treated with 600 mg/kg APAP (AALF), a dose of APAP that produces ALF, blood plasminogen levels were reduced compared to vehicle-treated mice or mice treated with 300 mg/kg APAP (AALI), a dose that fails to produce ALF. Despite these findings, plasminogen protein levels in the livers of AALF mice were greater when compared to control mice and similar to that in AALI mice. Notably, levels of a proteolytic fragment of plasminogen, referred to as angiostatin, were lower in AALF mouse livers compared to AALI mice. To determine whether this reduction contributed to failed liver repair, ALF mice were treated with recombinant angiostatin. Treatment with angiostatin increased measures of inflammation and enhanced evidence of hepatic vascular injury indicating that angiostatin is detrimental to outcome in AALF. Collectively, these studies suggest that angi

Physical & Mathematical Sciences

NUCLEAR ASTROPHYSICS - 3D FITTING OF PARTICLE TRACKS IN A TIME PROJECTION CHAMBER.

Presenter(s): Bhavya Jain (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Christopher Wrede (College of Natural Science)

In binary star systems featuring a neutron star and a hydrogen-rich companion, the mass transfer onto the neutron star's surface can ignite intense X-ray bursts known as Type I X-ray bursts (XRBs). These bursts, reaching temperatures between 1 to 2 billion degrees Kelvin, trigger nuclear reactions that synthesize elements beyond hydrogen and helium. The rate of a critical reaction, 15O(α,γ)19Ne, plays a pivotal role in determining the behavior of these bursts, influencing their light curves and the abundances of the produced elements. Experimental investigation of this reaction is crucial for accurate astrophysical modeling. The FRIB experiment E21072 aimed to measure $^{15}O(\alpha,\gamma)^{19}Ne$ using the GADGET-II system [2] filled with P10 gas (90% Ar, 10% Methane), which acts as a detection medium via the creation of ionization electrons. The goal of the experiment was to measure a finite value for the alpha particle branching ratio of the 4034- keV state of ^{19}Ne which is the last piece of information to determine the reaction rates. ^{20}Mg -decay was used to populate the state. The experiment generated data with millions of events classified into proton events and probable proton-alpha (p-α) events using a CNN model ensemble. These rare candidate p-α events require a rigorous process to determine the energy sharing between protons and alphas

INTERVALS IN PATTERN AVOIDING PERMUTATIONS

Presenter(s): Evan Calderon (Yale University)
Physical and Mathematical Sciences
Mentor(s): Brian Drake (Grand Valley State University)

This poster examines the weak order posets on permutations that avoid the patterns 132 and 312. These posets have nice recursive structures and are isomorphic to the shifted shape lattices, whose elements are Young diagrams above a staircase. We count the intervals of different types, including linear and Boolean intervals.

EDGE COVERS OF JOINED TADPOLE GRAPHS

Presenter(s): Jarrett Gadziemski (Grand Valley State University)
Physical and Mathematical Sciences
Mentor(s): Brian Drake (Grand Valley State University)

We investigate number sequences that arise from counting edge covers. An edge cover is a subgraph that includes all of the original vertices, such that every vertex has degree of at least one. A tadpole graph is a cycle and a path joined at an end vertex. The edge covers of tadpoles are known to satisfy nice properties like Fibonacci recurrences. In this project we study sequences of tadpoles joined head to tail. We use the Carlitz-Scoville-Vaughan theorem to find the recurrence relation for the number of edge covers.

THE HUNT FOR NEW NUMBER SEQUENCES IN THE UNION OF PATH AND CYCLE GRAPHS

Presenter(s): Bridget Rozema (Grand Valley State University)
Physical and Mathematical Sciences
Mentor(s): Brian Drake (Grand Valley State University), Feryal Alayont (Grand Valley State University)

This study focuses on the sequence of numbers formed by counting the edge covers of specific graph families. An edge cover is a subset of a graph where each vertex is adjacent to at least one edge. Using the known sequences derived from the path and cycle graphs (Fibonacci and Lucas, respectively), we examine how combining these two graph families together at certain vertices lead to new number sequences. We will employ various methods to find the sequences that arise from these combinations of path and cycle graphs, such as rocket and bolo tie graphs, and determine their properties.

CREATING AN ASSESSMENT ITEM TO ELICIT A BLEND OF SCIENCE AND MATHEMATICAL SENSEMAKING FOR STUDENTS IN INTRODUCTORY PHYSICS

Presenter(s): Sage Foster (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Rachel Henderson (College of Natural Science)

Students have many epistemological resources to use when encountering a complex problem. A framework we can use to understand how students approach such a task is a blend of science and mathematical (Sci-Math) sensemaking. While engaging students with Sci-Math sensemaking may be a goal in many introductory science courses, we have limited ways of assessing it directly. In this poster, we will discuss our efforts toward creating a physics task intended on eliciting students' Sci-Math sensemaking as a part of a larger multi-institutional and cross-disciplinary NSF award (DUE-2235487, DUE- 2235413, DUE-2235641, and DUE-2235311). Over the past year, we have leveraged the Three-Dimensional Learning Assessment Protocol, which includes core ideas, scientific practices, and cross-cutting concepts, and a modified version of Evidence Centered Design to develop an open-ended task centered around the core idea of Energy is Conserved. The task was given as an exam question in a calculus-based, introductory physics course. Here, we will present our development process as well as the Sci-Math themes from the students' responses.

PLASMA PHYSICS SIMULATION ON EXISTING QUANTUM COMPUTERS

Presenter(s): Rauan Kaldybayev (Williams College)
Physical and Mathematical Sciences
Mentor(s): Ryan LaRose (College of Engineering)

Particle-in-cell (PIC) is a class of computational methods in plasma physics where individual particles, whose positions and momenta occupy a continuous range, interact with fields defined on a mesh. PIC simulation has been successfully applied to study laser-plasma interactions, magnetohydrodynamics, magnetic reconnection, and more. In the application of PIC, one of the main limiting factors is the rapid scaling of computational complexity with system size. Luckily, PIC simulation seems to have certain desirable properties that allow it to benefit from quantum algorithms. A long-term overarching goal is to achieve exponential speedup in PIC simulation with the help of quantum linear solvers. A fully quantum implementation with exponential speedup is not feasible today due to noise. In this project, we tackle the short-term goal of implementing the complete PIC loop on existing quantum computers, constructing a hybrid quantum-classical solution using the variational quantum-linear solver (VQLS) algorithm. We demonstrate the feasibility of quantum PIC simulation and develop efficient field encodings. In addition to theoretical material, we present Python code in the Qiskit quantum simulator.

ALIGNING PREDICTIONS WITH OBSERVATIONS: PYTHON ANALYSIS OF MASS-LOSS IN TYPE 1A-CSM SUPERNOVAE

Presenter(s): Olivia Griffith (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Sumit Sarbadhicary (Ohio State University)

Type Ia-CSM are a rare subclass of supernovae (SNe) that exhibit pronounced interaction with circumstellar material (CSM), influencing their spectral characteristics. This subclass manifests hydrogen emission lines akin to Type IIn SNe, superimposed on an inherently over-luminous Type Ia spectrum. This study focuses on Type Ia-CSM SNe, exploring their mass-loss rates by leveraging Python tools. Utilizing data from 29 supernovae encompassing age, observed luminosity, and identifiers, we employed a Python Jupyter notebook to organize and analyze the dataset. Through iterative processes and scipy's interpolate.interp1d function, we aimed to predict luminosities closely matching observed values. This involved iterating over a range of mass loss rates, applying a luminosity calculation function, and identifying points on the luminosity curve where predicted and observed values aligned. The corresponding mass-loss rates at these points were recorded for each SN. This research contributes to understanding Type Ia-CSM SNe dynamics through computational modeling and radio observations, shedding light on possible progenitor scenarios through mass-loss behavior.

EXPLORATION OF WITTIG REARRANGEMENTS WITH SEVEN-MEMBERED RINGS

Presenter(s): Sandhya Manivasagam (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Robert Maleczka (College of Natural Science)

Wittig rearrangements are reactions whereby the deprotonation of an appropriately functionalized ether yields a restructured isomer by mechanisms involving either [1,2]-, [2,3]-, or [1,4]-shifts. Such rearrangements have potential in "green" organic syntheses due to their high atom economy. The [2,3]-Wittig rearrangement is the most thoroughly investigated, due in part to its concerted nature allowing the stereoselectivity of the reaction to be predictable. The mechanistic details of [1,2]- and [1,4]-Wittig rearrangements are less studied and their usefulness in syntheses less developed. This study looks to build on the prior art known for [1,2]- and [1,4]-Wittig rearrangements of six-membered dihydropyrans by applying those established protocols toward seven-membered tetrahydro-oxepins.

TRANSPORT PHENOMENA IN HIGH ENERGY DENSITY PLASMAS

Presenter(s): Fahliha Maisha (Stony Brook University)
Physical and Mathematical Sciences
Mentor(s): Luciano Silvestri (College of Natural Science)

On Earth, we live at an atmospheric pressure of approximately 1 atmospheres. However, at the core of the Earth, pressures can exceed 1 million atmospheres. These conditions create what are called high energy density plasmas (HEDP) in which electrons are partially degenerate and ions are strongly correlated. This unique state is also seen in many celestial systems such as in late stages of stars such as white dwarfs and neutron stars. HEDP can be reproduced on Earth through experiments; one example being inertial confinement fusion. HEDP experiments are difficult to diagnose and rely on multi-physics simulations, which in turn rely on material properties and accurate physical models. This project focuses on providing data and testing theoretical models of HEDP systems through molecular dynamics (MD) simulations. Being able to simulate these systems at an atomic scale allows for the study of macroscopic properties of HEDP. In this project, data such as the transport coefficients, diffusion and viscosity are calculated. Simulations primarily utilized Yukawa's potential; however, for one component cases, it was extended to using the Exact-Gradient corrected potential and Yukawa Friedel-tail pair potential. The calculated transport coefficients were compared between the various potentials in order to find which potential shows the most improvement and cost efficiency. Data from the Stanton-Murillo theoretical model is also compared to the simulation results.

THE SUPER LIFTED EULER CHARACTERISTIC TRANSFORM FOR THE ANALYSIS OF GRAYSCALE IMAGES

Presenter(s): Messiah Ridgley (Brandeis University)
Physical and Mathematical Sciences
Mentor(s): Elizabeth Munch (College of Natural Science)

The Euler Characteristic Transform (ECT) is a robust method for shape classification. It takes an embedded shape, and for each direction returns a curve that maps how the Euler characteristic of the shape changes across sublevel sets of the height function in that direction. It has been used in conjunction with machine learning tools for topological data analysis, with previous applications in plant and cancer biology. In this project, we define and bound the distance on the Euler Characteristic Transforms of two embeddings of the same abstract simplicial complex. Additionally, the Super Lifted Euler Characteristic Transform (SELECT) is a related tool that extends the ECT to fields, which can represent grayscale images. We bound the SELECT in a similar manner by restricting it to embedded complexes. Furthermore, we provide an implementation in an open source Python package.

IDENTIFICATION OF NEW TRANSITIONAL MILLISECOND PULSARS AND SPIDERS FROM MULTI-WAVELENGTH OBSERVATIONS

Presenter(s): Subhroja Roy (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Jay Strader (College of Natural Science)

Some neutron stars have hydrogen-rich companions in close orbits whose surfaces are ablated by the relativistic pulsar wind. The ionized material is blown off and absorbs or scatters radio emission, resulting in radio eclipses. These eclipsing millisecond pulsars are called "spiders", as the strong pulsar wind from the rotating neutron star can completely ablate the companion star, leaving nothing behind. This mechanism can explain the existence of isolated millisecond pulsars. A subclass of spiders, the transitional millisecond pulsars (tMSPs), transition between a rotation-powered state where the pulsar is active and disk-powered state where an accretion disk forms around the neutron star, allowing a window into the late stages of neutron star recycling. In the disk state of tMSPs, the system emits copious X-ray and optical emission and shows unusual strong and rapid variability. Only a handful of tMSPs are known. In this project we search for tMSPs and spiders by cross-matching gamma-ray, X-ray, and optical catalogs, following up potential optical counterparts with spectroscopy using the 4.1-m SOAR telescope in Chile. Here I present new tMSP and spider candidates identified by their optical, X-ray, and gamma-ray properties and discuss future work to better characterize these binaries.

ABUNDANCE SIGNATURE OF RAPID NEUTRON CAPTURE PROCESS (R-PROCESS)

Presenter(s): Pranav Agarwal (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Hendrik Schatz (College of Natural Science)

The origin and abundances of about half of elements heavier than iron has been attributed to the r-process. Analyses of significant features of the abundance signature formed by the r-process, visible for example in the distribution of elements and isotopes in in the solar system, are important to identify the astrophysical site and for insights into the nuclear physics behind the properties of the involved nuclides. One such feature in the solar abundances chart is the peak at mass number 104. To be able to understand the conditions and reasons behind this peak, it is essential to recreate it using computational simulation models. Skynet, a reaction network that simulates the r-process, was used throughout the analysis. A limitation of such an approach is the need for accurate nuclear masses and reaction rates, which are often not experimentally known and are approximated using several theoretical physical models. An understanding of the abundance signature, hence, also provides insights into the behavior of said models and provides guidance for future experiments at FRIB. In this presentation, I aim to highlight current findings and future plans for this ongoing research project.

AMMONIA AS A CLEAN FUEL: ACTIVATION OF N-H BONDS VIA COPPER CATALYSIS

Presenter(s): Ellen Daugherty (The College of Wooster)
Physical and Mathematical Sciences
Mentor(s): Timothy Warren (College of Natural Science)

Due to the detrimental effects of increasing levels of CO_2 in the atmosphere from widespread use of fossil fuels, there is an ongoing push for alternative clean energy sources that are better for the environment. Ammonia is already used worldwide to fertilize crops, so there is infrastructure in place for its transport and distribution. Furthermore, ammonia is a good candidate to replace fossil fuels as a cleaner energy alternative. Since the early 20th century, NH_3 has been synthesized using the Haber-Bosch process by reacting H_2 and N_2 under high temperature and pressure. When the hydrogen gas is sourced through carbon-free, renewable methods, "green" ammonia becomes a clean fuel due to the N-H bonds' high energy content. We seek to develop new chemical reactions to unleash the high energy content of ammonia's N-H bonds, such as its oxidation to H_2 and N_2. The Warren lab has developed one of the most efficient molecular systems for this reaction when driven by electricity based on a discrete copper complex supported by a β-diketiminate scaffold. This work envisions a new approach to H_2 generation from NH_3 through the stepwise loss of two hydrogen atoms as NH_3 reacts with two linked β-diketiminate copper centers. By monitoring this process with separate β-diketiminate copper complexes, we seek to gain fundamental insights into the conversion of N-H bon

PHOTOCHEMICAL PROPERTIES OF LANCELETIN AND RELATED FLUORESCENT COUMARINS

Presenter(s): Caleb Gatlin (Calvin University)
Physical and Mathematical Sciences
Mentor(s): Mark Muyskens (Calvin University)

Abstract: Lanceletin is a fluorescent, high quantum yield aminocoumarin novelly synthesized in our lab. Based on spectroscopic and fluorometric data, Lanceletin is more efficient than the commercial laser dye Coumarin 120, and the recently described coumarin called knightletin. Solvatochromic methods involving an array of 1-chloroalkanes, along with hydrogen-bonding solvents, test the effect of different solvent polarities on Lanceletin. Additionally, these solvents also reveal both the influence of hydrogen bonding on peak wavelength and the intensity of absorbance and emission spectra. Time-resolved fluorescence reveals some of the dynamics in the excited state. Along with data on Lanceletin, our lab will present the pH-dependent absorbance of a variety of related coumarins and new pKa measurements.

USING A KINETIC MODEL TO IDENTIFY EVAPORATED GASOLINE FOR FORENSIC FIRE DEBRIS ANALYSIS

Presenter(s): Grace Leahey (Kalamazoo College)
Physical and Mathematical Sciences
Mentor(s): Ruth Smith (College of Natural Science)

Fire debris analysis involves identification of ignitable liquid residues in fire debris samples collected from crime scenes as the presence of an ignitable liquid can indicate criminal intent. Fire debris samples are typically extracted using passive-headspace extraction, analyzed by gas chromatography-mass spectrometry (GC-MS), and the resulting chromatogram compared to a reference collection of ignitable liquid chromatograms. With evaporation, which is unavoidable due to heat from the fire, chromatograms of evaporated liquids look different from their unevaporated counterparts. As such, it is necessary to generate a reference collection of evaporated liquids. While liquids can be experimentally evaporated, our laboratory developed a kinetic model to predict evaporation of ignitable liquids. This study evaluated the success of the model in predicting the evaporation level of gasoline samples taken through the passive-headspace extraction method. Gasoline was evaporated to different levels by volume using nitrogen sparging. Evaporated samples were subjected to passive-headspace extraction, and analyzed by GC-MS. The same samples were also prepared for direct injection and analyzed by GC-MS. The kinetic model was used to predict chromatograms of these evaporated liquids that were then compared to the experimental chromatograms. Strong correlation was observed between experimental and predicted chromatograms for both methods. The kinetic model was then used to generate pre

RECURSIVE O(N) CONVOLUTION IN TIME-DOMAIN SIMULATIONS OF PONDEROMOTIVE INSTABILITIES WITH DYNAMIC LORENTZ FORCE DETUNING

Presenter(s): Tri Duc Nguyen (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Jacob Brown (Division of Student Life and Engagement), Sang Hoon KIM (College of Education)

The electromagnetic fields within a superconducting radio frequency (SRF) resonator can become strong enough to deform the cavity shape, potentially leading to ponderomotive instability due to Lorentz Force Detuning (LFD). Schulze (1971) derived linear and nonlinear stability criteria for a generator-driven cavity using Routh-Hurwitz analysis, but this approach is

limited by the complexity of calculating high-order characteristic polynomials. In this study, we revisit the stability criteria through time-domain simulation of a quarter-wave resonator by the lumped circuit model, in which a recursive O(n) convolution algorithm was developed. This approach allows the calculation of complex changes in electromagnetic fields and particle dynamics, accounting for ponderomotive instability and the dynamic changes in resonance frequency due to LFD, offering a robust solution for modeling complex beam interactions and the potential use of machine learning to study stability criteria for nonlinear controls in SRF cavities.

MULTIMODE RADIOFREQUENCY CAVITY

Presenter(s): Bouba Dicko (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Sergey Baryshev (College of Engineering)

The main goal of my research with Dr. Sergey is to design and test dual mode electromagnetic cavities. At the moment, my team and I fabricated a 3D printed cavity and now we are taking measurements on that cavity and comparing those measurements to a higher quality cavity (made from oxygen free copper, OFC) which serves as a benchmark trusted version. The point we are trying to prove is that a 3D printing approach can be efficient enough to become a means for quick novel cavity prototyping. One major reason is that metal coated plastic 3D printed cavities are >100x cheaper as compared to real cavities made of OFC.

PREPARATION EXPERIMENTS FOR HARVESTING ZN-62 AT FRIB

Presenter(s): Jonathan McCombs (Adrian College)
Physical and Mathematical Sciences
Mentor(s): Katharina Domnanich (Facility for Rare Isotope Beams)

During "isotope harvesting" radioisotopes are created and collected as by-products of performing nuclear science research at the Facility for Rare Isotope Beams (FRIB). In this experiment, a ^{76}Kr beam will be stopped in a flowing water target. This interaction will produce a variety of radioisotopes, the main ones being ^{77}Kr and ^{76}Kr; however, in a side reaction, ^{62}Zn is formed as well. We are interested in isolating ^{62}Zn from the water phase and purifying the product. The obtained ^{62}Zn will be used as a ^{62}Zn/^{62}Cu generator, which is relevant for nuclear medicine applications. In order to prepare for the experiment above, batch studies were performed with zinc to determine the optimal conditions for its adsorption onto anion exchange resin and its elution from the resin. Anion exchange resin was added to a $ZnCl_2$ solution of known concentration to determine optimal adsorption conditions for the zinc at various HCl concentrations. Additionally, various solutions were prepared to determine optimal conditions for eluding the zinc from the resin, including pure H_2O, dilute HCl, and HNO_3 solutions. Inductively coupled plasma-optical emission spectroscopy (ICP-OES) was used to determine the amount of zinc left in the solutions as well as how much was adsorbed onto the resin and eluded from it.

UV OPTICAL FIBERS AND FLUORESCENCE LASER SPECTROSCOPY

Presenter(s): Mason Moenter (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Alejandro Ortiz Cortes (Facility for Rare Isotope Beams), Kei Minamisono (Facility for Rare Isotope Beams)

Advances in Nuclear Physics have been happening rapidly thanks to new accelerator facilities being built. One of the most important is the Facility for Rare Isotopes (FRIB) at Michigan State University. At FRIB, the BEam COoling and LAser spectroscopy (BECOLA) group performs high-resolution optical measurements to provide model-independent nuclear data which are used to test state of the art theoretical calculations. In order to produce high quality data, resolution and sensitivity are crucial. This contribution will summarize recent achievements in developing a new approach to the fluorescent technique for laser spectroscopy. The use of optical fibers to couple UV light further reducing background and increasing the quality of the laser beam profile have been studied in the pursuit of higher sensitivity. The importance of optical fibers will be highlighted by presenting a new measurement of fluorescence laser spectroscopy on 232-Th ions.

X-RAY ANALYSIS OF THE GLOBULAR CLUSTER NGC 6528

Presenter(s): Bernard Monteiro de Barros Leal (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Kwangmin Oh (College of Natural Science)

Globular Clusters (GCs) are tightly bound systems containing tens of thousands to millions of stars leading to frequent dynamical interactions and the formation of compact binaries such as cataclysmic variables (CVs), millisecond pulsars (MSPs), and low-mass X-ray binaries (LMXBs). NGC 6528 is one of the metal-rich, non-core-collapsed GCs within the Milky Way. With the Chandra X-ray Observatory data of May 2008 and Feb 2011, we analyzed 13 X-ray sources detected within the half-light radius of the cluster in 0.5 to 7 keV. To understand the nature of the sources, we conducted a comprehensive search for optical counterparts, performed variability analyses, and examined their spectra. We also constructed an X-ray color luminosity diagram for an effective comparison with other well-studied GCs. In this study, we found the characteristics of X-ray sources in NGC 6528 which can contribute to a broader understanding of the compact binaries in metal-rich globular clusters.

UNDERSTANDING THE PHYSICAL AND ORBITAL CHARACTERISTICS OF BINARY PLANETESIMALS

Presenter(s): Donovan Robinson (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Seth Jacobson (College of Natural Science)

The following research explores planetesimal formation in the process of gravitational collapse. Discovering physical and orbital characteristics of formed binary planetesimals have allowed us to graph and analyze their pathways as we've come across micrometer dust particles in our solar system that overtime form into planets as the streaming instability occurs (not taking into account if these binary systems are part of a greater multibody system). Planetesimals are small bodies (1-100 km) in size and are large enough to be held together by self-gravity, as their orbital evolutions are not affected by aerodynamic coupling to gas within the protoplanetary disk (rotating disc of dense gas and dust surrounding a new formed star). The streaming instability occurs within the protoplanetary disk and followed by the gravitational collapse of clouds of pebbles to form planetesimals. Reading the data from planetesimals, we focused on the most massive binary systems and extracted the mass, the x-y-z position as well as their velocity vectors, their moment of inertia, the euclidean distance, and the euclidean velocity, all while converting to their respected units for calculation (km, kg, m, m/s & km/s). Running test scripts through ICER allowed us to understand the spin & shape data, the position & velocity state vectors, and graph/analyze the most massive binary systems. Using ICER to run simulations and code through Python while using a Binary Asteroid Simulator, underst

FASTER THAN A FERRARI: UTILIZING DIMENSIONALITY REDUCTION TECHNIQUES TO EMULATE NUCLEAR BETA DECAY CALCULATIONS

Presenter(s): Lauren Jin (University of Toledo)
Physical and Mathematical Sciences
Mentor(s): Kyle Godbey (Facility for Rare Isotope Beams)

Nuclear beta decay is one of the fundamental decay modes of a nucleus, mediated by the weak interaction. It exchanges a proton into a neutron (or vice-versa) while emitting a lepton and a neutrino. The significance of beta-decay spans many fields of physics, including tests of fundamental symmetries, explanation of the abundance of chemical elements heavier than iron, and probing the structure of nuclei themselves. An important point of observation for beta-decay is its half-life. Although half-life values can be experimentally measured, measurements for nuclei with large neutron numbers (neutron-rich) are currently unobtainable due to technological and experimental limitations. The absence of these measurements presents many problems within astrophysical processes, where the decay rates of neutron-rich nuclei are of great importance. Therefore, there is significant motivation for theoretical predictions of beta-decay half-lives. In contributing to this goal, we employ a theoretical framework based on density functional theory (DFT) and quasiparticle random-phase approximation (QRPA). DFT and QRPA are intercorrelated with beta-decay matrix elements as DFT determines the nuclear ground state while the QRPA probes the excited states. However, such calculations can be very time-consuming, and studies which require substantial calculations are often prohibitive. In this project, we employ dimensionality reduction techniques to emulate solutions of QRPA equations, thereby reducing

ORTHOGONAL BAYESIAN FORECAST COMBINATION WITH LOCAL WEIGHTS

Presenter(s): An Le (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Kyle Godbey (Facility for Rare Isotope Beams), Pablo Giuliani (Facility for Rare Isotope Beams)

There are many theoretical and computational models that describe different properties of nuclei. We want to combine these model forecasts, in a Bayesian framework with uncertainty quantification, to improve the predictability of unknown domain. In some cases, these models may have redundant information. By applying the method of Principal Component Analysis (PCA), we aim to keep the most informative, orthogonal components in this model space, therefore create predictions based on these components. Previous work has successfully explored the situations when we combine principal components in a linear and global way. Here, we expand upon that work by applying the local weights - input dependent - to the mix of our models, and further perform our analysis on heterogeneous data sets. This allows our combined model forecasts to be flexible and adjust to different nuclei.

GRAIN SHAPE ANALYSIS OF FINE SAND IN A POST-GLACIAL INLAND DUNE AND A PHOENIX MARS LANDER SITE ANALOG, MICHIGAN, U.S.A.

Presenter(s): Guilherme Eckert Roda (Michigan State University), Pablo Rizzo Mora (Michigan State University)
Physical and Mathematical Sciences
Mentor(s): Brian Wade (College of Natural Science), Michael Velbel (College of Natural Science)

The Phoenix Mars Lander (PHX) collected sand-sized grain samples from periglacial polygonal patterned ground (PPPG; polygon interiors surrounded by troughs) in the far north of Mars. The

general rounding of abundant black sand grains is attributed to grain abrasion either during eolian transport by saltation or locally by cryoturbation. The Saginaw Lowlands PPPG on glacial diamict in Michigan is a terrestrial analog of the PHX landing site. The Pinetum is a sand dune on the MSU campus. Previous work shows that dune formation in East Lansing occurred within 2000 years after the formation of PPPG in the Saginaw Lowlands. This work characterizes grain-shapes in these co-eval post-glacial landforms, to discern aeolian inputs of sand-size grains to troughs and ice-wedge casts in a terrestrial landform-process analog of PPPG on Mars. Fine-sand size grains from three landforms (PPPG polygon interior, PPPG trough-fill ice wedge cast, and post-glacial inland dune) were studied for shape. Grains were imaged using a scanning electron microscope (SEM). Eighty (80) grains from each sample were imaged to measure grain dimensions length (L) and width (W), and quantify grain shape (equantcy, W/L). Equantcy values do not differ among the sample sites. The similarity of form between dune-sand grains and the PPPG grains permits the interpretation that the sand inventories of the PPPG ice-wedge cast may include some Pinetum-like aeolian sand. Grains that th

Plant Science

ANALYZING HOW DIFFERENT CHLAMYDOMONAS MUTANT PYRENOIDS RESPOND IN DIFFERENT ENVIRONMENTS THROUGH LIGHT AND CONFOCAL MICROSCOPY

Presenter(s): Brett VanPoolen (Michigan State University)
Plant Science
Mentor(s): Peter Neofotis (College of Natural Science)

The algal carbon concentrating mechanism (CCM) is of interest to crop scientists because by engineering it into land plants, productivity could be increased by 60%. The mechanism is comprised of a series of carbonic anhydrases and transporters that bring inorganic carbon into the cell and concentrating it in the pyrenoid. Within the pyrenoid is also the primary enzyme of the carbon fixation reactions of photosynthesis, rubisco. The concentrating of CO2 around rubisco has been thought to enable carbon fixation under low CO2 conditions. This reasoning is due to observations that the pyrenoid is dynamic, changing size under different CO2:O2 ratios; and that algae cells with mutated pyrenoid genes fail to grow under low CO2:O2 ratios. Though much work has been done concerning the CCM's importance in aquatic photosynthesis when CO2 is low, no one has investigated how these proteins behave when, instead of being grown on ammonia, algae are grown on nitrate - the nitrogen source present in most agricultural soils. Furthermore, no one has examined the dynamics of pyrenoid proteins when algae are grown on free air, as land plants grow, rather than in liquid. In this work, we fluorescently tagged two important pyrenoid proteins, EPYC1 and SAGA1, and transformed them into respective knockouts of the alga Chlamydomonas. We then examined the localization and activity of these proteins under different carbon, nitrogen, and air/aquatic conditions. Our results yield an expanded view of the p

PHENOTYPIC AND GENETIC MARKERS ASSOCIATED WITH ABIOTIC STRESS RESPONSES IN HIGHER PLANTS.

Presenter(s): Aidan Deneen (American University)
Plant Science
Mentor(s): Rachel Naegele (College of Natural Science)

Extreme temperature fluctuations are a rising challenge to the agricultural industry. Plants use complex strategies to combat abiotic stress, from modifying their physical structure (e.g.

changing leaf architecture) to activating conserved pathways (e.g. seed dormancy). We will use two case studies to investigate the genetic components of two types of abiotic stress resistance in crop plants. These components will be used to improve abiotic stress resilience in crops. Leaf architecture (e.g. shape, size, etc.) is a major factor in managing light and water stress. Sugar beet (*Beta vulgaris L.*) is a field crop grown globally in temperate regions. Variation in leaf architecture was phenotyped across a diverse population using both image-based phenotyping and Procrustes analysis. Procrustes analysis is a method for morphometric based analysis which measures individual deviation from the population average. Within-genotype variation was low which suggests strong genetic control of these traits. The second case study focused on dormancy, which can be triggered in seeds by environmental conditions to preserve seed viability for optimal growth conditions. In grapes, environmental stress on maternal plants during seed development may affect the seeds weight, viability, and length of dormancy. Budbreak (e.g. release of dormancy) and rhAmpSeq data were collected from 5 biparental mapping populations to identify

IMPLEMENTATION AND STATISTICAL ANALYSIS OF A CALIBRATION MODEL FOR SORGHUM COMPOSITION USING NEAR-INFRARED SPECTROSCOPY

Presenter(s): Megan Gerber (SUNY Brockport)
Plant Science
Mentor(s): Ryan Johnson (Research and Innovation)

In recent years, there's been a notable shift towards renewable resources, moving away from non-renewables. The utilization of biomass from plants, particularly for biofuel and ethanol production, is positioned to shape the future of renewable energy. To establish a viable renewable energy system, it's crucial that scientists possess efficient and accurate methods of collecting biomass data. Near Infrared Spectroscopy (NIRS) is a method in which this can be accomplished, through the identification of biomass composition in plants. Near infrared light is directed onto a sample, which transmits and reflects the light which can then be correlated to light absorption. The data is analyzed to determine the sample's composition by comparing the spectra to wet chemistry results. The objective of this study is to implement and statistically analyze a calibration model that will identify the composition of sorghum (*Sorghum bicolor L. Moench*)using NIRS. Samples will be run using the NREL standard wet chemistry methods. With replicate samples, NIRS will be used as a prediction tool and will correlate the spectra data produced to the original wet chemistry results obtained first. A multivariate model can be produced that uses the correlation to predict the composition of other biomass samples. The second objective is to test the quality of the Sorghum model compared to the BAF switchgrass model and the NREL 6 sample model. We believe that the Sorghum and Switchgrass models will

UNCOVERING THE FUNDAMENTAL MECHANISMS OF ENERGY ORGANELLE MOTILITY AND INTERACTION DYNAMICS IN PHOTOSYNTHETIC ORGANISMS

Presenter(s): Olivia Conhagen (Hamilton College)
Plant Science
Mentor(s): Amanda Koenig (College of Natural Science), Hiruni Weerasooriya (College of Natural Science), Jianping Hu (College of Natural Science)

Organelle movement and interaction affects plant growth, reproduction, and health. The primary mode of transportation for plant organelles throughout the cell is along actin filaments with myosin motors, however the specific mechanisms by which each organelle is controlled remain unclear. Moreover, the interactions among organelles are critical for many cellular functions such as: signaling, cell cycle, and photorespiration. Photorespiration, which requires the interaction of mitochondria, peroxisomes, and chloroplasts, is a metabolic process in plants that occurs when RuBisCo fixes oxygen instead of carbon dioxide, requiring the reassimilation of toxic metabolites. Organelle interactions, like those during photorespiration, depend on membrane contact sites (MCS), areas of close contact between two organelles that facilitate communication and integration. Organelle motility was evaluated by visualizing mitochondria, golgi, peroxisomes, and actin using fluorescent markers transiently expressed in tobacco and tracked movement using MTrackJ. By assessing motility parameters such as angle, velocity, and distance, we observe similar motion patterns between peroxisomes and mitochondria, while golgi motility appears distinct, consistent with their roles in the plant. Additionally, we investigated how organelle interactions change under photorespiratory conditions. Preliminary data demonstrate an increase in mitochondrion-peroxisome-chloroplast interactions in tobacco cells under hig

CHARACTERIZATION OF GENETIC AND PATHOGENIC DIVERSITY OF EPIPHYTIC PSEUDOMONAS SYRINGAE ISOLATES FROM PRUNUS SPECIES

Presenter(s): Anna Hagemann (University of Wisconsin-Platteville)
Plant Science
Mentor(s): Daniel Maddock (College of Natural Science), Michelle Hulin (College of Natural Science)

Pseudomonas syringae is a pathogen that causes bacterial canker among *Prunus* species including sweet cherry, plum, peach, and tart cherry. *Pseudomonas syringae* can be found on its host as an epiphyte, or a surface-dwelling pathogen, among fruiting blossoms without causing symptoms. This pathogen ultimately affects the proficiency of stone fruit production. Specifically, sweet cherry orchards are a common host, suffering from symptoms of bacterial canker. We hypothesize that new pathogens emerge from epiphytic populations, and it is important to understand their diversity and pathogenicity potential. This study aimed to identify and characterize various strains of *P. syringae* isolates by testing their pathogenicity and deciphering their designated phylogroups. To determine these characteristics a total of 458 bacterial strains, previously isolated from the four *Prunus* species mentioned, were applied in a pathogenicity assay using immature sweet cherries. Data collection of this assay determined the level of disease and potential pathovar designation. This collection was then subsetted for phylogenetic analysis. For each *Prunus* species two epiphytic strains were selected that represented each of the pathovar groups, which included *Pseudomonas syringae pv. syringae* and *Pseudomonas syringae pv. morsprunorum*, as well as two strains that yielded no disease. These strains were further analyzed through s

ASSESSING SEED GERMINATION OF PENNYCRESS UNDER DROUGHT

Presenter(s): Isaiah Kam (Middle Tennessee State University)
Plant Science
Mentor(s): Danielle Hoffmann (College of Natural Science)

Unsustainable agricultural practices have led to increased soil erosion, reduced soil fertility, and heightened risks of disease outbreaks. Implementing cover crops can mitigate these issues, enhancing soil health and crop diversity. *Thlaspi arvense*, commonly known as field pennycress, shows promise as a cover crop due to its high cold tolerance, short life cycle, and high oilseed content. This study aims to identify genetic loci associated with drought adaptation in pennycress during seed germination. We tested seed germination rates across 427 natural accessions of pennycress under osmotic stress conditions using 8.9% polyethylene glycol (PEG) as a proxy for drought stress. We will use these germination rates in a Genome Wide

Association Study (GWAS) to uncover the genes that confer tolerance to drought stress. In addition, we investigated seed priming, a pre-sowing technique that involves controlled hydration of seeds to initiate the pre-germination process without radicle protrusion. Hydropriming and osmopriming assays were conducted to evaluate how germination would be affected under both control and osmotic stress conditions, as seed priming is known to enhance yield potential and emergence speed. The insights gained will allow us to engineer new pennycress lines resilient to drought at the germination stage, enhancing their effectiveness as cover crops and contributing to sustainable agricultural practices.

THE GENETIC BASIS OF SALT SPRAY TOLERANCE IN THE YELLOW MONKEYFLOWER

Presenter(s): Elle Mader (Mount Holyoke College)
Plant Science
Mentor(s): David Lowry (College of Natural Science)

Mimulus guttatus, or the yellow monkeyflower, is found across a wide range of habitats in the western United States. Across that range are two ecotypes, the coastal perennial and the inland annual. The coastal perennial has a higher salt spray tolerance due to its proximity to the coast and exposure to saline stressors compared to its inland annual relative. To determine how *M. guttatus* locally adapts to its environment and what the underlying genetic mechanisms controlling those adaptations are, we investigated two candidate genes involved in local adaptation to salt spray in the coastal perennial ecotype. The coastal perennial ecotype of *M. guttatus* was made to overexpress and knockout *GA20OX2*, a gene encoding an enzyme for the growth hormone gibberellic acid. To test whether the *GA20OX2* genotype affects response to salt spray, we measured growth-related phenotypes and performed control and salt spray treatments. We expect that overexpression of *GA20OX2* will make the coastal ecotype resemble the inland ecotype and increase salt spray vulnerability. Knocking out *GA20OX2* is expected to decrease salt vulnerability or have no effect. In addition, we created a CRISPR/Cas9 construct for another candidate salt-tolerance gene, *CBL10*, to also test this gene's contribution to local adaptation in monkeyflowers. The goal of this project is to better understand the underlying genetic differences between the coastal perennial and inland annual that produce stark phenotypic differences and contribute to each ecotype's fitness in its home environment.

INVESTIGATING ARABIDOPSIS FLOE FAMILY'S RESPONSE TO WATER LIMITATION

Presenter(s): Erika Vanada (Meredith College)
Plant Science
Mentor(s): Seung Rhee (Research and Innovation), Sterling Field (College of Natural Science)

Water is essential for life, but water in the environment can be limited. Plants encounter water limitation during freezing and drought, impacting plant growth and survival. To survive these water-limiting conditions, plants evolved to sense changes in environmental water and respond at the cellular level. One example is the *Arabidopsis thaliana* FLOE 1 protein that is proposed to work in sensing environmental water availability during seed germination. FLOE 1 is a part of the FLOE family that includes FLOE 2 and FLOE 3. FLOE 3 expression increases during cold stress while FLOE 1 and FLOE 2 expression increases during osmotic stress. We investigated if a knock-out mutant in FLOE3, *floe 3-1*, had reduced freezing survival compared to wild type plants by exposing them to 4°C then -4°C, but all genotypes consistently did not survive.

Interestingly, we noticed that when removing seedlings from media, several genotypes began shriveling faster than others. To investigate how the FLOE family members contribute to desiccation tolerance, we performed desiccation assays. We transferred 10-day old Col-0, *floe 1-1*, *floe 2-1*, *floe 2-2*, *floe 3-1*, *floe 1-1*; *floe 2-1*, and *floe 1-1; floe 2-1; floe 3-1* plants from agar media to containers at 70-90% or <30% relative humidity for three hours. After three hours, seedlings were returned to the agar media, and plant survival was scored two days later as normal, stress

TRANSCRIPTOME ANALYSIS USING NEXT GENERATION SEQUENCING TO UNDERSTAND RESISTANCE TO HERBICIDES IN RESISTANT AND SUSCEPTIBLE STRAINS OF THE WEED SPECIES CONYZA CANADENSIS

Presenter(s): Ryan Brener (California State University Channel Islands)
Plant Science
Mentor(s): Ednaldo Borgato (College of Natural Science), Eric Patterson (College of Natural Science)

Seeds outcompete crops for soil resources, posing a significant threat to agricultural productivity and global food production. *Conyza canadensis*, in particular, threatens agricultural sustainability due to its resistance to multiple herbicides, including glyphosate, and the production of allelopathic chemicals that inhibit germination and reduce seedling growth in various crops. This study investigates the mechanisms underlying glyphosate resistance in *C. canadensis* using RNA-Seq technology. We collected, isolated, and sequenced mRNA samples from susceptible, resistant, and highly resistant strains under well-watered and drought conditions, both before and after glyphosate application. The sequenced transcripts were aligned to a reference genome using HISAT2, and the indexed and sorted reads were used to generate a raw counts data table. Data normalization and pairwise comparisons were performed using edgeR, allowing us to identify differentially expressed genes associated with glyphosate resistance. We observed upregulation of genes such as Aldo-Keto Reductase 3 (AKR3), ABC Transporter Family G Member 11 (ABCG11), and ABC Transporter Family C Member 14 (ABCC14). However, high genetic diversity among individuals indicated no universal patterns, suggesting strain-specific gene expression patterns. This research lays the groundwork for future studies to validate these genes through in vitro molecular methods. Our ultimate aim is to understand the relatio

REFERENCE BIAS EFFECTS ON GENE EXPRESSION VARIATION IN CAPSELLA BURSA-PASTORIS

Presenter(s): John Ready (Davidson College)
Plant Science
Mentor(s): Emily Josephs (College of Natural Science)

Advancements in long-read sequencing technologies and genome assembly mean researchers increasingly have multiple options of genomes for species, and more recently pan-genomes, to align RNA-seq data as a reference for gene expression quantification. However, different reference genomes often have distinct genetic differences that could affect the alignment of RNA-seq reads, which we refer to as reference bias. For many species, it is unknown to what extent reference bias affects gene expression levels. To further understand gene expression variation due to reference bias, we mapped an RNA-seq dataset from *Capsella bursa-pastoris*, an allopolyploid weed distributed worldwide in urban environments, to three existent reference genomes derived from three separate individuals from China, California, or New York. We

quantified gene expression and compared the distribution of gene expression levels depending on which reference the dataset was mapped to. We found that the overall distribution of gene expression from the China reference was skewed significantly towards higher counts and had a significantly higher median, verified using the Kolmogorov Smirnov test (P<2.2 x 1016) and the Wilcoxon test (P<;2.2 x 1016), respectively. Furthermore, preliminary results from differential gene expression analysis on a subset of genes determined to be orthologous across the references revealed bias in expression based on the chosen reference. Our findings suggest that referen

EXAMINATION OF THE MICROBIOME OF POPULUS TRICHOCARPA LEAVES

Presenter(s): Max Smith (Michigan State University)
Plant Science
Mentor(s): Sarah Lebeis (College of Natural Science)

Melampsora leaf rust is a fungal disease that commonly affects trees of the *Populus* genus, resulting in greater susceptibility to other pathogens. The disease presents a significant problem for young *Populus* trees, making recovery difficult for forests impacted by *Melampsora* leaf rust. This project examines the natural microbiota of *Populustrichocarpa* leaves to better characterize the microbes that are present before exposure to *Melampsora* fungal pathogens. In total, 137 bacteria and 62 fungi were isolated from leaf tissue samples that were extracted from five different *Populus trichocarpa* trees. The Gram status of the bacteria was determined by growing the isolates on MacConkey agar and mannitol salt agar. 52% of bacterial isolates were determined to be Gram-negative and 39% as Gram-positive, with the remaining 9% growing on both or neither of the media types. Salicylic acid plays an important role in plant defense against pathogens by inhibiting the growth of bacteria. As such, the bacteria were also grown on Luria-Bertani agar with 0.5 mM salicylic acid, with 77% of bacteria able to grow. Isolates that exhibited biofilm formation, changes in growth rate, or growth on all media types were identified by 16S rRNA gene sequencing.

THE VITAL ROLE OF PRX6 IN REDOX REGULATION IN PLANT PHYSIOLOGY AND PHOTOSYNTHESIS

Presenter(s): Karla Gomez Lopez (University of Puerto Rico – Rio Piedras)
Plant Science
Mentor(s): Christoph Benning (College of Natural Science), Timothy Nicodemus (College of Natural Science)

To thrive in a dynamic and often unpredictable environment, plants have evolved innumerable measures to mitigate stressors. Particularly important are those that generate reactive oxygen species (ROS) in the chloroplast. High ROS levels can be harmful to photosynthetic membranes, negatively affecting the process of photosynthesis and plant's health, making regulation essential to help maintain REDOX homeostasis. Peroxiredoxin Q (PRXQ), an enzyme belonging to the 1-Cys peroxiredoxin family, efficiently scavenges harmful ROS by catalyzing their reduction. Our bioinformatic analysis of the PRX6 gene locus has highlighted it as a homolog of Arabidopsis thaliana PRXQ. Further, works from our group have demonstrated PRXQ possesses activities necessary for lipid remodeling in the plastid. The work presented below confirms Prx6 is a homolog of PRXQ and interacts with lipids in a similar manner, carrying out catalytic functions including acyltransferase and lipase activities. These experiments demonstrating the catalytic function of PRX6 suggesting it plays a much more pivotal role in plastid remodeling and damage mitigation than previously thought. The study outlined below not only serves a foundational work for further exploration of the interface between lipid metabolism and REDOX biochemistry but convincingly demonstrates PRX6's previously unknown involvement in the remodeling of thylakoid and chloroplast membranes.

GENETIC ANALYSIS OF TANNIN CONTENT IN SORGHUM

Presenter(s): Jenna Wood (Truman State University)
Plant Science
Mentor(s): Addie Thompson (College of Natural Science), Anuradha Singh (College of Natural Science)

Tannins are a group of diverse, naturally occurring polyphenolic compounds. Higher tannin content within the testa of sorghum grain seed coat decreases herbivory due to its bitter taste and antimicrobial properties and therefore limits yield loss. However, this results in more bitter seeds with decreased protein digestion; which makes it less desirable for consumption. Increasing knowledge of genes responsible for tannin production can lead to increased yields and food security, as well as introducing the ability to choose the best tannin levels for specific purposes to improve efficiency. Tannins were quantified via HCL-Vanillin assay from a ~400 accession sorghum diversity panel. A Genome-Wide Association Study (GWAS) was then conducted with publicly available genome data which identified significant single nucleotide polymorphisms that may be associated with tannin content. This data was further investigated with known tannin production genes through haplotype analysis by selecting those with contrasting haplotype variants and confirming tannin presence using a bleach test. Additionally, bleach testing was done for all samples to provide another set of GWAS data and to confirm the presence of tannins within each sample. Determining vital genes for tannin production can aid growers and breeders to produce the sorghum best suited for their individual needs within biofuel, livestock feed, or human consumption industries.

EVOLUTIONARY RELATIONSHIPS OF FUNGI IN THE FAMILY CERATOBASIDEACEAE

Presenter(s): Cecille Beers Quintero (University of Puerto Rico-Rio Piedras)
Plant Science
Mentor(s): J. Rojas (College of Natural Science)

Rhizoctonia solani is a soilborne pathogenic fungus whose strains cause 15-50% of agricultural damage annually, affecting a wide range of hosts in food crops of high economic importance, such as potato, rice, soybean, cotton, and wheat. This research seeks to characterize the diversity within Rhizoctonia solani AG1-IA isolates and to compare the evolutionary dynamics of Rhizoctonia and Ceratobasidium species. Samples were grown from collected sclerotia on PDA agar, moved to ½ PDB. After 3-5 days mycelium tissue was transferred and lyophilized for a period of 8-12hrs. DNA Extractions were conducted using G-BioSciences OmniPrep™ For High Quality Genomic DNA Extraction Kit and sent to the Research Technology Support Facility at Michigan State University for Sanger sequencing. Existing sequences of genome and internal transcribed spacer (ITS) were used in this study to develop phylogenetic associations. By analyzing the protein sequences of different isolates of members of the Ceratobasiceadiaceae family, novel genetic information may reveal patterns in pathogenesis and morphology between related groups. Orthofinder was used to elaborate phylogenetic associations between genomes based on the ortholog genes present by aligning them with existing references from Gonzalez et al, 2016. A Maximum Likelihood phylogenetic tree of the AG1-IA isolates ITS sequences was constructed using NGphylogeny.fr, providing a more thorough background into the m

RELATIONSHIPS BETWEEN SEED AND VEGETATIVE DESICCATION TOLERANCE

Presenter(s): Ashton Datko (Kutztown University of Pennsylvania)
Plant Science
Mentor(s): Serena Lotreck (Cornell University)

Desiccation tolerance (DT) is the ability of an organism to survive extended periods without water by transitioning to a dry state. This ability depends on many complex physical and biological mechanisms and is present across many domains of life. Therefore, desiccation is a promising candidate for studying convergent evolution. In desiccation tolerant vascular plants, it is thought that the process reemerged by repurposing seed DT pathways. To test this hypothesis, we will compare the gene expression of the desiccation tolerant plant *Oropetium thomaeum*, in seed and leaf tissue during dehydration and rehydration. Our work will elucidate the relationship between DT pathways in different plant tissues through the use of computational analyses for time series gene-coexpression data. Understanding the evolution of desiccation tolerance in vascular plants will help us develop crops resilient to water stress.

EFFECTS OF FUNGAL VOLATILE ORGANIC COMPOUNDS ON SORGHUM AND SWITCHGRASS GERMLING GROWTH

Presenter(s): Manasa Donepudi (University of Illinois Urbana-Champaign)
Plant Science
Mentor(s): Bryan Rennick (Research and Innovation), Gregory Bonito (College of Natural Science), Shuang Liu (Research and Innovation)

When looking at the relationship between plants and microbiomes, it is clear that they are essential for advancing agricultural practices and bio-based industries such as biofuel and pharmaceuticals. The different fungal volatile organic compounds (VOCs) play a significant role in interactions with plant development. Though this is clear, there is still uncertainty about the effects that certain types of fungal species have on plant growth, as there have been both positive and negative consequences observed. This study investigates the impact of fungal VOCs on the growth and germination of sorghum (Sorghum bicolor) and switchgrass (Panicum virgatum), two promising bioenergy crops; furthermore, it aims to identify the different effects that the particular species can inflict on the crops. This is measured in the plant's root length, plant height and mass to calculate the differences accurately. Petri dish and test tube growth methods were also used to determine the most effective growth pattern for results and accurate collection. The results of the experiment will be reviewed to illuminate the differences in data collection of the growth methods, the effects of fungal VOCs, and the difference that species may have on plant growth overall.

OBSERVING THE INFLUENCES OF AUXIN AND GENETICS ON PLANT ARCHITECTURE

Presenter(s): Daynicha Celisca (Saint Augustine's University)
Plant Science
Mentor(s): Daynicha Celisca (Saint Augustine's University)

The Green Revolution achieved significant increases in crop yield, reducing hunger and poverty in developing countries, through plant breeding and agricultural technology advancements. Breeding programs focused heavily on plant architecture, as "dwarfing genes" allowed growers to create high-density plantings. The molecular mechanisms on which dwarfing genes act have been characterized; however, other genes have since been implicated in affecting plant architecture, and their mechanisms are still under investigation. In this project, we observe the expression of three architecture-related genes, *LAZY1, TAC1,* and *WEEP*, which are hypothesized to convey novel plant architecture phenotypes by influencing auxin localization. As such, we also observe auxin localization in the *lazy1* and *tac1* genetic backgrounds. Using the luciferase reporter system, we captured in vivo expression of LAZY1, *TAC1,* and *WEEP* in *Arabidopsis thaliana* ecotype Col-0 (WT), as well as expression of the synthetic, auxin-sensitive promoter *DR5* in WT, *lazy1*, and *tac1* mutant backgrounds. We have compiled these images into a time series to illustrate the expression of our genes of interest and describe auxin localization in wild-type (WT) and mutant backgrounds throughout plant development. Our data will guide the design of future experiments; for example, the native expression patterns of *LAZY1, TAC1,*

FLORAL MORPHOLOGY PATTERNS AND SHIFTS IN CO-EXISTING CLOSELY RELATED WILD ANGIOSPERMS AND THEIR HYBRIDS

Presenter(s): Mohamed Elgallad (CUNY- Hunter College)
Plant Science
Mentor(s): Andrea Case (College of Natural Science), Christopher Blackwood (College of Natural Science), Svea Hall (College of Natural Science)

Biodiversity is quantified by the number of species coexisting throughout a habitat and is influenced by ecological and evolutionary factors. In order for species to coexist within the same habitat, especially with sister taxa or the species' closest relatives, they need to avoid resource competition and maintain reproductive isolation to preserve their genetic integrity. In this project, we study how floral trait variability dictates *Lobelia's* biodiversity by allowing sister taxa to closely coexist without hybridizing through mechanical isolation and how floral morphology changes across species. Mechanical isolation is a mechanism of reproductive isolation where different floral morphological traits prevent pollen transfer among different species. Since *Lobelia* provides a promising model for investigating mechanisms of species co-occurrence across shared spatial ranges, we examine 2 parental species: (*L. siphilitica* and *L. cardinalis*) and their respective hybrids. Even though *L. siphilitica* and *L. cardinalis* are sympatric, share the same habitat type, are both perennial, and bloom between July and October, they rarely hybridize in nature. Investigating their floral traits will illuminate aspects of genetic diversity, speciation and trait evolution and can serve as a future model for further understanding the processes behind Angiosperm speciation and evolution. We imaged the parental and hybrid flowers using a stereomicro

EVALUATING A GROWTH-HORMONE SILENCER BY CRISPR/CAS12A DELETION IN ARABIDOPSIS THALIANA

Presenter(s): Taina Marigny (Worcester Polytechnic Institute)
Plant Science
Mentor(s): Lourdes Lopez (College of Natural Science)

Plants are highly dependent on internal regulators within their genome to facilitate the appropriate responses to the environment. Therefore, identifying the transcriptional mechanisms that allow plants to resist and adapt to changes is pivotal to optimizing crop genetic engineering. While promoters turn genes on or off, distal cis-regulatory elements (CREs) can fine-tune expression from thousands of base pairs away by increasing or decreasing transcription. Consequently, these CREs are key to dynamic gene regulation in plants. Previous DNase-sequencing results suggest that a CRE silencer, DNase I hypersensitive site (DHSs), may be involved in regulating GIBBERELLIC ACID 2 OXIDASE 8 (GA2OX8), inhibitor of the gibberellic acid growth hormone, when plants are cold-stressed-- resulting in stunted growth and early flowering. Although enhancer CREs in plants are well studied, information on down-regulator CREs, "silencers" is limited. To assess the impact of the DHSs silencer, it is deleted with CRISPR/Cas12a in Arabidopsis thaliana to compare the expression levels of GA2OX8 to a wild type in cold and normal conditions. Additionally, to quickly visualize its effect, the silencer is cloned into a separate vector containing a promoter or enhancer, and the luciferase reporter gene for an agrobacterium-mediated transient assay. Agrobacterium infiltration of Nicotiana benthamiana leaves in-vivo then visualizes the silencer's impact by differential luciferase expression under t

IDENTIFICATION OF COMMON BEAN ROOT MICROBIOME ENDOPHYTES THROUGH METAGENOMICS AND CULTURING

Presenter(s): Jessica Navarro (Illinois Wesleyan University)
Plant Science
Mentor(s): Miranda Haus (College of Natural Science), Viviana Ortizlondono (College of Natural Science)

The common bean (*Phaseolus vulgaris*) plays a vital role in food security as a diverse legume crop consumed across many cultures. Stampede, a cultivar from the Middle American gene pool, shows greater disease tolerance compared to Red Hawk, a cultivar from the Andean gene pool. A 2019 study by the Haus Lab revealed that these two cultivars display differential root gene expression at early growth stages through RNA sequencing. Our study aims to correlate these differential expression patterns with the presence of distinct endophytic communities across both genotypes. Endophytes are microbial communities that do not negatively impact the plant and potentially support plant health. To establish this correlation, Stampede and Red Hawk have been planted for 5 days and the roots processed for DNA extraction and culturing. Fungal communities will be described using both fungal transcripts from host-derived RNA sequencing and nuclear ribosomal internal transcribed spacers (ITS) amplicon sequencing data. Additionally, species identification of fungal and bacterial endophytes will be conducted using ITS and 16S rRNA Sanger sequencing. Future steps include testing these endophytes for antagonistic effects against pathogenic *Fusarium*. This presents an opportunity to potentially establish biocontrol strategies for less resistant common bean cultivars such as Red Hawk

STRESS RESPONSES TO SALINITY -STRAWBERRIES

Presenter(s): Davion Simpson (Elizabeth City State University)
Plant Science
Mentor(s): Patrick Edger (College of Natural Science)

Climate change poses substantial hazards to global agriculture through diminishing crop yields and deteriorating soil. Salinization, a kind of soil deterioration caused by sea-level rise, drought, and poor water management, affects 833 million hectares globally and threatens over 1.5 billion individuals. This issue is particularly important in California's San Joaquin Valley and Florida, major locations for the US strawberry industry, which suffers salinity-induced production losses of 20% to 50% each year, affecting a $2.3 billion market. To address agricultural salinity, this research project examines salt stress mechanisms in strawberries, with an emphasis on root behavior and gene regulation. Understanding root responses to salt stress is essential because roots regulate water and nutrient intake, thus affecting plant growth and performance. This project will utilize rhizotron phenotyping to monitor root architecture and plasticity during salt stress, in addition to transcriptome analysis to discover salinity response genes. We seek to identify phenotypic and genetic changes that give salinity resistance by researching two strawberry species, Fragaria x ananassa cv. 'Camarosa' (salt-sensitive) and Fragaria chiloensis ecotype 'Del Norte' (salt-tolerant). Using daily high-resolution imaging and RNA sequencing, the analysis will detect substantial changes in the structure of roots and gene expression. This integrative strategy see

ROLES OF ROOT MICROBIOMES ON HOW PLANTS RESPOND TO DROUGHT STRESS

Presenter(s): Erieliz Vazquez Tomei (University of Puerto Rico-Mayaguez)
Plant Science
Mentor(s): Sarah Lebeis (College of Natural Science), Tri Tran (College of Natural Science)

Climate change exacerbates drought stress, significantly impacting plant growth and productivity. In response to drought stress, plants exude chemicals into the soil that may modulate their interaction with the root-associated microbiota. This interaction can play an important role in enhancing plant tolerance to drought stress. However, the mechanism by which plant-microbiome interaction leads to enhanced drought resilience remains unknown. In this study, we aim to investigate the role of the root-associated microbiota in plant resilience to drought stress. This aim is achieved through three questions (1) what is the role of myoinositol, a sugar alcohol that plants produce during drought stress, in plant-microbe interaction in the presence of drought stress? (2) what are the effects of commercially available bioinoculants on soybeans under field drought conditions? and (3) what is the impact of root development when seedlings are inoculated with a drought-tolerating bioinoculant? In the first experiment, we assess *Arabidopsis* seedlings inoculated with a bacterial strain and its mutant that modulates the level of endogenous inositol in tissues and subsequently induces drought stress on plants. In the second project, we will evaluate the influence of five commercial bioinoculants on plant performance and their associated community after the field. Finally, we will examine the impact of Bio ST+R, a product that was demonst

EXPLORING RESPIRATION RATES IN NORTHERN HIGHBUSH BLUEBERRIES THROUGHOUT THE HARVEST SEASON

Presenter(s): Cassandra Austin (Michigan State University)
Plant Science
Mentor(s): Josh Vanderweide (College of Natural Science), Michael Gasdick (Robert Morris University)

Understanding respiration in blueberries is significant in post-harvest storage as respiration affects shelf-life, the quality of the berry and thus, flavor. Respiration directly affects flavor because glucose (sugar) is broken down during the metabolic process and released as carbon dioxide, decreasing the sugar to acid ratio that dictates berry flavor. Respiration is also closely related to ripening. Ripening, characterized by ethylene production, also degrades sugars and decreases firmness of the berry, affecting quality. Tracking post-harvest berry carbon dioxide production, mass, sugar content and firmness under varying temperature storage conditions will allow us to determine the impact of respiration on berry flavor and quality, in order to make standard storage guidelines. We expect cold storage will slow respiration and ripening which will extend the shelf life and preserve the flavor and firmness. 'Draper' blueberries were obtained in a 'delayed harvest' field experiment and the release of ethylene and carbon dioxide was analyzed, as well as firmness and mass measurements. After initial evaluation, the berries were subject to room temperature or cold storage (refrigeration) and subsequent measurements were taken days later. Blueberries are widely classified as nonclimacteric, or non-ripening post-harvest, but small amounts of ethylene are still produced after berries are removed from bushes, challenging this classification. Preliminary results suggest cold stor

ANALYSIS OF PHOTORESPIRATORY ENZYME ACTIVITY IN ISOLATED PEROXISOMES

Presenter(s): Kelsie Montroy (Eastern Michigan University)
Plant Science
Mentor(s): Berkley Walker (College of Natural Science), Emily Stringham (College of Natural Science), Ludmila Roze (College of Natural Science)

Elevated temperature and CO2 levels driven by climate change are expected to significantly impact plant productivity in the near future. These factors are directly linked to carbon metabolism in plants, particularly through the photorespiration pathway. Photorespiration is a coordinated metabolic pathway in plants that recycles phosphoglycolate, a toxic compound produced by the oxygenase activity of Rubisco. Rubisco typically fixes CO2 but it's affinity for O2 increases with temperature. Photorespiration is the second largest contributor to carbon flux in plants. Activated by carboxylation reactions between intermediates, photorespiration releases more CO2 in high temperature conditions. It is not fully understood how the photorespiratory pathway processes high levels of flux at elevated temperatures, but the movement of metabolites may play a key role. We aim to explore if the formation of a metabolon - a spatial assembly of sequential enzymes into a supramolecular structure - facilitates the flux of carbon via metabolite channeling in the peroxisome. We investigated the potential presence of a peroxisomal metabolon in model organism Pisum sativum, commonly known as garden peas. Peroxisomes were isolated from homogenized leaf tissue using a series of differential centrifugations in density gradients. Spectrophotometric analyses revealed latency and activity of peroxisomal marker enzymes. Peroxisomes isolated in this study will be used in future labeling and functional assays

BIOCHEMICAL CHARACTERIZATION OF PUTATIVE LIPASE ELT5 (ESTERASE/LIPASE/THIOESTERASE 5) FROM ARABIDOPSIS THALIANA

Presenter(s): Ty Wilson (Utah State University)
Plant Science
Mentor(s): Peter Lundquist (College of Natural Science)

Many elements of plant physiology and biosynthesis have not yet been fully studied due to the difficulty and/or the need for better technology and techniques. Plastoglobules (PGs), one of these untapped elements, are small lipid droplets within the chloroplast that are linked to the thylakoid and have been shown to aid plants in their general growth and development, particularly when dealing with stress. They have been shown to affect drought resilience, protect against sun-scorching, and help facilitate senescence. Ultimately, if we better understand the functionality and structure of PGs, we may be able to improve the viability of crops in high-stress environments. Additionally, due to their nature as response-mediated lipid chambers, there is potential for them to help with production and dispersion of organic molecules in medicine. During this project, we will be studying a lipase enzyme known as Esterase/Lipase/Thioesterase 5 (ELT5). We believe, due to its genomic similarity to its cousin gene ELT4, that ELT5 will have similar, stress-mediating functions. ELT5 lacks a transit peptide, however, so we are unsure of where it is expressed and whether the gene even has active functionality. To determine the gene's localization, we will use fluorescence tags alongside confocal microscopes. We will also be performing a biochemical assay, using transformed Escherichia coli and visualizing the results using Thin-layer chromatography, to determine its activity and enzymatic substr

Psychology

THE EFFECTS OF SOCIAL SUPPORT ON DEPRESSION RELATED TO DISCRIMINATION

Presenter(s): Antonia Gitau (Eastern Michigan University)
Psychology
Mentor(s): Jamie Lawler (Eastern Michigan University)

Social support is linked to lower depression (Alsubaie et al., 2019). Research shows that depression is influenced by discrimination (Nadimpalli et al., 2014), posing the question of whether these three variables could be connected. We hypothesized that individuals who reported more social support would have a weaker association between discrimination and depression. Data were collected as part of a larger study to investigate this link in a group of parents of young children ($N = 27$) , given that parental depression is known to impact the next generation. Measures included the Patient Health Questionnaire, the Everyday Discrimination Scale, and the Multidimensional Scale of Perceived Social Support questionnaire. Bivariate correlations indicated a moderate positive correlation between depression and discrimination ($r = 0.46$, $p = 0.015$). Linear regression analysis, factoring in income and social support, highlighted discrimination as a significant predictor of depression ($b = .40$, $p = .03$), with the model explaining 34% of the variance ($F(3, 23) = 3.94$, $p = .02$). No correlation was found between social support and either depression ($p = .54$) or discrimination ($p = .68$). Moderation analysis examining the buffering role of social support on the relationship between discrimination and depression was not significant ($p = .83$). Findings suggested that higher levels of discrimination were associated with higher levels of depression but social support did not buffer this association

BREAKING THE CHAINS: UNDERSTANDING AND ADDRESSING SEX ADDICTION AND ADVERSE CHILDHOOD EXPERIENCES

Presenter(s): Kira Proffitt (Siena Heights University)
Psychology
Mentor(s): Amy Wertenberger (Siena Heights University)

This abstract jumps into the impact of sex addictions, both on the individuals who struggle with the condition(s) and the family members and friends of the individuals. It explores the emotional, psychological, and social/sociocultural consequences of sex addiction, which include the complexity and disruption of communication, familial roles being compromised, and the potential risk of passing these addictive behaviors onto their children and other family members. By addressing this cycle of potential generational trauma and providing support to the people who are affected by this addiction(s), this paper sheds light on the scores of the Adverse Childhood Experience test (ACEs), potential family-based therapeutic options such as Sex Addicts Anonymous (SAA) and other support groups/counseling options, and other potential addictions that coincide with sex addiction such as gambling and other substance use. The research methods used involve quantitative surveys of college students (18+) and their potential parental figures, which include the ACE test and questions that ask about demographics. Scoring from this test may indicate trauma presence and the potential chance of addiction.

THE AUTISTIC PERSPECTIVE ON PARENTAL AND FAMILY STRAIN AND STRESS THROUGHOUT THE CHILDHOOD EXPERIENCE

Presenter(s): Allea Burton (Siena Heights University)
Psychology
Mentor(s): Julie Osland (Siena Heights University)

Autism spectrum disorder (ASD) is frequently depicted as a detriment to the individual and family (Botha, 2022). However, due to a better understanding of ASD as well as pushback from its vocal community, the scientific literature is expected to progress in both its approach to ASD and expand its discussion to describe the concerns and distress of families more accurately (Gowen, 2020). This study considers the current revelations surrounding past problematic language and attitudes. In addition, this study will fill the gap of autistic experience in current literature by using thematic analysis of open-ended interviews with young autistic adults. These interviews will gather input about childhood experiences; participants' take on interpersonal conflict, and the influence of familial background on participants' at-home relationships. In summary, this study will attempt to investigate the childhood experience and family conflicts from the autistic adult perspective.

EXAMINING THE ASSOCIATION OF COMORBID DEPRESSION AND ANXIETY WITH ERN AND REWP

Presenter(s): Kaitlyn Wilcox (Michigan State University), Vikshita Pallerla (Michigan State University)
Psychology
Mentor(s): Bre Lind (College of Social Science), Grace Anderson (College of Social Science), Jason Moser (College of Social Science)

The Reward Positivity (RewP) is brain potential that indexes individual differences in rewarding responding and is often blunted in youth experiencing depression. The Error-Related Negativity (ERN) is another brain potential that measures cognitive response to error recognition and is typically enhanced in anxious youth. Previous research has explored the connections between depression and RewP or anxiety and ERN; however, limited research has looked at comorbid anxiety and depression in relation to these two brain potentials. It is important to understand the relationship between these disorders and these brain potentials to help clarify anxiety-depression comorbidity. The aim of this study is to examine youth with anxiety and depressive symptoms to explore how brain potentials differ in relation to comorbid symptoms. Participants were recruited as part of a longitudinal study tracking familial transmission of mental disorders. Mothers completed the questionnaires to assess depressive and anxious symptoms in youth, and the youth completed EEG tasks to elicit the brain potentials of interest. We hypothesize that youth with higher levels of anxiety will exhibit a larger ERN, youth with higher levels of depression will exhibit a smaller RewP, and youth with both depression and anxiety will have a blunted RewP and enhanced ERN when compared to individuals with only one disorder or neither of the disorders. Exploring potential relationships between internalizing disorder comorbid

IDEOLOGICAL SIMILARITIES AND DIFFERENCES IN PARTISAN BIAS

Presenter(s): Aymin Triki (Michigan State University)
Psychology
Mentor(s): Mark Brandt (College of Social Science)

Social and political psychologists have argued and theorized about the psychological similarities and differences between liberals and conservatives. For example, one area where these similarities and differences are looked at is in people's biased reasoning processes. A recent development in this debate was a meta-analysis looking at partisan bias that showed support for the symmetry hypothesis, meaning both liberals and conservatives were equally susceptible to partisan bias (Ditto et al. 2019). However, this meta-analysis was challenged for not using a representative set of policy issues, so it could not support an asymmetry hypothesis (which means that conservatives are more biased than liberals) (Baron & Jost, 2019). To address this concern, we use data from Tappin (2022) which includes a set of issues representative of contemporary political debates. We analyze this data to see if there are any significant differences between liberals and conservatives in their susceptibility to bias from party elite cues. Our study contains data on 34 different issues and uses the stance of political leaders Donald Trump and Barack Obama to serve as party cues. When looking at the 34 issues individually (N=1,591), we found a few which showed significant support for the asymmetry hypothesis, but there was a concerning amount of variability. When combining the difference in bias across all issues, we found a non-significant interaction smaller than the effect size of interest, which

ERROR-RELATED NEGATIVITY AS A PREDICTOR OF CLINICAL DISORDERS IN A SAMPLE OF COLLEGE-AGED WOMEN

Presenter(s): Jordan Schebel (Michigan State University)
Psychology
Mentor(s): Bre Lind (College of Social Science), Grace Anderson (College of Social Science), Jason Moser (College of Social Science)

Studies have shown that depression and anxiety are linked to a higher error-related negativity (ERN), a brain potential that occurs following the commission of an error during cognitive tasks. Larger ERN amplitude is commonly used as a predictor of anxiety disorders, and not as frequently for depressive disorders. Past studies have focused on the relationship between ERN and anxiety in young women; however, anxiety and depression are frequently comorbid diagnoses, making it important to understand the relationship between both disorders and ERN amplitude. In this study, I will test whether a larger ERN amplitude is related to a clinical diagnosis of either an anxiety or depressive disorder in college aged women. I hypothesize that a larger ERN will relate to a clinical diagnosis of anxiety, a slightly smaller ERN will relate to a clinical diagnosis of depression, and the smallest ERN will relate to neither diagnosis. To measure ERN, subjects performed a letter flanker task, during which they respond to a central target stimulus flanked by either congruent or incongruent stimuli, while undergoing continuous electroencephalography (EEG). Clinical diagnoses were determined by the Structured Clinical Interview for DSM-5 (SCID). An ANOVA analysis included diagnostic categories (anxiety disorder, depressive disorder, comorbid, neither) predicting ERN amplitude. There was not a significant difference across the groups, $F(3,135) = 2.119$, $p = 0.101$. My findings suggest higher ER

ASSESSING QUANTITY OF IMITATION OPPORTUNITIES FOR BEHAVIORAL INTERVENTION STRATEGIES

Presenter(s): Ashley Poothurail (Michigan State University), Seth Siskonen (Michigan State University)
Psychology
Mentor(s): Brooke Ingersoll (College of Social Science)

Reciprocal imitation teaching (RIT) is an intervention strategy designed to help young children with social communication delays develop imitation skills during play. In RIT, the caregiver is taught to provide their child with three imitation opportunities, and then use physical guidance to help their child imitate if they do not do so on their own. However, this number of opportunities was chosen speculatively. In this study, we investigated whether providing three (as opposed to one or two opportunities) provides a benefit for increasing spontaneous imitation. Videos from RIT intervention sessions were observed to note the number of imitation opportunities given to the child and after which opportunity the child imitated. The videos contained a mix of caregivers trained specifically in RIT and some caregivers trained in other intervention strategies. All videos used for this study received a global rating score of 2 or above, which indicated that they used two or more strategies from RIT. The number of imitation opportunities provided by the caregiver and quantity of trials it took for the child to imitate the action were documented on an excel sheet. The data comprised the percentage of imitation by trial number: the first trial had 20.7%, the second trial had 10.6%, and the third trial had 10.5%. Therefore, the data indicates that the most imitation occurs after the first trial, but the second and third trials also had a substantial impact on imitation respons

OPTIMISM AND PERCEPTIONS OF MAJOR LIFE EVENTS

Presenter(s): Marcus Ward (Alabama State University)
Psychology
Mentor(s): William Chopik (College of Social Science)

Optimism is the generalized sense that good things will happen in the future. Optimism is associated with a host of positive personal and relational outcomes. However, when good and bad things happen to optimists, they rarely change their perspective about the future. One reason why optimists are resilient to life circumstances-such as losing a job, experiencing a breakup, or facing a health scare-is that they might vary in how they perceive those life circumstances. This study examines how optimists and pessimists differ in their perceptions of life events using a recently developed taxonomy of life event characteristics. To do this, we conducted a large study (N = 900) of college students, who were tasked with responding to their perceptions of hypothetical life events. We find evidence to suggest that there are differences between optimists and pessimists in how they perceive life events, but these data show that perceptions vary by the exact life event and how optimism was measured.

INVESTIGATING THE IMPACT OF MENTAL HEALTH VARIABLES ON ACUTE EXERCISE-INDUCED CHANGES IN ANXIETY AND EMOTION REGULATION AMONG COLLEGE-AGED FEMALES

Presenter(s): Isteaq Zim (CUNY Hunter College)
Psychology
Mentor(s): Jason Moser (College of Social Science)

Exercise has been shown to reduce anxiety sensitivity in individuals. We aim to examine if one's anxiety or depression level affects the extent to which exercise reduces their anxiety sensitivity (AS). Using a randomized within-subjects crossover design in a sample of 60 college-aged females with elevated AS, measures of anxiety, depression, worry, and self-efficacy were used to determine whether these variables influence exercise-induced changes in AS, emotion regulation, and state anxiety. Participants were randomized either an acute bout of moderate intensity aerobic exercise or a seated rest control condition on two, counterbalanced sessions. Participants reported state anxiety using the State-Trait Anxiety Index - State (STAI-S), before and after each intervention. Depression levels were measured using the Patient Health Questionnaire (PHQ-9), anxiety levels were measured by the Generalized Anxiety Disorder - 7 (GAD-7) questionnaire, and self-efficacy was measured by the General Self-Efficacy Scale (GSE). A moderation analysis revealed an interaction effect of GSE x Intervention x ERQ in which those with greater GSE levels in the exercise condition showed greater ERQ scores while the control condition showed the opposite effect. An interaction effect of PHQ-9 x Intervention x STAI-S was also found in which greater PHQ-9 scores were correlated with a greater decrease in STAI-S scores in the exercise condition with the control intervention also showing the opposite effect.

IDEOLOGICAL SIMILARITIES AND DIFFERENCES IN PARTISAN ANIMOSITY

Presenter(s): Jolie Kretzschmar (Michigan State University)
Psychology
Mentor(s): Mark Brandt (College of Social Science)

Partisan animosity is the expression of dislike for a person's political outgroups. Debates have recently been sparked among scholars as to whether members of the political left and members of the political right experience partisan animosity in more similar or different ways. However, previous work specific to this topic has largely only sampled from the United States. We have re-analyzed existing data from 8 European countries (N = 11,217) with plans to analyze additional data from 36 countries from around the world to better understand if members of the political left and political right have similar psychological processes that lead to expressions of partisan animosity. Our analysis also studies the relationship between a person's political extremity and partisan animosity. Thus far, we found that left-wing and right-wing people experience animosity in similar ways (but towards different political outgroups) and that people with extreme political ideologies express more animosity towards political groups who disagree with them. We believe that the wider number of countries sampled in these two studies will give the global context necessary to compare how members of the political right and left experience political animosity. Our hope is that study will lead to further study on partisan animosity and more generally political polarization.

Social Sciences

REPRODUCTIVE FREEDOM FOR MICHIGAN: UTILIZING SURVEY RESULTS TO EXPLORE DEMOGRAPHIC FACTORS INFLUENCING VOTING BEHAVIOR, LEGAL PERSPECTIVES, AND SELF-IDENTIFICATION RELATING TO ABORTION

Presenter(s): Lola Browne (Michigan State University)
Social Sciences
Mentor(s): Matthew Grossmann (College of Social Science)

The 2022 midterm election introduced six proposals addressing the constitutional protection of abortion, three of which were approved by voters in California, Michigan, and Vermont. These states were the first to establish the right to abortion post Dobbs v. Jackson, which exonerated protections under the 14th Amendment's implied right to privacy. Out of these states, Michigan's notability stems from its swinging electoral partisanship, as observed in the 2016 and 2020 elections in which abortion was a focal point. The Pew Research Center's Religious Landscape Study (2007-2014) surveyed over 35,000 Americans on their religious affiliations, beliefs, practices, and social and political views, providing critical insights into demographic opinions on abortion legalization in Michigan. Using the State of the State Survey (SOSS) of 2022, this research adopts a similar analytical approach to investigate the intersectionality of voting behavior, legal perspectives, self-identification, and associated demographics including sex, generation, education, race, religion, political party & ideology, relationship status, income, residence, and parental status. Quantitative analysis using R examines the frequency, proportion, and average of each demographic subgroup's responses regarding abortion opinion

and Michigan's Proposal 3 of 2022. This analysis hypothesizes that anti-abortion sentiment is most prevalent among Christian conservative Republicans living in rural areas who were born

ORGANIZED OPPOSITION AND SUPPORT FOR RENEWABLE ENERGY IN THE MIDWEST: A REGIONAL ANALYSIS

Presenter(s): Daniel Horowitz (Michigan State University)
Social Sciences
Mentor(s): Douglas Bessette (College of Natural Science)

As the size of renewable energy projects and the speed of development increase with our state and federal decarbonization targets, the role and influence of organized groups in supporting or opposing those projects continue to grow. This study utilizes data from the Sabin Center for Climate Change Law and the Robert Bryce Report as a starting point to build a first-of-its-kind database of organized online support and opposition groups. The database includes group names, states, townships and counties, group and member counts, project and developer names, dates of events, and finally a number of hyperlinks including local ordinances and local news articles for further analysis. So far in our process, we have recorded over 250 entries of organized opposition or support in the midwest region, a number which grows on a daily basis. The goal of this database and studies is to better understand how developers and states alike can improve development processes and community outcomes, and provide community-acceptance researchers access to a growing body of opposition and support group data. The database currently focuses on wind and solar projects in the US Midwest, but work has begun to expand its reach across the US. Additionally, we are currently using the database to explore the relationship between project size and opposition, the types and locations of projects that receive the most opposition, and finally which developers have faced the most opposition. Development of a websit

THE DOUBLE-HEADED EAGLE COMES TO LATIN AMERICA: ALBANIAN CRIMINALS AND LATIN AMERICAN CARTELS IN EUROPE'S GROWING COCAINE PROBLEM

Presenter(s): Brandon Loy (Michigan State University)
Social Sciences
Mentor(s): Galia Benitez (James Madison College)

The late 20th and early 21st centuries saw a new wave of globalization. With the expansion of legal markets through neoliberal trade agreements, so did the growth of illicit markets and the goods that come with them. Through organized criminal groups such as mobs and cartels, the web of international crime began to wrap its way around the world slowly. A fascinating intersection of the broadness of international crime can be found in Latin America: here, local cartels and mobs work and fight with each other for the trade, smuggling, and profit of drugs from countries from all around the world. Completing with the Russian and Italian mobs in Ecuador are the well-established Albanian mobs, who work hand in hand with local cartels for the international shipment of cocaine from Colombia, Peru, and Bolivia. Strongholds that the Albania mob developed starting back in the early 2000s have become most prominent in Ecuador, which has allowed it to triumph in the distribution of cocaine. All over the European continent, due to the operation of the Albanian mob, they have become the number one distributor of cocaine and other illicit substances, surpassing the Italian mobs in organized criminal activists. Entering the late 2010s and early 2020s, the Albania mob has further strengthened its foothold within Ecuador and, taking advantage of Ecuador's domestic policies and corruption within the government and police agencies, which has led Ecuador and Colombia to become a hotbed for violent

EXPLORING FACTORS BEHIND THE SIGNIFICANT DECLINE IN ACCOUNTING GRADUATES IN RECENT YEARS AND STRATEGIES FOR PROMOTING ACCOUNTING CAREERS

Presenter(s): Enkhmaa Buyanbadrakh (Albion College)
Social Sciences
Mentor(s): Connie OBrien (Albion College)

The American Institute of Certified Public Accountants (AICPA) - a non-profit professional organization representing certified public accountants (CPA) in the United States - has reported in their recent "2023 Trend Reports" that the number of bachelor's and master's degree graduates in accounting dropped significantly since 2021. In this research, the interest lies in learning more about why the number of U.S. graduates with bachelor's and master's in accounting majors is declining, finding the influential factors for the significant drop in recent years. The primary focus will involve examining historical trends and statistical data related to the enrollment and graduation rates of accounting majors across U.S. educational institutions. Quantitatively, an analysis of numerical patterns will be conducted, considering factors such as changes in student preferences, economic conditions, and technological advancements that may contribute to the observed decline. This study is crucial for informing educational institutions, industry stakeholders, and policymakers to ensure the sustained growth of the accounting profession in the U.S. Through a comprehensive exploration, this study aims to contribute meaningful insights to accounting education and the profession, with the ultimate goal of encouraging a revived and sustained interest in pursuing accounting careers in the United States.

OSTEOBIOGRAPHY OF A PRECLASSIC MAYA INDIVIDUAL

Presenter(s): Lily Moura-Ricks (Michigan State University)
Social Sciences
Mentor(s): Gabriel Wrobel (College of Social Science)

Despite the research on ancient Maya culture and ways of life, little is known about smaller communities. This case study presents an osteobiography of a young adult female who lived during the Late Preclassic period (0 - 300 AD) in the Roaring Creek River Valley of central Belize. This individual was found in a rock shelter called Actun Uayazba Kab (Handprint Cave) with multiple other individuals spanning several different eras. Not only were multiple individuals found at this site, but there were also obsidian blades, petroglyphs, and handprints on the sides of the walls. Using standard methods in bioarchaeology, including age and sex estimation and identification of signs of poor health, I hoped to gain a better understanding of the individual's life experience and explore the nature of the rock shelter's mortuary use. Several interesting details emerged during this analysis, such as the lack of cranial modifications (that were common at this time), an accessory molar and dental cusp, and a supratrochlear foramen. These anomalies demonstrate personal features that bring a humanistic perspective to the past. The goal of this research was to try and uncover details of this individual's life that could help us better understand how specific ancient Maya communities lived and how their culture could potentially be different than what we currently know about the modern Maya.

FROM EAST TO WEST: HOW DO MUSLIM IMMIGRANT STUDENTS DEAL WITH THE DIFFICULTIES OF BELONGING TO MULTIPLE CULTURES, AND HOW DOES THIS AFFECT THEIR SENSE OF IDENTITY?

Presenter(s): Shahad Nasir (Michigan State University)
Social Sciences
Mentor(s): Steven Fraiberg (College of Arts and Letters)

Culture encompasses the shared beliefs, behaviors, customs, language, and artifacts passed down through generations. This ethnographic study focuses on the cultural experiences of third-generation Muslim immigrant students at Michigan State University, examining their strategies for adapting, resisting, or merging the diverse cultures they inhabit. Drawing from my experience as an immigrant student engaging with multiple cultures, I reflect on my journey of initially resisting American culture, followed by gradual adaptation and creating a hybrid cultural identity that blends my Muslim-Iraqi heritage with the American culture. Many immigrants arrive in the U.S. seeking better education and work opportunities. However, the younger generation often struggles with the challenges of navigating and adapting to multiple cultural identities. This study aims to shed light on these struggles, exploring the details of cultural adaptation and resistance among third-generation MSU students. Through in-depth interviews and participant observation, I identify key issues these students face and propose strategies to address them. The findings of this study not only provide valuable insights for educators and immigrant families but also offer practical guidance for young immigrants striving to find their cultural identity. By highlighting these issues, this research contributes to a deeper understanding of the multicultural dynamics at play within immigrant communities o

A WAR ON MEMORY: A COMPARATIVE ANALYSIS OF NINETEENTH-CENTURY AMERICAN HISTORY TEXTBOOKS

Presenter(s): Lee Ferris (Michigan State University)
Social Sciences
Mentor(s): John Waller (College of Social Science)

In the nineteenth century, the United States was in search of a national identity. American history education became a prominent means through which patriotism and national values were defined and instilled into the growing youth of the country. This research presents a qualitative and comparative analysis of nineteenth-century American history textbooks, through a framework that understands these texts as devices to assert an American hegemony. As the young nation's identity became increasingly divided from the issue of slavery, American history textbook authors across region and time often developed conflicting narratives and themes into their work. While Northern authors promoted themes of individual industriousness and enlightenment as well as emphasized the role of the North throughout American history, Southern authors provided a reactionary narrative that idealized Southern society and its "peculiar institution" of slavery. Following the Civil War, Southern textbook authors employed the Lost Cause narrative in its lessons on the brutal inter-state conflict, proclaiming that secession was justified through the need for states' rights. Northern authors, alternatively, did little to defend the historical record from the Lost Cause narrative, instead opting for themes of unification. While the issues of slavery, the Civil War, and the clashing cultures of the North and South were implicitly debated within American history textbooks, white authors-the overwhelming majority

BARISTAS UNITED? THE FORMATION AND USE OF COLLECTIVE IDENTITY WITHIN LABOR MOVEMENTS

Presenter(s): Elliott Smith (Michigan State University)
Social Sciences
Mentor(s): Monique Kelly (College of Social Science)

Previous scholarship has extensively examined unionization utilizing social movement theory, labor relations theory and beyond. Such research has often documented the processes of forming unions from varying perspectives, what may have precipitated the formation of unions, and common characteristics that drive worker collective identity. This research has overlooked workplaces defined by precarious employment and where unions have struggled to gain traction. Centering the case of Starbucks I investigate how anti-unionizing efforts impact workers. Using content analysis of videos made by Starbucks workers gathered from social media platforms, I examine worker identity formation, subsequent changes over time and in response to anti-union practices to their movement work, as well as work climate. The case of Starbucks is theoretically and analytically important as it represents a current and public labor movement. In 2021 workers at Starbucks began to organize prompted by poor working conditions. The Starbucks corporation, noted for its categorical and wide-ranging attempts to stifle organizing attempts by workers, continues to challenge workers with textbook anti-union practices to date. Understanding these workers' experiences during unionizing efforts and the impacts of "union-busting" tactics on collective action and work climate for these workers may offer insight into unionizing outcomes. The expected contributions of this work are related to aiding in understanding the ef

"ENTERING MY SOFT GIRL ERA" : EXAMINING THE COMPLEXITIES OF SELF-LOVE FOR BLACK WOMEN

Presenter(s): Drue Bender (Michigan State University)
Social Sciences
Mentor(s): Chamara Kwakye (College of Arts and Letters)

Black women are often characterized as "superwomen" known for their reliability and inordinate strength. This is one of many ways Black women have been misrepresented in society that makes it challenging for us to engage in self-love practices. When society constantly devalues or misrepresents Black women it can lead to internalized race-based trauma and impact self-worth making it challenging to see the importance of self-care. Self-care can be defined as engaging in experience to show up as your unapologetic self; knowing you are worthy of love & joy invariably. This includes but is not limited to self-acceptance and forgiveness. Black women have historically been conditioned to suppress and conceal our identities and natural attributes. Traces of this oppressive behavior are the root of respectability politics and roadblocks on the journey to self-love. Therefore, the oppression of Black women's intersectionality has created a complex relationship for Black women and how they practice self- care. The blame is often placed on Black women to learn how to carry our baggage and less on the reason it is so heavy and how to reduce the load hoisted upon us. This research will investigate the complexities between Black women and our relationship with self-love. The challenges of this relationship are visible in parts of Black history that are prevalent to Black popular culture today. This study will utilize thematic content analysis of social media to investigate the int

THE POLITICAL EFFECTS ON SCHOOL BOND ELECTIONS

Presenter(s): Cesar Gonzalez (Roosevelt University)
Social Sciences
Mentor(s): Sarah Reckhow (College of Social Science)

U.S. school districts often request money to build new or upgrade existing school facilities. Funds for capital-improvement projects are usually raised through school bonds, which local property taxes can raise. (Duncombe & Wang 2009). The importance of these bonds comes down to helping improve schools structurally along with any resources they may lack. (Theobald & Meir 2002). However, whether a bond passes depends on several factors. For one, voter turnout is paramount for a bond to pass; whether parents care about their local school and decide to vote for school bonds can be a significant determinant. Our research will examine how parent voter turnout, among other factors, plays a vital role in determining school bond elections in local Michigan schools (Pogodzinski et al., 2018). Our research gathered data from previous bond elections of local Michigan public schools by the State of Michigan Department of Treasury. We compiled all the bond elections and socio-demographic data in an Excel spreadsheet and later coded everything using logistic regression analyses. Specifically, our study aims to demonstrate if bond elections in local Michigan school districts are impacted by specific common factors listed in previous literature and research. Our results indicate that the particular factors usually associated with bonds failing or passing, such as parent voter turnout, appear not to matter-however, this is the question moving forward in our research.

HOW DID THE AMERICAN RESCUE PLAN AFFECT CITIES AND COUNTIES' ABILITY TO CONTINUE IN TIMES OF CRISIS?

Presenter(s): Grace Jang (UC Berkeley)
Social Sciences
Mentor(s): Meghan Wilson (College of Social Science)

The American Rescue Plan Act of 2021 was a bill signed into law by President Biden in March of 2021 to combat the economic downfalls and financial hardships brought about by the COVID-19 pandemic. This paper examines the impact of ARPA on cities throughout the United States and whether they had enough money to achieve the things they set out to do. It explores whether cities used it to keep their lights on, or utilized it to better things they wanted to and couldn't before. The study begins with a literature review exploring background on ARPA and its position in academic research. We take from the Journal of Public Policy, American Administrative Theory and Praxis, and Public Integrity for this review. The paper then takes and analyzes data from programs and expenditures under ARPA to dive into cities' spending and the programs they were able to implement with said spending. Reported spending will be collected from the National League of Cities. Alternatively, we will utilize the Local Government ARPA Investmentment Tracker, which is an online resource that compiles information from local governments to offer a detailed picture of how large cities and counties are deploying ARPA State and Local Fiscal Recovery Fund dollars. In conclusion, the study examines expenditures by city, county, and state. It performs a case selection to look at cities in financial crisis, cities that were stable, and cities that were thriving after the passage of the bill.

IMPACT OF OPPORTUNITY ZONES IN MICHIGAN

Presenter(s): Trenton O'Bannon (UC Berkeley)
Social Sciences
Mentor(s): Jeffrey Wooldridge (College of Social Science)

Created by the Tax Cuts and Jobs Act in 2017, the Opportunity Zone program was designed to encourage investment in distressed communities across the U.S. This project aims to answer the question: What are the economic and societal impacts of Opportunity Zones in Michigan? Specifically, we focus on variables such as employment, earnings, poverty, education, and crime for the years 2012, 2015, 2020, and 2022. We examine the early impacts of the Opportunity Zone program on residents of targeted areas. Using U.S. Census data, we employ difference-in-differences statistical analysis to study the economic and societal impacts of Opportunity Zones in Michigan over time. We are testing the hypothesis that the implementation of Opportunity Zones created by the 2017 tax act leads to positive societal and economic benefits. Previous research suggests that Opportunity Zones have had little to no positive effects. However, as Opportunity Zones are a relatively new policy, there is a need for follow-up research. In addition to the economic and societal indicators, we are also collecting demographic information from 2012, such as average education levels, high school graduation rates, age distributions, racial/ethnic composition, gender breakdowns, marriage rates, and single-parent household rates. These demographic variables will be used as controls in our analysis to ensure a more robust understanding of the impacts. We plan to further the field by providing more recent resear

ENHANCING ACCESS TO STUDY ABROAD RESOURCES FOR FIRST-GENERATION STUDENTS: A QUALITATIVE STUDY

Presenter(s): Rachel Robinson (Grand Valley State University)
Social Sciences
Mentor(s): Anna Hammersmith (Grand Valley State University)

Studying abroad is essential for developing skills needed in the 21st century. Increasing participation among first-generation college students (FGCS) is crucial as they constitute a significant portion of college enrollment. In 2018, FGCS made up over a third of all university students, rising to 56% by 2021 in the U.S. (National Center for Education Statistics, 2018; RTI International, 2019a, 2019c). However, only 8% of FGCS studied abroad compared to 17% of their non-FGCS peers (RTI International, 2021). This disparity shapes educational outcomes and workforce readiness. FGCS, defined as students whose parents did not complete a bachelor's degree, face unique obstacles like limited financial resources, lack of familial support, and unfamiliarity with academic norms. Despite efforts to enhance diversity in study abroad programs, FGCS remain underrepresented due to challenges with applications, funding, and cultural adjustment. To address these issues, semi-structured interviews with faculty and staff in study abroad offices at various institutions will be conducted to understand the barriers FGCS face and potential solutions. Analyzing this qualitative data will reveal common themes and recommendations, informing strategies to create more opportunities for FGCS to study abroad, fostering educational equity.

INSTAGRAM AND REALITY TV?S IMPLEMENTATION OF COOPERATIVE PRINCIPLES

Presenter(s): Janiah Piper (University of Rochester)
Social Sciences
Mentor(s): Taiquan Peng (College of Communication Arts Sciences)

The economic condition of the African American community has never been on par nor capable of comparing to the state of their always prospering Mmmmmm oppressive white counterparts. Blacks are paid less than their white colleagues, less likely to be hired for high-income positions, and are less likely to be considered for promotions. In response to this, Black communities created cooperatives to combat these socioeconomic, discriminatory policies and practices. Simply put, members of cooperatives share the same voice, authority, contribution, and gain. This study analyzes how joint accounts on Instagram and The Baddies reality TV series on Zeus Network alter the communal core of cooperatives. Through a literature review of cooperatives and a content analysis of both platforms, I will compare the function and structure of potential digital cooperatives (joint accounts and reality TV) to two historical cooperatives implemented between the 17th and 21st centuries.

THE EFFECTIVENESS OF BODY DOUBLING IN CO-WORKING SPACES THAT CAN GAUGE AN OVERALL POSITIVE EFFECT LARGER POPULATIONS.

Presenter(s): Evan Wasson (Morehouse College)
Social Sciences
Mentor(s): Angela Hall (College of Social Science)

Body doubling is the practice of working alongside someone else to boost motivation and focus while utilizing social accountability and facilitation to maximize productivity. This study evaluates body doubling's growing popularity in its effectiveness and its effects on individual productivity as other studies lacked to include the importance of attention of those involved. The research we are employing is survey questionnaires which will be used to evaluate the effectiveness body doubling has on accountability, action, and performance. The focused study titled "Investigating the Effects of the Presence of Others on Task Performance: Mediation of Attention" is used as a source for measuring the level of attention which can be similar in our case. This assessment is used to determine how it involves monitoring attention both before and after the surveys will be crucial in evaluating surveys that focus on efficacy in environments as well as productivity, procrastination, and satisfaction. In this research, we explain how body doubling improves performances by decreasing procrastination and increasing focus/attention. This approach's effectiveness will be demonstrated by the notable decline in procrastination combined with increases in productivity and satisfaction scores. We believe that the benefits of body doubling are further enhanced by the collaborative and encouraging atmosphere of coworking spaces, which offers an organized yet

COUNTER-TERRORISM IN THE U.S.: RECOGNIZING THE STRATEGIES AND THEIR EFFECTIVENESS

Presenter(s): Keymoni Coleman (Dillard University)
Social Sciences
Mentor(s): Steven Chermak (College of Social Science)

Since the 9/11 attacks, law enforcement has significantly improved with how they respond to terrorism. For example, the Federal Bureau of Investigation (FBI) have enhanced their strategies to effectively combat terrorism in the United States shortly after. However, despite the advancements of the FBI, terrorist groups are continuously growing with the intention to harm

U.S. soil. Due to the growth of many terrorist organizations, they are also improving their ways to attack America. Specifically, violent groups like Jihadist and Neo-Nazis, are most often seen in many terrorist plots in the U.S. Jihadism is a form of religious violence by the Islamic state where they are posed as threats to the west. Neo-Nazism is a post-World War 2 ideology of Nazi Germany, and they aim to bring back that ideology with the use of force. Furthermore, the FBI strategies used to counter terrorism in the U.S. need to be proven effective for modern day terrorism. The purpose of this research is to answer the question; "Are the current strategies used by the FBI, effective for modern day terrorism". This research also aims to provide more qualitative literature, due to there being limited qualitative data on this topic. The methods in this research contain the use of qualitative/explorative analysis by conducting four case studies of domestic terrorism. These cases range from the years 2019-2023, and this is due to them being more recent. This case study analysis will have two cases being, Far-rig

MEANINGS OF AUTISM, MEANINGS OF WORK: A QUALITATIVE STUDY

Presenter(s): Nadine Shetiah (Michigan State University)
Social Sciences
Mentor(s): Ariel Cascio (College of Human Medicine)

Inclusion at work means working together across differences. Our qualitative study asks how autistic and non-autistic people navigate shared spaces of work, centering the perspectives of autistic people. This poster will present meanings of work and meanings of autism identified through thematic analysis of interview transcripts and ethnographic fieldnotes. Different ideas about what autism means are important for working together across differences because (1) characteristics participants attribute to autism can make things easier or harder at work; (2) people use ideas about what autism is to find accommodations and strategies to make work easier; (3) (mis)understanding impacts interpersonal relationships, masking, and disclosure at work; and (4) autistic people must contend with "debates" about autism at work.

MAKING APPOINTMENTS: THE POLITICS OF JUDICIAL NOMINATIONS

Presenter(s): Meera Kanade (Michigan State University)
Social Sciences
Mentor(s): Ian Ostrander (College of Social Science)

Appointments to the lower federal courts are often a source of partisan and inter-branch conflict. This project seeks to promote new exploration into the politics of lower federal court appointments by examining the duration and outcome of presidential nominations to fill such vacancies. The data gathered will include detailed political contexts, including information on senate delegations, as well as biographical background data on nominees for all vacancies and formal nominations within the current 118th Congress. This timeframe will allow contemporary practices within the Senate to be compared against historical data, which we have gathered for previous studies. These data also allow us to examine what kind of nominations presidents make including the role of race and gender, how and how fast they move through the Senate, as well as to measure the relative priority that each branch places on these positions.

EXPERIENCE OF WOMEN IN THE WORKFORCE

Presenter(s): Troy Borrero (Sienna Heights University)
Social Sciences
Mentor(s): Heather Moore (Siena Heights University)

For generations, aspects of diversity have been promoted differently in the workplace, for better or worse. Still, the consistent issue of discrimination against women and women of color arises that creates barriers of entry into executive or higher leadership positions. By studying the historical aspects of these barriers, including education, the research hopes to find how discrimination in many aspects of getting to higher leadership impacts women and women of color today. It is important to question why women are still being inequitably treated in modern organizations and why the barriers that have been created have and are still negatively impacting women's upward mobility. Using qualitative research methods, expectations and research hope to show a deeper insight into modern women's stories and some patterns of discrimination or invisible barriers while also looking for institutional corruption or mistakes. By using a wide variety of women's interviews, expectations are set to see a difference between White women's and women of color's experiences and how they felt the institution of business and education has impacted them to where they are now. Continuing the studies can broaden women's opportunities in the workforce and modernize the literature in human resources management and industrial organization psychology.

Social Science, Arts & Humanities

EVALUATING MSU TRANSFER POLICIES THROUGH A TRANSFER RECEPTIVE CULTURE LENS

Presenter(s): Gianna Sorge (Michigan State University), Jazmin Russell (Michigan State University), Rodashi Roy (Michigan State University)
Social Science Arts Humanities
Mentor(s): Vashti Sawtelle (Lyman Briggs College)

Students who transfer to Michigan State University (MSU) from other institutions have diverse experiences that are often different from non-transfer students. It is MSU's responsibility as the receiving institution to take equitable actions to ensure a smooth transition for these students. Grounded in Critical Race Theory, the framework of Transfer Receptive Culture (Jain et al., 2011) highlights key elements for institutions that receive transfer students to create equitable and accessible practices for nontraditional transfer, first-generation, and low-income students at their chosen institutions. The current responsibility of a successful transfer falls solely on the student; fostering Transfer-Receptive programs and communities helps redistribute this responsibility onto their respective sending and receiving institutions. This study uses policy document analysis methodology to examine MSU's transfer policies by combining the Transfer Receptive Culture framework with an auditing tool created by the National Institute for the Study of Transfer Students (NISTS, 2022). Analyzing policies through these two frameworks has enabled us to create a database of current MSU policies related to the transfer process. The database catalogs these policies and their alignment and/or misalignment with the current NISTS framework and a Transfer Receptive Culture. In this presentation we share the current process & methods of our work and our goals for the future database. This

CHEMISTRY CONCEPTS ON YOUTUBE: HOW WELL DO EDUCATIONAL VIDEOS SUPPORT CONCEPTUAL LEARNING OF INTERMOLECULAR FORCES?

Presenter(s): Ana Ivanov (Michigan State University), Deborah Herrington (Grand Valley State University), Lucian Forestieri (Grand Valley State University), Sophia Gudinas (Michigan State University), Victoria Chisholm (Michigan State University)

Social Science Arts Humanities

Mentor(s): Deborah Herrington (Grand Valley State University), Ryan Sweeder (Lyman Briggs College)

Many students supplement their chemistry coursework with YouTube educational videos. Intermolecular forces are the foundation of general chemistry, and YouTube videos that cover this topic lack a common standard for assessing quality educational content. A framework has been developed to identify and analyze YouTube videos that best support conceptual understanding of intermolecular forces. To find relevant videos, general search terms are used for each type of intermolecular force, and videos are filtered by number of views. Criteria addressing chemistry content and multimedia aspects of educational videos are then applied. Data collection follows a series of watching highly viewed videos and discussing the content for a final consensus. The data are further analyzed for connections between criteria met, types of intermolecular forces, and styles of each channel. This presentation will share the analysis of these videos, key findings and important takeaways, such as the atypically high prevalence of causal mechanistic reasoning. The goal of this project is to identify higher quality intermolecular force videos and determine variances in criteria met for other chemistry concepts. Examining the characteristics of educational videos on YouTube can emphasize what areas creators need improvement in to best contribute to the conceptual understanding of chemistry.

IDENTIFYING REFLECTION PROMPTS THAT ELICIT SELF-EFFICACY EXPLICIT STATEMENTS WITHIN STEM STUDENTS' DAILY REFLECTIONS

Presenter(s): Amanda Graessle (The College of New Jersey)

Social Science Arts Humanities

Mentor(s): Rachel Henderson (College of Natural Science), Vicky Phun (College of Natural Science)

Self-efficacy (SE)-one's confidence in their ability to successfully perform a task-has been shown to be a major predictor of achievement and persistence in undergraduate STEM courses and majors. SE has largely been studied utilizing pre- and post-interviews or surveys. While these studies provide an impression of general trends in how SE changes over time, they simplify and ignore the intricacies of how SE fluctuates and is impacted on a daily basis. Using a mixed methods approach, which combines daily quantitative surveys and qualitative personalized reflections, we are seeking to gain a deeper understanding of STEM undergraduate students' experiences and how and why SE is impacted in the moment. For this project, I will be assessing the qualitative personalized reflections and their connections to self-efficacy explicit (SEE) statements-statements in which a student is clearly discussing their SE. Currently, the daily reflection prompts draw upon the student's survey responses and are written with the intent of probing certain areas of a student's SE. However, it is unclear whether the prompts elicit responses from students which explicitly discuss their SE. Therefore, to investigate this I will identify what area of SE the prompts are meant to probe and code the student responses for SEE statements. In this poster, I will discuss the preliminary findings on the overlap between th

IMPACTS OF A TRANSFER PEER MENTORING PROGRAM ON TRANSFER STUDENTS

Presenter(s): Delaney Dixon (Michigan State University)
Social Science Arts Humanities
Mentor(s): Vashti Sawtelle (Lyman Briggs College), Vicky Phun (College of Natural Science)

Transferring from a community college and being a newly transferred student at a bachelor-degree granting university can be a challenging experience, especially when students do not know the university's resources. The Transfer Experience Mentoring Program (TEMPO) aims to give new and potential transfer students access to those resources through peer mentoring and community building. Peer mentoring at MSU allows experienced transfer students to pass on knowledge, advice, and navigational resources to incoming and new transfer students. I was a part of TEMPO as both a mentee and a mentor and greatly benefited from this program. Based on my experience and literature, peer mentoring can support students in developing a sense of belonging. Establishing a sense of belonging in a community is critical to student development in college (Gunn et al., 2017). When students experience a stronger sense of belonging, this has been shown to be a predictor of academic success and supports learning new skills like navigating an academic setting, goal setting, and time management (Gunn et al., 2017). In this poster, I will use an autoethnographic reflection to discuss my experience as a part of TEMPO, and how TEMPO can benefit incoming and newly transferred students by providing them with an increased sense of belonging.

GOTHIC SYMBOLISM AS IT PERTAINS TO GENDERS

Presenter(s): Haley Bell (Siena Heights University)
Social Science Arts Humanities
Mentor(s): Julie Barst (Siena Heights University)

When trying to understand the Gothic literature of now or of years ago it is important to acknowledge the difference in interpretations as well as which authors helped researchers to greet the point of over-analyzation relevant to some specks of gothic lenses. The purpose of this study is to analyze the possibility of different focus groups interpreting the symbolism of gothic literature through an esoteric filter. More in depth, how do different genders and sexualities experience the same symbol. From the beginning of the grotesque there have been undertones of social roles, discrete threats of straying from the status quo, tinged with the secrecy of homoerotic relationships. How sexuality might be examined has only recently come to light in the 21st century sparking debate that maybe symbolism is not stapled to the intention of symbolism from the author. Wonder of if an audience can truly know what the intention was at all plagues the mind of several gothic readers.

Assorted Disciplines

PRELIMINARY FINDINGS OF TART CHERRY SUPPLEMENTATION ON SLEEP OUTCOMES

Presenter(s): Gabby Cooney (Michigan State University)
Assorted Disciplines
Mentor(s): Eric Gurzell (College of Natural Science), Jenifer Fenton (College of Natural Science), Robin Tucker (College of Natural Science)

Nearly 1 in 3 Americans do not get enough sleep. Insufficient and poor-quality sleep are linked to negative health outcomes including obesity, hypertension, and dyslipidemia. Montmorency tart cherries (TC) may help resolve sleep issues due to bioavailable melatonin - a hormone that promotes sleep. The objective of this RCT study is to determine if TC supplementation improves the duration and quality of sleep in overweight individuals. A preliminary cohort of 22 participants, 72.7% female, aged 18-50 y, with a BMI ≥ 25.0 kg/m2 completed the study. Baseline and post-treatment insomnia, sleep quality, and Fitbit data were collected. The average age of the participants was 35.2 ± 11.8 y and BMI was 33.5 ± 8.2 kg/m2. Insomnia Severity Index scores for participants did not change based on treatment (pre TC: 12.5 ± 5.4 vs. post TC: 11.0 ± 5.1; pre ctrl: 12.6 ± 5.1 vs. post ctrl:11.5 ± 4.6; $p > 0.05$;). Pittsburg Sleep Quality Index score improved in the placebo group (pre ctrl: 9.0 ± 3.2 vs. post ctrl: 8.0 ± 2.9; p=0.008) and nearly in the TC group (p=0.050). Contrary to the hypothesis, TC supplementation resulted in shorter sleep duration (pre: 7.0 ± 1.0 h vs, post: 6.4 ± 0.9 h; p=0.021); whereas, the control group experienced longer sleep duration (pre: 6.6 ± 1.2 h vs. post: 7.1 ± 0.9 h; p =0.019). These preliminary results raise questions about whether TC supplementation aids in positive sleep outcomes. With the addition of more participant data, these results are subject

ANDROGEN HORMONES REGULATE THE PRODUCTION ON THE PAIN-INDUCING INFLAMMATORY MOLECULE IL-1β IN A MOUSE MODEL OF INFLAMMATORY PAIN

Presenter(s): Hari Ramakrishnan (Michigan State University)
Assorted Disciplines
Mentor(s): Geoffroy Laumet (College of Natural Science)

Chronic pain prevalence varies between sexes with a higher incidence and duration reported in women compared to men. This disparity suggests that biological factors, such as sexual hormones, may influence pain perception and development. Among the key players in pain mechanisms, interleukin-1 beta (IL-1β), an inflammatory molecule, has been identified to activate neurons involved in pain sensation. This study explores the hypothesis that sexual hormones, particularly androgens, regulate IL-1β production in inflamed tissues, thereby influencing pain responses. To investigate this, we induced inflammatory pain in male and female mice using Complete Freund's Adjuvant (CFA), injected into the hind paw. To assess the effect of sex hormones on the production of IL-1β; and pain, we modulated the levels of sex hormones by surgical and pharmacological approaches: ovariectomy, orchidectomy, and administration of flutamide, an androgen receptor antagonist. The analysis of IL-1β levels was conducted through quantitative Polymerase Chain Reaction (QPCR). We measured mechanical pain sensitivity thresholds using the von-Frey method. Our results indicate that injection of CFA drastically increased the levels of IL-1 β in the inflamed skin. Blocking IL-1β significantly reduced pain sensitivity. We found decreasing systemic androgen levels, by orchidectomy or flutamide, significantly increase IL-1β expression and pain recovery times. Overall, we foun

CHARACTERIZATION OF 3HE-IMPLANTED GOLD TARGETS FOR STUDYING 22NA DESTRUCTION RATES IN CLASSICAL NOVAE

Presenter(s): Chloe Ricker (Michigan State University)
Assorted Disciplines
Mentor(s): Christopher Wrede (College of Natural Science), Lijie Sun (Facility for Rare Isotope Beams)

Classical novae are thermonuclear explosions on accreting white dwarf stars in binary systems. Radioactive 22Na, a target of space based gamma-ray telescopes, is expected to be produced in considerable amounts in these novae. However, these predictions depend on the unknown destruction rate of 22Na by protons to produce 23Mg. The first run of a nuclear reaction experiment was performed in December 2022 at the TRIUMF-ISAC-II user facility in Canada to deduce the lifetime of a key excited state in 23Mg. At that time, two 3He ion-implanted gold foil targets were tested and data was obtained with the Doppler Shift Lifetimes 2 setup. One target was implanted at TRIUMF and one was implanted at Lawrence Livermore National Laboratory (LLNL). Both were made using similar procedures, but produced unique signatures in the experimental data. This work focuses on the analysis of charged particles and gamma rays detected during the experiment by using data taken on each target in order to better characterize the 3He content and contamination of each target. Ongoing analysis has discovered that the LLNL target contains more 3He, and thus had more reactions with the 24Mg beam, providing ample data on reaction rates. However, the TRIUMF target is less contaminated with elements and isotopes other than 3He and Au. Further analysis is being done to analyze the gamma spectra to discover the specific nuclides found on each target.

RETURNING CITIZENS' FEELINGS ABOUT THEIR ONLINE RECORDS

Presenter(s): Cara Pellegrino (Michigan State University)
Assorted Disciplines
Mentor(s): Kaelyn Sanders (The Ohio State University)

This project uses qualitative data from returning citizens in Michigan to explore their sentiments and feelings about the online availability of their criminal records.

NUMBER SEQUENCES GENERATED BY THE EDGE COVERS OF FAN GRAPHS

Presenter(s): Marshall Nicholson (Grand Valley State University)
Assorted Disciplines
Mentor(s): Feryal Alayont (Grand Valley State University)

In an effort to discover new integer sequences, we examined the number of edge covers of fan graphs. An edge cover of a graph is a subset of the edges such that every vertex is the endpoint of at least one edge. A fan graph is obtained from a path graph by adding new vertices adjacent to each vertex of the path graph. In this poster, we will present our research on the edge cover sequences and edge cover polynomials of fan graphs, beginning with the cases obtained from a path graph of length two and extrapolating to larger fan graph cases.

PROVIDING APPROPRIATE THERAPEUTIC CARE TO LGBTQ+ OLDER ADULTS IN MICHIGAN NURSING HOMES

Presenter(s): Alexis Karpenko (Michigan State University)
Assorted Disciplines
Mentor(s): Linda Keilman (College of Nursing)

Long-term care (LTC) health care professionals (HCPs) and direct care staff need appropriate and accurate information about delivering competent care to LGBTQ+ older adults. HCPs and staff who are not educated in care of this population may inadvertently provide biased care. This research identified preferences for education among individuals providing LTC services in Michigan (MI). In this descriptive cross-sectional study, an online survey was used to collect data from MI facilities (n = 429). Survey items included diversity training history, perceived need for training on care of LGBTQ+ older adults, barriers to training, and training preferences. Results were obtained from 71 facilities. Thirty-seven percent of responses came from direct care staff; 63% from administrators. There was good support for diversity training, with 24% stating diversity training was "somewhat important" and 74% stating it was "very important". Most (72%) endorsed the need and desire for more training on LGBTQ+ aging. More content on concerns such as room assignments, dementia, and use of pronouns were identified. Barriers to training included: cost, availability of trainers with the appropriate expertise, staff turnover, bias among staff and residents, and the need to provide rationale for this type of training. Most endorsed a mixed type of training and a training length between 1 and 3 hours. Diversity training is critical for LTC and needs to be expanded to include needs, values, and preferen

RETURNING CITIZENS' FEELINGS ABOUT THEIR ONLINE RECORDS

Presenter(s): Abbey Holland (Michigan State University)
Assorted Disciplines
Mentor(s): Kaelyn Sanders (College of Social Science)

This project uses qualitative data from returning citizens in Michigan to explore their sentiments and feelings about the online availability of their criminal records.

FURTHER INVESTIGATIONS INTO ASPERGILLUS CELL WALL POLYSACCHARIDES THROUGH SOLID-STATE NMR SPECTROSCOPY

Presenter(s): Aswath Karai (Michigan State University)
Assorted Disciplines
Mentor(s): Tuo Wang (College of Natural Science)

With the rise in the prevalence of antibiotic-resistant fungal infections, there is an imperative need for research on pathogenic fungi to improve treatment options. Aspergillosis, a particularly lethal fungal infection with a mortality ranging from 30-95% and estimates of 600,000 people dying each year, is caused by fungi in the Aspergillus genus. However, over 80% of aspergillosis cases are Aspergillus fumigatus infections. The average person breathes in thousands of spores daily. For healthy people, the spores show no adverse effects. However, immunocompromised people, like those with AIDS, Leukemia, or even COVID-19, or those taking immunosuppressants, can develop aspergillosis. Current antifungal treatments for aspergillosis generally target the polysaccharidic components of the fungal cell wall, which are unique to fungi and not found in humans, providing a layer of protection for the fungi. Our research uses high-resolution solid-state nuclear magnetic resonance (ssNMR) to determine the polysaccharides that make up the cell wall of Aspergillus fumigatus and related non-pathogenic Aspergillus nidulans. Studying both fungi allows us to see how the cell wall structures help influence pathogenicity. Using ssNMR allows us to view intact cells in their natural environment without the need for chemical modifications. Our findings shed light onto the structural components of the complex Aspergillus cell wall, informing the design of new and more efficient antifungal medication

HARNESSING THE POWERTOOLS ON MICHIGAN STATE UNIVERSITY HIGH PERFORMANCE CLUSTER COMPUTERS

Presenter(s): Clara Linjewile (Michigan State University)
Assorted Disciplines
Mentor(s): Craig Gross (Research and Innovation), Dirk Colbry (College of Natural Science), Nicholas Panchy (Research and Innovation)

At Michigan State University (MSU), high-performance cluster computers are at the forefront of Research and Innovation, supported by the unique integration of powertools that significantly enhance user experience and productivity. These powertools encompass a suite of advanced software and hardware technologies tailored to optimize computing efficiency, streamline workflows, and empower researchers across diverse fields. One key aspect of these powertools is their ability to harness the full potential of MSU's high-performance computing (HPC) clusters. These clusters are equipped with state-of-the-art processors, large-scale memory systems, and high-speed interconnects, enabling researchers to tackle complex computational challenges efficiently. Powertools provide intuitive interfaces and integrated development environments (IDEs) that simplify the management of computational tasks, offering researchers a seamless experience from initial setup to data analysis and visualization. Moreover, the powertools at MSU are tailored to meet the specific needs of different research disciplines, ensuring versatility and scalability. Researchers benefit from tools designed to optimize code performance, automate job scheduling, and facilitate collaborative projects across departments and institutions. These tools not only accelerate the pace of discovery but also promote interdisciplinary collaborations that are crucial for addressing today's complex scientific and societal challenges. The

IMPACT OF PH CHANGES ON ADIPOSE TISSUE LIPOLYSIS IN POSTPARTUM DAIRY COWS

Presenter(s): Elisabeth Schneider (Michigan State University)
Assorted Disciplines
Mentor(s): Andres Contreras (College of Veterinary Medicine), Miguel Chirivi Gonzalez (College of Veterinary Medicine)

Adipose tissue (AT) in dairy cows plays a crucial role in energy storage and metabolism, particularly during the postpartum period. Excessive lipolysis can predispose cows to various postpartum diseases. The regulation of acid-base, a physiological process that helps maintain extracellular pH in the body, is a pivotal factor influencing this metabolic process. Understanding how variations of pH levels impact AT function, and the rate of lipolysis is essential for mitigating health risks in dairy cows. This study aims to explain how pH changes impact AT lipolysis. The methods used were urine and blood samples taken from 10 multiparous Holstein dairy cows once per week 3 weeks before, 2 weeks after parturition. Subcutaneous and visceral AT samples were collected from dairy cows at a local abattoir. Isoproterenol (ISO, 1μM) to stimulate lipolysis and insulin (1 μg/L) inhibition of ISO was determined using ex vivo explant culture by measuring the glycerol release (μM/mg AT) at three different pH levels 7.3,7.4 and 7.5. Results show pH levels of blood and urine were measured, the averages for prepartum cows: blood pH 7.37 ± 0.04, urine pH 5.48 ± 0.30. For postpartum cows, blood pH 7.42 ± 0.03, urine pH 8.17 ±

0.32. These results show that both blood and urine pH increase postpartum. At pH 7.3 and 7.5 insulin fails to reduce lipolysis, there was a 22% reduction in lipolysis for pH 7.4. There

EVALUATION OF DIFFERENT BODY COOLING STRATEGIES FOR FORMULA 1 DRIVERS

Presenter(s): Aidan Davis (Michigan State University), Gabriel Gulbransen (Michigan State University)
Assorted Disciplines
Mentor(s): Abigail Faltus (College of Education), David Ferguson (College of Education)

Automobile racing is a physically demanding sport that requires drivers to pilot vehicles at high speeds while being exposed to elevated gravitational forces, cockpit temperatures, cognitive loads, and physical work to pilot the vehicle. Recent literature suggests that thermal strain is the most profound stressor placed on race car drivers with a recent study (1) demonstrating that when drivers succumb to thermal fatigue there is a loss in performance and more driving errors. Consistent with these results, at the 2023 Formula 1 Qatar Grand Prix ambient temperatures were dangerously elevated and several drivers experienced heat-related illness during the race and post-race. Consequently, efforts need to be made to identify effective cooling strategies for racecar drivers not only to reduce thermal fatigue, but also to increase their health and safety. The Spartan Motorsport Performance Lab at Michigan State University has conducted the first experiment to evaluate methods to cool drivers. In this study, 14 participants with fitness levels like Formula 1 drivers were recruited. All participants completed four exercise trials in an environmental chamber that mimicked hot race car cockpits. During all trials, participants wore a Formula 1 racing suit / helmet and cycled on an ergometer for 60 minutes. The six exercise trials differed in the following ways: (1) a Control condition (no cooling), (2) Cool Shirt condition, (3) Helmet Blower cold air condition, an

DEVELOPMENT OF THE 1-MONTH INFANT FECAL MICROBIAL COMMUNITIES: BIOACTIVE MARKER (HMO) HUMAN MILK OLIGOSACCHARIDE AND INFANT FORMULA INTAKE

Presenter(s): Katrina Liang (Michigan State University)
Assorted Disciplines
Mentor(s): Sarah Comstock (College of Natural Science)

Breastfeeding, the recommended diet for human newborns, is crucial in shaping the infant's gut microbiota. Human milk oligosaccharides (HMOs), one of the highly concentrated bioactive factors in human milk, are polymers of simple sugars which contribute to the development of the infant's microbiota. By acting via various mechanisms, they protect against infections (pathogens) and improve brain development. Infant formula is a substitute method of feeding, which can provide the necessary nutrients. Currently, some infant formulas include one or more HMOs, though these formulas still lack the other bioactive ingredients in human milk. The objective of the study was to screen specific HMO-metabolizing genes in genomic DNA of 1-month infant stool using quantitative real-time PCR (qPCR). Then, using that data and information about infant formula and human milk intake, we will evaluate and compare the effects of human milk and infant formulas on the presence and abundance of HMOs metabolizing genes in 1-month infant stool. Our findings indicate that the exposure to human milk is responsible for the varying concentrations of HMOs metabolizing genes in infants. Future studies of infant formula and microbial genes of the gut microbiota are needed to fully understand the impact of diet on gut microbes and subsequent effects on infant development.

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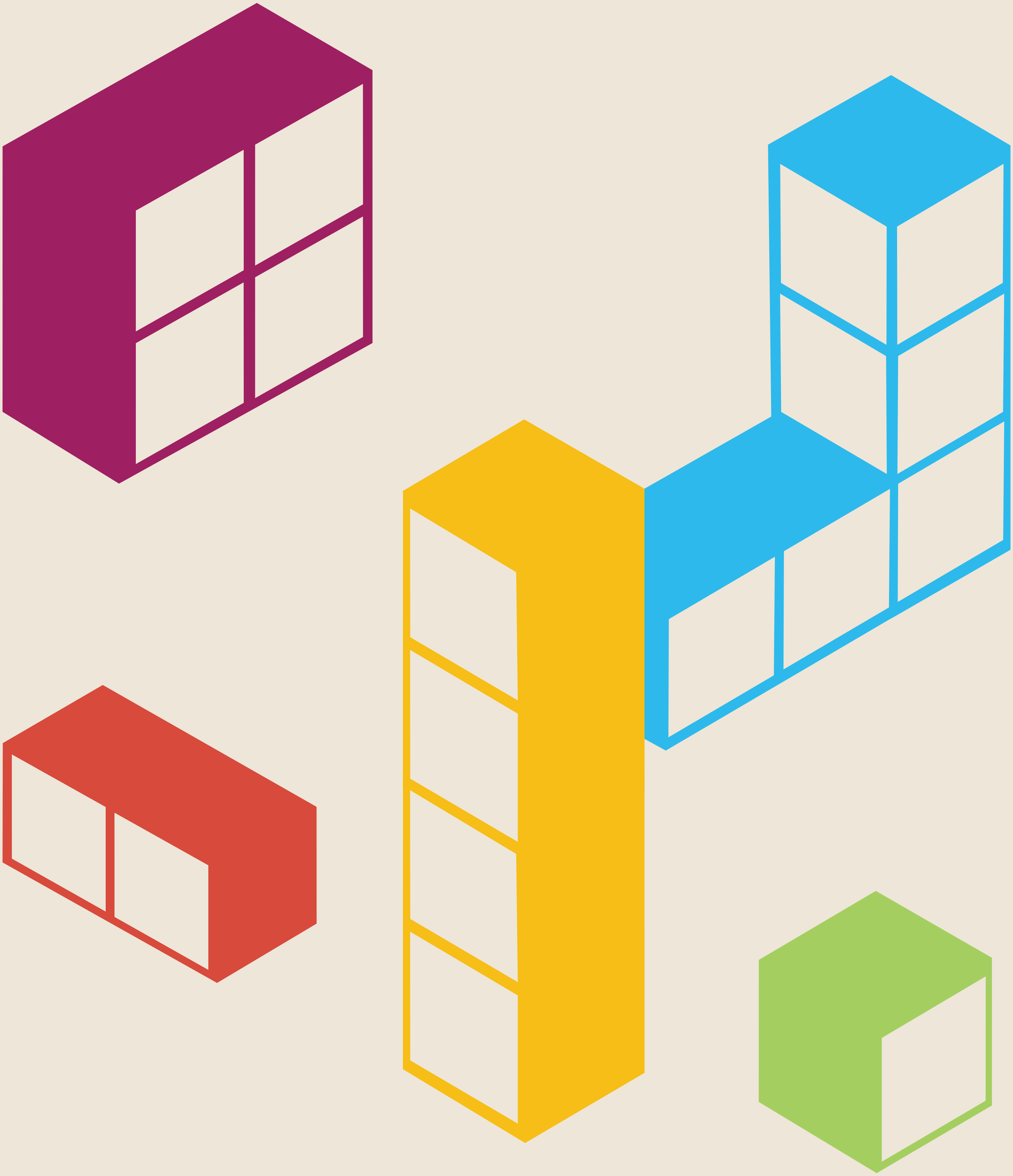

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