
MID-
SURE
Mid-Michigan
Symposium for
Undergraduate
Research
Experiences
July '21

ACKNOWLEDGEMENTS

The goal of the 11th annual Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE) at Michigan State University (MSU) is to provide a forum for undergraduates in the region to share their research and creative activities with the university community and beyond. More than 350 undergraduate students from over 110 different institutions will present their outstanding research and creative endeavors at Mid-SURE on July 28, 2021. These students are mentored by more than 320 faculty, staff, graduate students, and government or industry researchers.

Partnering Programs

More than half of the student presenters participated in an MSU-sponsored summer research program. We would like the thank the following MSU programs for encouraging their students to present at Mid-SURE 2021:

- Advanced Computational Research Experience for Students (ACRES)
- BEACON Center for the Study of Evolution in Action
- Biomedical Research for University Students in Health Sciences (BRUSH)
- Communities and Future Earth Scientists (GeoCaFES)
- Cross-Disciplinary Training in Sustainable Chemistry and Chemical Processes (SCCP)
- Engineering Summer Undergraduate Research Experience (EnSURE)
- First-Time Research Experience in Environmental Health Science (ENDURE)
- Physics & Astronomy Research Experience for Undergraduates
- Plant Genomics Research Experience for Undergraduates
- Research Experience for Undergraduates in Structural and Functional Neural Biology (ASPET SURF)
- Sociomolbility Research Experience for Undergraduates
- 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 faculty. Many thanks to…

- Our undergraduate and graduate staff: Paul Billock, Jessica Diaz, Nadir Fouani, Srikar Kesamneni, Benjamin Kessler, and Victoria Rubio
- Heather Dover, Coordinator for Undergraduate Research
- Korine Steinke Wawrzynski, Assistant Dean of Academic Initiatives and Director of Undergraduate Research

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 hundreds of dedicated mentors who guided the research projects and creative activities presented in this program book and during the virtual symposium.

About the Cover

The cover art was designed by Emma Simon, a 2021 graduate of Advertising Creative from the College of Communication Arts & Sciences and member of the Design Center of MSU.

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MICHIGAN STATE UNIVERSITY

Schedule of Events

All events take place on July 28th at https://symposium.foragerone.com/midsure2021. View the pre-recorded poster presentations at any time. You may also leave comments for presenters.

Q & A Sessions with Presenters

Chat with student presenters during the Question-and-Answer sessions. Use the comment function on the event site to speak with students about their presentations.

1:00 AM – 2:15 PM Eastern

CATEGORY
Arts & Humanities
Biochemistry & Molecular Biology
Cell Biology, Genetics & Genomics
Diversity & Interdisciplinary Studies
Education
Health Sciences
Kinesiology & Nutrition
Microbiology, Immunology & Infectious Disease
Pharmacology & Toxicology
Plant Science
Social Sciences

2:30 PM – 3:45 PM Eastern

CATEGORY
Agriculture & Animal Science
Biosystems & Agricultural Engineering
Chemical Engineering & Materials Science
Civil & Environmental Engineering
Computer Science & Engineering
Electrical & Computer Engineering
Environmental Science & Natural Resources
Integrative & Organismal Biology
Mechanical Engineering
Neuroscience
Physical & Mathematical Sciences

Abstracts

Presentations are organized by category and section, followed by presentation number. Asterisks (*) denote students or mentors from institutions other than Michigan State University. Abstracts truncated at 250 words.

AGRICULTURE & ANIMAL SCIENCE

QUANTITATIVE MICROBIAL RISK ASSESSMENT WITH THE DOSE-RESPONSE MODELS IN INOCULUM CONCENTRATION OF MICROBES-PLANTS INTERACTION

Presenter(s): Gustavo Garay *
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 101
Mentor(s): Jade Mitchell

Microbes-plant host interactions can be mutual, comeliest, mutualist, beneficial and pathogenic. Parasites colonise their host but cause only what might be described as collateral damage by their physical presence and by taking resources from their hosts. Inoculum concentration by the pathogen can help us predict potential risk assessment in the illness of the plant. Quantitative Microbial Risk Assessment (QMRA) is an economic and practical application for risk assessment use in animals and human host but very new for plants. The assessment of risk is the probability or the chances of getting exposed to some hazard and if exposed what is the consequence. Using the Dose-Response (DR) models we collected data from previous paper that had inoculum concentration data with the response in a host (infection, illness, death). The data from the papers were digitalized with the Web Plot Digitizer and then using the software R Studio, the dose-response codes were applied to the software to see if were fit of the models by inferred each of the data and their relationship across all levels of exposure. The expected outcome of result will be the identification and verification of a set of biologically plausible DR models and a framework using QMRA for plant disease management for research for future disease management practices by generating crucial knowledge to improve decision-making related to the control of plant diseases and providing new information on epidemiological factors that influence disease spread.

RESILIENCE OF URBAN AGRICULTURE IN LANSING TO COVID-19

Presenter(s): Allie Swartz
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 102
Mentor(s): Allison Goralnik, Jennifer Hodbod

On December 1st, 2020, a virtual workshop was held to explore how Lansing's urban agriculture system was affected by and responded to COVID-19. This discussion allowed us to further our understanding of what builds and erodes resilience in the system framed around threeelements: Challenges and opportunities created by COVID-19, needs for capacity building that would allowresponseto these challenges andopportunities, shifts in visions for a desirable local food system as a result of thisshock. Resilience is the capacity of a system to respond to change through adaptation or transformation while maintaining structure, function, and identity and support positive and proactive development. When studying the resilience of Lansing's urban agriculture system through the pandemic, we looked to see if the varied functions and thus the overall identity of the system was maintained. The pandemic resulted in a shock to the system and many of its functions and participants were forced to

cope and adapt to this shock. This allowed us to analyze the system through the lens of the 7 resilience principles: (1) maintain diversity and redundancy, (2) manage connectivity, (3) manage slow variables and feedbacks, (4) foster complex adaptive systems thinking, (5) encourage learning, (6) broaden participation, (7) promote polycentric governance systems. The results of this study serve to represent the resilience of Lansing's urban agriculture system but can also be applied to many communities and organizations to effectively evaluate their ability to persist despite being faced with a challenge and remain true to their mission.

COMPARISON OF ANTIOXIDANT CONTENT IN COMPLEX MICHIGAN PASTURE VS. CONVENTIONAL FEED FOR BEEF CATTLE

Presenter(s): Esha Garg, Viji Jambunathan
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 103
Mentor(s): Jenifer Fenton

Grass-finished beef contains higher concentrations of beneficial antioxidant compounds and a lower omega-6/omega-3 ratio compared to grain-finished beef, which makes it more desirable for human health. Further, complex pasture mixtures are purported to contain greater concentrations of plant secondary metabolites which may increase accumulation in grass-finished beef. The objective of this study was to compare the chlorophyll, carotenoid, and phenolic content in a complex Michigan pasture vs conventional feed. Pasture samples containing alfalfa, orchard grass, red and white clover, trefoil, chicory, fescue, timothy, and dandelion were collected biweekly between June and September of 2019 (n=21) and 2020 (n=24). These were compared to grain samples containing hay, dry and high moisture corn, and pellet (n=15 for 2019 and n=10 for 2020). Total carotenoid concentration and chlorophyll A and B were measured using UV-Vis spectrophotometry. Phenolic compounds were quantified using a microplate reader and were compared to a gallic acid standard. Total carotenoids were significantly higher in pasture vs grain in both 2019 (60.30 ± 2.58 vs 10.40 ± 0.80; $p<0.0001$) and 2020 (55.02 ± 4.69 vs 14.50 ± 1.37, $p<0.001$). Chlorophyll A and Chlorophyll B concentrations were also significantly higher in pasture vs grain in 2019 and 2020 ($p<0.001$). Additionally, total phenolic content was significantly higher in pasture vs grain in 2019 (4.44 ± 1.01 vs 2.91 ± 0.35, $p<0.01$) and 2020 (7.73 ± 0.86 vs 3.07 ± 0.11, $p<0.01$). The significantly richer antioxidant profile of pasture compared to conventional feed may explain the nutritional differences between grass- and grain-finished beef.

COMPARISON OF THREE REBOUND TONOMETERS IN DOGS

Presenter(s): Ava Cabble, Shayla Bajric
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 104
Mentor(s): Andras Komaromy

To compare intraocular pressure (IOP) readings across a wide range and obtained via three rebound tonometers in ADAMTS10-mutant Beagles with different stages of open-angle glaucoma (OAG) and normal Beagles; and to investigate the effect of central corneal thickness (CCT). A total of 99 eyes from 51 Beagles were used in this study with variable genetics - 15 normal and 36 affected with ADAMTS10-OAG. IOP was measured in each eye using three tonometers - ICare Tonovet (TV), ICare Tonovet Plus (TVP), and the novel Reichert Tono-Vera (TVA) - in randomized order. TVP and TVA have different positioning systems to facilitate targeting of the central cornea. CCT was measured with the Accutome PachPen. Statistical analyses included one-way ANOVA and Tukey pairwise comparisons tonometer readings and pairwise IOP-CCT Pearson correlations (MiniTab). A total of 116 IOP measurements were taken with each of the three tonometers. When comparing readings over

a range of ~7-77 mmHg, mean IOPs from the TV were significantly lower compared to TVP (-4.6 mmHg, p<.001) and TVA (-3.7 mmHg, p=0.001). We found no significant differences between TVA and TVP measurements (p=0.695). There was a moderate positive correlation between CCT and IOP for TVA (r = 0.53, p<.001) and TVP (r=0.48, p<.001). TVP has been shown previously to provide canine IOP measurements that more accurately reflect true IOP than TV (Minella et al. 2021). Our data demonstrate strong agreement between TVP and TVA, suggesting that the same is true for TVA. IOP measurements are influenced by CCT.

EFFECT OF GRASS FED VS. GRAIN FED BEEF CATTLE ON GENETIC EXPRESSION OF INFLAMMATION

Presenter(s): Isabelle Bernstein
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 105
Mentor(s): Zheng Zhou

Many studies have been completed to analyze the differences between grass fed (pasture raised) and grain fed diets in beef cattle. Based on the study done by Ph.D. student Lucas Krusinski of forage type impact on fatty acid and antioxidant content in beef, it is fairly obvious that there are significant differences between grass and grain fed beef. In this project, tissue samples from the latter study had the RNA extracted, converted to cDNA, and analyzed for specific genes impacting inflammation with PCR. Inflammation is an extremely negative factor in meat production, as it impacts meat quality. Due to this, it is a fairly important point of study considering that producers want to prevent anything that will negatively affect meat quality. It was found that grass fed beef had a higher concentration of omega-3 fatty acid (anti-inflammatory) and lower omega-6 fatty acid (pro-inflammatory) compared to grain fed. It is predicted that grass fed beef will likely show reduced inflammation markers compared to grain fed beef.

CONSUMERS BEHAVIOR TOWARDS PACKAGING MADE OF AGRICULTURAL WASTE FOR FOOD

Presenter(s): Korey Fennell *
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 106
Mentor(s): Eva Almenar Rosaleny

Agricultural waste and packaging waste are both environmental concerns worldwide. Agricultural waste can be used to replace plastic during the production of packaging materials, thus reducing environmental impact and raw material consumption while supporting the circular economy. However, the success of novel food packaging hinges on consumers' acceptance. Consumers can influence the market penetration of environmentally-friendly food packaging as they decide whether to purchase this form of packaging. This study investigated consumers behavior towards environmentally friendly food packaging, specifically packaging made from agricultural waste. A questionnaire was developed and shared with eighty-six consumers. The SIMS 2000 Sensory Evaluation Testing Software was used to give panelists instructions, questions, and the ability to input responses using different Likert scales. The responses were analyzed as a whole. Responses were further evaluated by the population segments age, gender, education, ethnicity, and environmental consciousness. The results show that approximately 75% of the panelists rated "greener packaging" as very important or extremely important. However, this importance was different based on age, gender, and the environmentally consciousness of the panelist. Responses on the "reduction of harmful environmental impacts (water, air, or soil)" were more important among those identifying as: environmental conscious & gender (male/female). However, there were no significant differences in the responses pertaining to cost. This research identifies the

consumer sectors most amenable to environmentally friendly food packaging, specifically packaging made from agricultural waste.

ANALYZING DOMATIA ACROSS SPECIES AND DEVELOPMENT BY CONFORMAL MAPPING

Presenter(s): Cassandra Hernandez *
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 107
Mentor(s): Daniel Chitwood, Margaret Fleming, Marjorie Weber, Sourabh Palande

Grapevines (Vitis) have been shown to harbor mites in small structures located in the axil of leaf veins called domatia. A way to recognize domatia is by looking at white hair filaments they contain where mites shelter and lay eggs. The domatia benefit mites by providing shelter, and in return, the mites protect grapevines against pests. Specific traits of grapevines leaves might determine whether there are domatia distributed throughout a leaf or not as well as during the development of a leaf and knowing when and where domatia develop and in which species may allow domatia to be bred to protect grapes from pests by recruiting mites. These details will be analyzed by the use of conformal mapping with the help of image processing in ImageJ. The ImageJ tool will be used to mark and specify distinctive shapes of domatia on images of grapevine leaves from different species and stages of development. Conformal mapping will be used to gather and warp leaves into an average leaf. Onto this average leaf, the locations of domatia across different leaves will be projected, allowing a relative comparison of domatia distribution across species and development. The purpose of this project is to analyze and compare the distribution of domatia across grapevine species and leaf development to understand how domatia can be potentially bred into grapevine varieties to protect crops from pests by recruiting mites.

EVALUATING NUTRIENT TRANSPORT IN DRAINAGE WATER AS A FUNCTION OF OXIDATION-REDUCTION POTENTIAL AND DISSOLVED OXYGEN

Presenter(s): Carley Allison
Agriculture & Animal Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 108
Mentor(s): Ehsan Ghane

An excess amount of nitrogen and phosphorus in water systems can cause water quality degradation. One source of these excess nutrients is agricultural fields. Different farm management methods can influence the amount of nutrients that leave the agricultural field through sub-surface drainage discharge. pH, dissolved oxygen, water temperature, and oxidation-reduction potential are measured using a YSI probe and then compared to water chemical analysis of dissolved reactive phosphorus and nitrate. This is to determine the relationship between nitrate and dissolved oxygen as well as the relationship between oxidation-reduction potential and dissolved reactive phosphorus. The first expected result is a decrease in the amount of dissolved reactive phosphorus in drainage discharge when the oxidation-reduction potential is high and an increase in the amount of dissolved reactive phosphorus in drainage discharge when the oxidation-reduction potential is low. The second expected result is that an increase in the amount of nitrate in drainage discharge when the oxidation-reduction potential is high and a decreased amount of nitrate in the discharge water when the oxidation-reduction potential is low. The third expected result is when dissolved oxygen is high, the nitrate will be high and when the dissolved oxygen is low, the nitrate will also be low. The value of determining a relationship is to gain a better insight into nutrient loss, which can then be used to reduce nutrient loss.

ARTS & HUMANITIES

EXHIBITS, PUBLIC PROGRAMMING, AND FILM, OH MY!: A STUDY OF FILM UTILIZATION IN MICHIGAN

Presenter(s): Katie Higley *
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 201
Mentor(s): Brittany Fremion *

This presentation will provide an introduction to a McNair research project, the Michigan Museum Film Collections Survey, with an emphasis on methodology. The presentation will detail how I became interested in this topic, the significance of film collections, and the educational value they can add to museum exhibits and public programming. I will also explain the process of building the survey in Qualtrics and share a breakdown of the responses collected thus far. The goals of this study are to document how Michigan museums preserve and employ these valuable primary sources, to encourage their continued preservation, and to advocate for their use in educational programming.

DID HE EAT THREE CUPCAKES?: PRAGMATIC EFFECTS ON TELICITY INTERPRETATIONS

Presenter(s): John Ryan, Newt Kelbley, Sophie Cleland, Thomas Iobst
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 202
Mentor(s): Cristina Schmitt, Jingying Xu

The notion of telicity is generally defined as whether an event encodes a natural final endpoint or not. Telic events have a natural endpoint (e.g., The man ate two sandwiches), while atelic events have an arbitrary endpoint (e.g., The man carried two bags). The telicity of an event depends on the interaction between the verb and properties of its object. In this study we examine to what extent pragmatic information alters a speaker's judgements. Previous work found that participants sometimes produced a 'yes' answer to a question such as 'Did he eat the cookies?' in a context where the character had not finished eating them. Participants were sensitive to verb-type; the presence of quantity-sensitive verbs (e.g., build); and the presence of a cardinal number in direct objects (e.g., two houses). These prompt telic readings while verbs such as carry do not prompt telic readings independently from the object. Interestingly, eat/drink's telic interpretation counterintuitively depended greatly on the type of determiner in the object. Recently, Grigoroglou and Papafragou (2018) found pragmatic considerations may also affect event descriptions. In our experiment each sentence is paired with two animations: one in which the character completes the action and one in which he/she gives up beforehand, replicating previous work. Participants are then asked 'Did the man/woman [verb] x?'. We also add a pragmatic component by having an authority figure (that was a passive observer of the action) produce the experimental prompt, which may prompt more precise responses.

HOW THE SELF-SERVING ATTRIBUTIONAL BIAS AFFECTS TEACHER PEDAGOGY

Presenter(s): Natalia Anderson *
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 203
Mentor(s): W. John Koolage *

In this presentation, I argue that the Self-Serving Attributional Bias, which involves attributing success to internal features about oneself and failure to external factors, negatively affects

the teaching practice known as "Closing the Loop" wherein teachers recognize issues in student learning and then adjust their approach to increase student learning. This practice requires teachers to recognize that the learning activity is to blame for both failure and success in student learning which the SSAB might prevent teachers from noticing. I detail what can be done to address this bias. I suggest that institutional structures and measures that are intended to serve as a check on biased reasoning would be an effective way to help reduce the negative impacts of the SSAB.

NEVER SINCE BEFORE...: THE ACCEPTABILITY OF THE SIMPLE PAST WITH CERTAIN ADVERBIALS

Presenter(s): Evie Cook, Jason Kenny, Kaelyn Hopton
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 204
Mentor(s): Alan Munn

Present perfect statements may occur in conjunction with adverbials such as 'already', an example being 'Nancy has visited the mall already'. That said, some speakers of American English also allow these same adverbials with the simple past tense, such as in 'Nancy visited the mall already'. Our research looks at this phenomenon with respect to three specific adverbials, namely 'before,' 'never,' and 'since.' Specifically, we want to know how much the meaning of the simple past overlaps with the present perfect. Participants were given an acceptability judgement test where they were asked to rate sentences based on how natural they sounded. We carefully designed our experiment to elicit a present perfect reading in participants, even when assigned the simple past condition, with the goal of investigating this overlap. Our results show that although speakers still prefer the present perfect with these adverbials, they are also able to be used with the past tense, showing considerable overlap in the meanings of the two forms.

THE RELATIONSHIP BETWEEN MUSICAL TENSION, NARRATIVE ENGAGEMENT, AND TIME PERCEPTION

Presenter(s): Anusha Mamidipaka, Jewelian Fairchild
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 205
Mentor(s): J McAuley

Recent studies have shown that people, within a culture but not between cultures, tend to imagine remarkably consistent stories in response to listening to instrumental music (Margulis et al., 2019; McAuley et al., 2021). Both musical contrast and topicality seem to affect narrativity (the tendency to imagine a story) and narrative engagement (the tendency to become 'lost' in the imagined narrative). The present study explores how narrative engagement and music tension (defined as the anticipation music creates in listeners' mind for relaxation or release) affects time perception (i.e., how long individuals perceive instrumental musical excerpts to last). Sixty-nine participants listened to 16 musical excerpts presented in random order and estimated their duration in seconds. Next, they listened to the same excerpts and made continuous judgments of musical tension. There were two hypotheses. First, we hypothesized excerpts with greater musical tension would lead to increased arousal and a faster internal clock, thus resulting in longer duration estimates. Second, we hypothesized that musical excerpts with greater narrative engagement will cause listeners to imagine stories with more events, thus leading to longer duration estimates based on the number of imagined events (i.e., richness of the story). Consistent with the first hypothesis, we observed a robust positive correlation between average musical tension and perceived duration. Inconsistent with the second hypothesis, results show no relationship between narrative engagement and perceived duration.

THE EFFECTS OF HORMONE THERAPY ON THE VOICE AND BODY: THROUGH A SINGER'S LENS

Presenter(s): Sydney Timmer *
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 206
Mentor(s): Heather Shouldice *

This presentation analyzes how hormone therapy, in the form of testosterone and estrogen intake, affects the voice and body of the individual taking it. To inform this presentation, scholarly articles, dissertations, and texts on teaching transgender voice students were read and analyzed. The results of this literature survey found that students taking testosterone were more likely to see physical changes in both their voice and body than those taking estrogen. This study discusses the changes that transgender and nonbinary students go through when taking hormone therapy. By looking at this topic through a singer's lens, we are then able to understand how these changes affect transgender and nonbinary students while taking voice lessons.

INSIDE THE BUSY MIND

Presenter(s): Carmen Cheng *, Samadhi Tedrow *
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 207
Mentor(s): Ryan English *

The mind is a highly complex network of biological matter that holds spiritual connotations to every culture around the world. Our presentation over the inner machinations of the mind illustrates a surrealistic world divided into a few key elements that most are familiar with in one form or another. Separated into four distinct, carefully modeled 'zones' each district houses a subconscious embodiment of the mind that is translated into an all-encompassing racetrack devolving into a rugged path of tumultuous volcanoes, an underwater raceway under the dominion of a sinister creature, and an enigmatic maze with a mind of its own. These interconnected zones all house their own effects on the population of racing thoughts—each with their own human visage—as they navigate the raceway, much like the nature of our own thoughts. Studying color theory, 3D construction, and composition, our project, Inside the Busy Mind, demonstrates the effectiveness of visual storytelling through various outlets of media combined into one presentation. With action at every foot of this unearthly world, our technical artistry delivers symbolism, absurdism, and a touch of vibrant cyberspace ecstasy in this thrilling presentation.

BIOCHEMISTRY & MOLECULAR BIOLOGY

ROLE OF ORGANIC SOLVENTS TOWARDS CELLULOSE-LIGNIN SEPARATION: A MOLECULAR DYNAMICS STUDY

Presenter(s): Ian Santiago *
Biochemistry & Molecular Biology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 301
Mentor(s): Josh Vermaas

In order to facilitate a robust and sustainable bioeconomy, it is essential that abundant biopolymers in plant cell walls can be separated and utilized as feedstocks for industrial processes. However, interactions between the biopolymers that make up the cell wall have

led to tremendous recalcitrance that has impeded biomass utilization. Despite their close proximity within secondary plant cell walls, the interactions between lignin and cellulose polymers have remained stubbornly unresolved. The computational microscope offered by molecular simulation techniques is uniquely suited to study the molecular details that lead to specific lignin-cellulose interactions. Building on top of prior work studying lignin-cellulose interactions in aqueous solution, we are applying the same molecular simulation techniques to quantify the solvent impact on lignin-cellulose interactions. By assessing the bound and unbound probabilities of small lignin molecules to crystalline cellulose surfaces during equilibrium simulations, we can determine the binding free energy for lignin to cellulose for a range of different organic solvent environments, thereby quantifying the change in lignin-cellulose interactions within organosolv contexts.

MEASURING HEME-HOPPING ELECTRON TRANSFER THROUGH A BIOLOGICAL NANOWIRE

Presenter(s): Dayna Olson
Biochemistry & Molecular Biology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 302
Mentor(s): Josh Vermaas, Martin Kulke

Filamentous structures have been identified in bacteria that are strongly associated with long-range electron transport, sometimes over several micrometers. Diverse research groups have been working to understand the structural basis for this long range electron transfer. In some systems, the electron transfer is mediated by nanoscale cytochrome assemblies, where multiple heme-bearing proteins come into close contact. The close contact between the hemes allows the excitations to hop rapidly between them, allowing for long-range electron transfer to take place. Recent crystallographic and cryo-electron microscopy studies have provided insight into the typical cytochrome arrangement within these nanowire structures. Combining the electron transport geometry with Marcus theory for electron transport can estimate the electrical conductance for synthetically grown conductive nanocrystals. Interestingly, these synthetic nanocrystals of small tetraheme cytochromes have electron transport rates that are significantly slower than what Marcus theory suggests for the crystallized geometry. Using molecular simulation tools, we investigate if the low temperature for crystallization increased the electron transport rate above what is actually the case at higher temperature. After analyzing our simulation trajectories, we used graph visualization tools to calculate the electron transport rate, and determined that they are still faster than what has been measured experimentally. Studies of stochastically generated nanowire models indicate that the wire dimensions influence the electron transfer rate, and we are currently evaluating what the predicted mesoscopic nanowire conductance would be. We hope that this research will eventually enable bio-compatible photovoltaic or electronics applications.

INVESTIGATING THE INTERACTIONS OF LATE STAGE ENDOSPORULATION PROTEINS IN BACILLUS SUBTILIS

Presenter(s): Maura Barrett
Biochemistry & Molecular Biology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 303
Mentor(s): Lee Kroos

Bacillus subtilis, a Gram-positive soil bacterium, undergoes endosporulation during starvation conditions. During endosporulation, the intramembrane metalloprotease, SpoIVFB, activates the transcription factor σ^K. Two inhibitory proteins, SpoIVFA and BofA, regulate SpoIVFB activity, preventing cleavage of the Pro-domain of Pro- σ^K. Signaling from the forespore

releases this inhibition. Once activated, σ^K RNA polymerase expresses the products that form the spore coat and lyse the mother cell. It is currently unknown how BofA and SpoIVFA interact with each other and with SpoIVFB. Previous work suggested that BofA and SpoIVFA may interact through their C-terminal regions. To study this, *Escherichia coli* was engineered to express a vector containing Cys-less Pro- σ^K and SpoIVFB with single-Cys variants of BofA and SpoIVFA. The cysteine residues were added to the C-terminal regions of BofA and SpoIVFA. If two residues are in proximity to each other, a disulfide bond will form after exposure to the oxidant Cu^{2+}(1,10-phenanthroline)$_3$. Multiple variants were tested; however, no complex was observed. Currently, experimentation is directed towards purifying the heterotrimeric complex of BofA, SpoIVFA and SpoIVFB. We constructed six plasmids to express variants of SpoIVFB, native BofA, and SpoIVFA in *E. coli* and accumulation was visualized by immunoblot analysis. The structure of SpoIVFB has not been solved, thus our work aims to improve knowledge of intramembrane metalloproteases and their regulation.

TOWARDS A SECURE BIOCONTAINMENT SYSTEM TO PREVENT HORIZONTAL GENE TRANSFER IN TRANSGENIC MICROBES

Presenter(s): Alexander Szura, Emma Boismier, Emma Rico, Kate Adams-Boone, Shelby Santos, Tyler Criss
Biochemistry & Molecular Biology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 304
Mentor(s): Bjoern Hamberger, Daniel Ducat, Kati Ford, Masako Harada, Robert Quinn, Shaylynn Miller

Modern biotechnology and genetic engineering has the potential to solve contemporary issues in medicine, agronomy, climatology, and nutrition. However, with the inherent unpredictability that comes with engineering biology, synthetic biology solutions face major barriers to real-world implementation. We aim to tackle frontiers of synthetic biology biosafety using a comprehensive, multi-tiered biocontainment system focused on preventing horizontal gene transfer. We are developing three rationally-designed biocontainment approaches. By methodically testing the efficacy of our strategies, we hope to evaluate all facets of cellular behavior and ensure the all-encompassing security of the introduced synthetic part (gene of interest). To develop our biocontainment system, we are working to implement three separate approaches and strategically layer them in order to curtail gene transfer. Our first approach aims to reduce the incidence of conjugation by preventing the uptake of conjugative plasmids via an artificial CRISPR-Cas9 immunity system. Secondly, we intend to inhibit gene-of-interest expression in unintended recipient cells by utilizing a non-native promoter. Our third approach uses the GhoST toxin-antitoxin system to lyse recipient cells. We use a standardized gene transfer assay to measure the baseline rate of transfer between Escherichia coli cells and to evaluate the success of our strategies. This data is collected for computational analysis in order to predict the behavior of our biocontainment approaches in different contexts. Based on preliminary results from our compartmental model, we believe our multi-tiered biocontainment strategy will be effective in reducing horizontal gene transfer and may allow synthetic biology projects to move towards implementation in broader contexts.

IRE1 PLAYS A ROLE IN 5-FU CHEMORESISTANCE IN COLORECTAL CANCER CELLS

Presenter(s): Kevin Chen, Sean Foster
Biochemistry & Molecular Biology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 305
Mentor(s): Christina Chan

Obesity has been shown to be a risk factor for many diseases, including colorectal cancer. Over 40% of adults in the United States are obese; this puts a large proportion of Americans at higher risk of developing colorectal cancer and having a worse prognosis than those who are not obese. Obese individuals have a higher level of circulating free fatty acids (FFAs). A study found colorectal cancer patients have higher level of palmitate (PA), an FFA, in the blood serum as compared to healthy individuals. It has also been shown that elevated levels of palmitate activate the IRE1 branch of the endoplasmic reticulum (ER) stress pathway, and increased expression of IRE1 has been associated with poorer prognoses. A common treatment known to improve survival of colorectal cancer patients is 5-fluorouracil (5-FU), which alters RNA processing and causes DNA damage. However, colorectal cancer cells have been shown to develop resistance to the drug, resulting in relapses. We propose that IRE1 plays a role in chemoresistance of 5-FU in colorectal cancer cells. To test this, we will treat wildtype (HCT116 WT) and IRE1 knock out (HCT116 KO) colorectal cancer cells with 0.3mM PA with BSA as the control and use an MTT (3-(4, 5-dimethylthiazolyl-2)-2, 5-diphenyltetrazolium bromide) assay to compare the viability of HCT116 WT to HCT116 KO.

THE LOSS OF TSPO AND AHR AFFECTS THE EXPRESSION OF RNA IN THE MITOCHONDRIA

Presenter(s): Edwin Laboy *
Biochemistry & Molecular Biology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 311
Mentor(s): John LaPres

The Aryl Hydrocarbon Receptor (AhR) is a member of the PAS (Per-ARNT-Sim) superfamily of environmental sensors. The AHR is a transcription factor that is found in the cytosol in the absence of ligand. Upon exposure to ligand, such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the AHR will translocate to the nucleus and form a heterodimer with its partner, the Aryl Hydrocarbon Receptor Nuclear Translocator (ARNT). The AHR:ARNT dimer is capable of modulating the expression of a wide battery of genes, most notably those that encode proteins involved in metabolism of xenobiotics, such as TCDD. Several endogenous ligands have also been proposed for the AHR, including cholesterol, heme, and tryptophan metabolites. Interestingly, many of these ligands have also been linked to Translocator protein (TSPO, previously known as the Peripheral Benzodiazepine receptor, PBR) which is an outer mitochondrial membrane protein. TSPO has been linked to the immune response, steroid synthesis, and apoptosis. Given the overlap between putative ligands, we hypothesized that crosstalk exists between the AHR and TSPO and that it would impact AHR-mediated transcription. To test this hypothesis, the AHR and TSPO were removed from mouse lung epithelial cells (i.e. MLE12 cells) using CRISPR-Cas9 and then stimulated with TCDD and/or PK11195, a ligand for TSPO, and the expression of several nuclear and mitochondrial encoded genes was assessed. Our results show that loss of TSPO impacts several mitochondrial-encoded genes and that this could impact the organelles function. Moreover, in the absence of TSPO, the battery of TCDD-induced genes was also significantly impacted.

CREATING A TUTORIAL FOR PERFORMING UMBRELLA SAMPLING SIMULATIONS WITH THE WEPY SOFTWARE PACKAGE

Presenter(s): Emma Fink *
Biochemistry & Molecular Biology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 312
Mentor(s): Alexander Dickson, Nicole Roussey

The determination of free-energy differences is a central task in computational (bio)chemistry, as this value is the driving force for chemical reactions. One software utilized for biomolecular simulations, wepy, is an open-source software framework for simulating rare events through weighted ensemble (WE) simulations. Wepy is written in pure Python, which readily allows alterations for development and testing of new methods or algorithms. With the addition of a two-atom Lennard-Jones pair based tutorial, wepy can now be more readily utilized for both weighted ensemble and umbrella sampling (US) simulations. While both methods do physical sampling of the (un)binding pathway, US differs from WE as it requires the addition of a potential energy term to the system, which is projected along a collective variable of interest. In this tutorial, we utilize the center-of-mass to center-of-mass (COM-COM) distance as the collective variable of choice, which is the feature of the system that helps to distinguish the progress of the reaction. Many simulations are run with a specific interval of COM-COM distances, and the data from these simulations is used to generate a free energy surface using the Weighted Histogram Analysis Method (WHAM). This is useful because it allows us to visualize the free energy landscape for a two molecule system, and to calculate (un)binding free energies. Our goal is to develop a tutorial to use Umbrella Sampling simulations to compare WHAM free energy surfaces to the true free energy surface.

EXPLORING THE ELECTROCHEMICAL INTRICACIES OF NON-AQUEOUS REDOX FLOW BATTERIES

Presenter(s): Amber Little *
Biochemistry & Molecular Biology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 313
Mentor(s): Thomas Guarr

There is currently a high demand from the nation's power grid for stationary energy storage devices which are stable and long-lasting. One solution can be found in redox flow batteries, specifically systems which rely on easily accessible organic compounds over metals. Through investigation of a lab-scale flow battery, we were able to probe a variety of conditions to optimize overall battery performance with our chosen chemical systems. A variety of electrochemical tests were utilized including electrochemical impedance spectroscopy and cyclic charge discharge testing.

ANALYSIS OF SMGGDS INTERACTIONS WITH RAC1 AND RAC1B

Presenter(s): Ra'Mal Harris *
Biochemistry & Molecular Biology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 314
Mentor(s): Jeremy Prokop

The RAS family of proteins, including their regulators, are activated in many tumor types, including oncogenic mutations or overexpression. Overall, up to 30% of all human tumors are found to carry some mutation in one or more of the canonical RAS genes. All of the RAS proteins belong to a class of protein called small GTPases, which are enzymes that catalyze the hydrolysis of GTP into GDP. Multiple of these small GTPases participate in interactions with the chaperone protein SmgGDS, which binds to and promotes the prenylation of the proteins through two distinct isoforms of the protein. Some of the interaction between SmgGDS and small GTPases occurs through the poly basic region (PBR) of the small GTPase and a highly conserved electronegative patch on SmgGDS, with several additional contacts in other sites. Protein models for SmgGDS, RAC1 and RAC1B were generated in the molecular modeling software YASARA and placed through molecular dynamics simulations in multiple confirmations to determine if the differences between the two proteins modulates the PBR interactions to stabilize RAC1B more so than RAC1. Once run, data is analyzed through Dynamics Cross Correlation Matrix and Root-mean-square deviation. Early data from the

generated protein models show that the loop of RAC1B is stabilized by its PBR binding site, shifting interaction between SmgGDS isoforms. The results of this research give more insights into how these proteins interact and could lead to new routes for oncological therapies.

APPLYING COMPUTATIONAL PROTEIN-LIGAND DOCKING IN ROSETTA TO A LARGE PHYTOCHEMICAL LIBRARY AND SEVERAL SARS-COV-2 PROTEINS FOR THE IDENTIFICATION OF ANTIVIRAL CANDIDATES

Presenter(s): Theodore Belecciu
Biochemistry & Molecular Biology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 315
Mentor(s): Daniel Woldring, Zirui Wang

The COVID-19 pandemic has claimed over 3.8 million lives worldwide since it began. Vaccines have been developed, but they currently are only abundant in the wealthiest parts of the globe. Moreover, the international distribution of vaccines has been a noticeably slow process. Consequently, there is a dire need in many regions for cheap and readily available therapeutics that can treat COVID-19 infection. Historically, the largest sources for therapeutic substances have been plants. Many such phytochemicals (plant chemicals) have antiviral properties and plants containing these substances are available throughout the world. In this study, we seek to computationally screen a phytochemical library against several SARS-CoV-2 protein structures in order to determine which phytochemicals have the strongest binding interactions. We obtained our digital protein structures from the Protein Data Bank, and we obtained our digital phytochemicals from the ZINC and PubChem databases. We used Rosetta 3.12 to conduct the computational protein-ligand docking, and we used the Pre-Talaris2013 and Talaris2014 score functions to establish necessary docking parameters. Additionally, we used the CASTp webserver to identify potential ligand binding pockets on protein surfaces prior to docking, and we also used OpenBabel to ensure that the ligands were protonated in accordance with a specified pH. Numerous Python scripts were written in order to move, process, and extract files, docking jobs, and data within Rosetta. In our presentation, we hope to present a workflow that expedites high-throughput computational protein-ligand docking tasks and identifies antiviral candidates that merit further investigation.

THE ROLE OF PIEZO-1 IN PRE-ADIPOCYTE DIFFERENTIATION

Presenter(s): Andrew Decker
Biochemistry & Molecular Biology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 316
Mentor(s): Andres Contreras

Cardiovascular disease (CVD) is currently the leading cause of death in the United States every year. One such disease with high prevalence is hypertension, which also has poorly understood mechanisms making it difficult to control. One factor contributing to high blood pressure is the elasticity and compliance of the aortic perivascular adipose tissue (aPVAT), tissue immediately surrounding the aorta. The aorta periodically expands and contracts in response to changes in blood flow, which is compromised by a loss of aPVAT compliance. Mesenchymal stem cells from the aPVAT can differentiate into different cell types, fibroblasts, with low compliance, and adipocytes, with higher compliance. Adipocyte accumulation in the aPVAT is favorable as this can increase compliance of the tissue. Piezo1, a mechanically gated cation channel, has the potential to impair adipogenesis, which would reduce compliance. Preadipocytes were induced for adipogenesis under three variables: induction/maintenance media with the Yoda1 agonist, induction/maintenance media without the Yoda1 agonist, and with preadipocyte media without Yoda1 as a control. For each variable, two conditions existed of induction without mechanical strain (MS-) or, applying mechanical strain (MS+) via

the FlexCell machine. Our data indicates that mechanical stimulation of Piezo1 reduces adipogenesis of preadipocytes. These results reveal the impact of mechanical stimulation on the differentiation of preadipocytes that might aggravate fibrogenesis within aPVAT in hypertension. Understanding the relationship that mechanical forces have on adipogenesis through Piezo1 signaling can lead to treatments being offered with the potential to combat the epidemic of heart disease in this country.

ENZYME KINETIC PARAMETERS OF FUMARATE HYDRATASES USING MALATE DEHYDROGENASE IN A COUPLED ENZYME ASSAY

Presenter(s): Jada Harvey *
Biochemistry & Molecular Biology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 321
Mentor(s): Bismarck Amaniampong

Carbohydrate feedstocks are primarily used for the bioproduction of commodity chemicals. However, with a rapidly growing and evolving population, it will be valuable to secure an alternate feedstock for producing these chemicals. Escherichia coli is the platform organism for most microbial fermentations. Acetylene dicarboxylate (ADCA), derived from methane and carbon dioxide, has shown auspicious potential to make commodity chemicals such as lactic acid. The use of ADCA as the primary source of carbon and energy has not yet been reported, unlike other C4-dicarboxylate (fumarate, malate, and oxaloacetate). ADCA is a promising alternate to glucose because it can be synthesized in 2 steps, using CO2 and CH4, which are greenhouse gases. E. coli expresses 3 different fumarases; FumA, FumB, and FumC. These catalyze the reversible transformations of fumarate to (S)-malate in the TCA cycle. FumA has also been reported to catalyze the conversion of acetylene dicarboxylate to oxaloacetate. Currently there is no evidence on the activity of the other fumarases using ADCA as a substrate. This project is important to determine the catalytic efficiency of the fumarases with ADCA. Kinetic parameters obtained in this experiment, Km, Vmax, and Kcat, are important to justify the productions of the specific E. coli fumarate hydratases in the presence of ADCA carbon source. In order to obtain desired parameters, assays will be ran and analyzed using a UV-Vis Spectrophotometer.

COMPUTATIONAL ANALYSIS OF BSHC, AN ENZYME RESPONSIBLE FOR ANTIBIOTIC RESISTANCE IN FIRMICUTE BACTERIA

Presenter(s): Matthew Martin *
Biochemistry & Molecular Biology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 322
Mentor(s): Mary Karpen *

Bacillithiol is a compound synthesized by certain gram positive bacteria called firmicutes, such as B. Subtilis. This compound is used to protect the bacterium from oxidative stress and establish antibiotic resistance. There are three enzymes in the synthesis pathway of bacillithiol: BshA, BshB, and BshC. BshC, unlike the other two, has a potentially novel mechanism that is not yet well understood. This enzyme is a putative cysteine ligase, however the ligand that donates the cysteine is unknown. The structure of BshC has been previously solved and has a unique dumbbell shape suggesting a hinging motion. Previous Small Angle X-ray Scattering (SAXS) results indicate that the structure in solution may adopt a slightly different conformation compared to the crystal structure. Using computational biochemistry methods, including molecular dynamics and normal mode analysis, we found a conformer that better fits the SAXS data and identified structural hinges. By performing structural homology searches, we were able to find potential ligands for the HUP domain Rossmann fold of the BshC active site. The results of this project will be used to formulate hypotheses about ligand interactions and possible enzyme mechanisms.

UNSUPERVISED LEARNING FOR MOLECULAR FEATURE SPACE DIMENSIONALITY REDUCTION

Presenter(s): Kyra Rivest *
Biochemistry & Molecular Biology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 323
Mentor(s): Samik Bose

In the interest of novel drug discovery, several computational methods have been developed to study the movement of biomolecules. There is a specific interest in visualizing the interactions of these molecules with various other relevant, molecular species including chaperone proteins and ligands. A recently developed technique, called ClassicalGSG, applies a scattering transform to a set of atomic descriptors that are created for use with classical molecular dynamics force fields and include partial charge, atom type, and Lennard-Jones interaction parameters. The result is an index invariant matrix of custom molecular features that can then be used to predict molecular properties that are important in the drug design process. In this project, unsupervised learning approaches, including k-means clustering, PCA, and t-SNE, are applied to these resulting molecular features in order to reduce the dimensionality of the feature space. The Tanimoto similarity index will be used to evaluate how well the set of features retains important molecular information at different magnitudes of dimension reduction. Finding an optimal feature space enhances the robustness of the method by reducing the amount of input data provided to supervised learning models. Additionally, this pipeline has the potential to be used as a screening tool of identifying suitable drug molecules candidates in a dynamic protein binding cavity.

CONSERVATION OF THE CTBP CO-REPRESSOR C-TERMINAL DOMAIN ACROSS METAZOA

Presenter(s): Kayla Bertholf *, Yahui Yang
Biochemistry & Molecular Biology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 324
Mentor(s): David Arnosti

The C-terminal binding protein (CtBP) is a transcriptional corepressor deeply conserved from invertebrates to vertebrates. CtBP structurally resembles NAD(H)-dependent dehydrogenases, and the protein binds to NAD(H), allowing the formation of dimers and tetramers. However, the structure and function of the uncharacterized, likely unstructured CtBP C-terminal domain (CTD) is still not well understood. Vertebrates encode two paralogous genes, CtBP1 and CtBP2, whereas invertebrates have a single CtBP gene that is alternatively spliced to produce isoforms with unique C-termini. Here, we use a comparative evolutionary approach to study the conservation of the CTD, using cDNA and genomic sequences from diverse phyla. In cnidaria, the only homologs of CtBP are only weakly conserved in the catalytic core region, and lack the unstructured C-terminus, suggesting that these genes are not likely to encode transcription factors, but rather dehydrogenases with ancestral functions. Strikingly, although CtBP-like genes are found throughout bilaterian animal genomes, including structural features of the CTD that are conserved in arthropods and vertebrates, in certain lineages, the CTD has undergone lineage-specific alteration, substituting the canonical sequences with entirely novel, similarly unstructured sequences of unknown function. Such "tail switching" is observed in several protostome lineages including roundworms, flatworms, and mites, as well as some chordate lineages. The conservation of CTD sequences suggests that this portion of the CtBP corepressor has an important function that may relate to structure, activity or stability of the transcription cofactor, and experimental approaches are needed to identify possible processes impacted by this conserved domain.

WHOLE-CELL BIOCATALYSIS OF A CYCLOPROPANECARBONYL BACCATIN III ANALOG AS AN INTERMEDIATE TO A NEW GENERATION TAXANE SB-T-1214 FOR PHARMACEUTICAL USE

Presenter(s): Laura Hiotaky
Biochemistry & Molecular Biology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 325
Mentor(s): Aimen Al-Hilfi, Kevin Walker

Cancer cells can develop resistance to chemotherapeutic taxanes, including paclitaxel (Taxol) and docetaxel (Taxotere), reducing their effectiveness in cancer regiments. Researchers at Albert Einstein College and Stony Brook University found SB-T-1214 effective against taxane-resistant chemotherapeutics. SB-T-1214 is currently made by semisynthesis, a 9-step elaboration of a taxane isolated from Taxus plants. SB-T-1214 comprises a 10-deacetyl-10-cyclopropanecarbonyl baccatin III (DCCB) core which provides enhanced efficacy over paclitaxel and docetaxel. Based on green chemistry principles, we look to develop a whole-cell biocatalyst to make SB-T-1214 in fewer steps, solvents, and stoichiometric reagents than the current semisynthesis. Here, we developed a whole-cell biocatalyst to assemble DCCB in E. coli cells (EColi-DBAT) which overexpress 10-deacetylbaccatin III-10-O-acetyl transferase (DBAT). DBAT can produce DCCB from cyclopropanecarbonyl CoA (CCCoA) and 10-deacetylbaccatin (10-DAB) in vitro. When a culture of EColi-DBAT was incubated with cyclopropanecarboxylic acid and 10-DAB in fresh growth media, three de novo taxanes were made, DCCB (2% rel. to 10-DAB), 10-deacetyl-10-propionylbaccatin III (2% rel. to 10-DAB), and baccatin III (10-acetyl analog at 3.4% rel. to 10-DAB). Our goal is to increase the production of DCCB to >30% rel. to 10-DAB in E. coli cells that overexpress an acyl CoA synthase (ACS) to increase CCCoA in vivo and DBAT. We will report on the overexpression of an ACS gene, while altering various parameters of the biocatalytic system. HPLC-UV and LC-ESI/MS analyses will monitor the effects of these parameters on the abundances of taxanes made. We will report on the effectiveness of biocatalysis in industrial pharmaceutical use.

EXPLORING C-PEPTIDE BINDING IN THE PRESENCE OF BOVINE ALBUMIN AND OVALBUMIN

Presenter(s): Charlie DeLuca
Biochemistry & Molecular Biology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 326
Mentor(s): Suzanne Summers

Type 1 diabetes is a condition in which the pancreas produces insufficient amounts of insulin. As a result, insulin must be administered into the body via an injection. People with type 1 diabetes may face health challenges as they grow older due. Some of challenges include decreased mobility, dexterity, vision, and hearing. This study aims to support hypotheses that provide solutions for the long-term health of those with type 1 diabetics. One proposition is the co-administration of not only insulin, but also C-peptide, a protein that is normally secreted in equal amounts with insulin. When both substances are present in an insulin shot, diabetes complications have been seen to lessen. The exact mechanism is not fully understood. In order to further study this phenomenon, ELISAs, or enzyme-linked immunoassays, were utilized to test the binding ability of C-peptide. BSA (Bovine serum albumin), OVA (ovalbumin), along with C-peptide and blood were the substances used in the ELISA. The experiments were set up with half of the ELISA using bovine albumin based and the second half being ovalbumin based. After collecting data on the ELISA, it was found that OVA was up taken more so than when BSA was used. This information contributes to an increase in knowledge about why the presence of C-peptide with insulin helps to decrease compilations in diabetics.

BIOSYSTEMS & AGRICULTURAL ENGINEERING

IN-FIELD SENSOR MONITORING TO IMPROVE IRRIGATION MANAGEMENT

Presenter(s): Brenden Kelley
Biosystems & Agricultural Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 401
Mentor(s): Younsuk Dong

Irrigation water use efficiency has become one of today's top concerns in agriculture. It is imperative that enough water is applied to meet the needs of a given crop, however, exceeding the amount of water that the crop can make use of wastes one of our most valuable natural resources. Finding the balance between the crop's water requirements and water use is necessary to maximize water use efficiency. By estimating the soil moisture available to the plant and comparing that value to the water removal for that crop under present conditions it's possible to calculate a theoretically optimal application. Since individual's irrigation practices vary, our goal is to compare producers' applications to a theoretically optimal application, a reduced application with a lower soil moisture threshold at which water is applied, and an excessive application with a higher threshold. To assess these treatments, soil moisture sensors have been placed within the different sectors, corresponding to the different treatments, all beneath the same center pivot. Additionally, leaf wetness, temperature, and humidity sensors have been placed on the LOCOMOS datalogger in each treatment sector to understand the environmental conditions that promote potential disease risk. These sensors are intended to help identify potential benefits or stressors that may result from the variations in treatments. Finally, yield data will be collected from the harvester and compiled to match the different treatment areas to interpret the water use efficiency for each treatment. We intend to use this data to help farmers improve their irrigation practices.

UNDERSTANDING THE CHANGE IN IRRIGATION METHODS, FARMS, ACRES, IRRIGATION EDUCATION SOURCES, AND THE BARRIERS FACED IN EFFORTS TO CONSERVE WATER, OVER THE LAST 15 YEARS

Presenter(s): Erica Belloso *
Biosystems & Agricultural Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 402
Mentor(s): Younsuk Dong

The conservation of water has always mattered. In recent times, it has become of uttermost importance. Not only have our agricultural needs increased as our populations grow, but also the demand for water. With temperatures rising because of climate change, we are faced with the dire need of water but in exchange, we are living the consequences of severe weather conditions, one of them being severe droughts. Irrigation can reduce the effects of prolonged dryness and plant moisture stress. Because of this benefit, high-value crops such as vegetables, potatoes, seed crops, turf, and ornamentals are almost 100 percent produced and/or managed under irrigation. In efforts to better understand the importance of irrigation and utilization of our water, this study will explore data provided by the United States Department of Agriculture-National Agriculture Statistics Service from the years 2003, 2008, and 2018. This study will be focusing on Michigan and Indiana. From the data, we will calculate the percent change of Irrigation methods, Irrigation education external sources, and the efforts to conserve water over the last 15 years. Because agriculture is one of our main sources of food, we hope that our research can provide some information on how to be better equipped, informed, and prepared in the prevention of water scarcity. Results from

percent change in the "Irrigated Farms in the Censuses of Agriculture 2017 and earlier" show that there has been a 22% increase in total irrigated farms over a 15-year period.

THE EFFECT OF POLYPLOIDIZATION ON ALTERNATIVE SPLICING

Presenter(s): Hannah Nguyen *
Biosystems & Agricultural Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 403
Mentor(s): Nathan Catlin

Diversity in the proteome can be affected by many post-transcriptional and genomic processes, including alternative splicing and polyploidy. Alternative splicing (AS) produces a variety of different mRNA transcripts by conserving, skipping, and excising different exons and introns from a single gene parent. The production of multiple proteins from a single gene can potentially increase or decrease an individual's fitness, so the evolutionary forces affecting alternative splicing have become a topic of interest. Polyploidy is a phenomenon commonly observed in plants where species have three or more chromosomal copies. Two types of polyploidy include autopolyploidy, where each copy of the genome comes from the same species, and allopolyploidy, where copies of the genome come from two different but closely related species. Because polyploidy creates multiple copies of a single gene and AS can create multiple mRNAs from a finite number of genes, it is hypothesized that polyploids may experience less AS per locus since mRNA transcripts generated from a parental copy can be divided among new, homeologous gene copies. To test this hypothesis between polyploidy and AS, RNAseq data of the allopolyploid plant Capsella bursa-pastoris was trimmed and aligned, as well as data for its diploid progenitors, Capsella grandiflora and Capsella orientalis. The transcriptomes then had AS annotated, allowing direct comparison of AS events in the polyploid and diploid species. Overall, the results from this study will reinforce the notion that gene duplication in polyploids decreases AS on a genomic scale, supporting a dynamic interplay between AS transcript generation and polyploidy.

DETERMINING THE FATE AND TRANSPORT OF PHROHPRUS IN THE SOIL OF CORN FIELDS

Presenter(s): Zukari Castillo *
Biosystems & Agricultural Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 404
Mentor(s): Steven Safferman

Excess phosphorus in natural waters causes harmful increases of toxic cyanobacteria and can pose potential health risks. In reducing phosphorus especially in fertilizer applications, there is potential that these high levels could be decreased. However, may damage Michigan's corn industry's overall production and profit since phosphorus loss amongst soil is common due to runoff, erosion, and tile drainage. There is still a need to supply phosphorus to crops whilst preventing the increase of phosphorus in bodies of water that have risen over the past several years. Understanding the variables that influence phosphorus adsorption, can allow for the prediction of the amount of phosphorus that can be retained by soil in the root zone to help benefit the crops. In order to do this the project's objective is to create a dynamic soil phosphorus sorption index. In order to establish this overall objective, one must establish generic situations that are frequent in Michigan cornfields, each with its own set of soil, weather, and fertilizer characteristics. Run HYDRUS 1D using the default setting for each scenario to estimate the amount and form of phosphorus with depth as well as the sensitivity of each parameter. Conduct a laboratory experiment with soil to obtain model calibration and verification data. Reanalyze the scenarios using HYDRUS 1D utilizing the calibration and validation data to allow more precise predictions. The creation of an index can be made and utilized by Michigan farmers following the Corn Marketing Program of Michigan principles.

TRANSPORT AND FATE OF NUTRIENTS IN BIOSOLIDS FROM THE CITY OF DETROIT WATER RESOURCE RECOVERY FACILITY

Presenter(s): Greg Rouland
Biosystems & Agricultural Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 411
Mentor(s): Steven Safferman

A majority of nutrients in fertilizer applied to farmlands escape the root zone and contribute to the runoff of nutrients into rivers and lakes. The utilization of biosolids can lead to an alternate mobilization in nutrient uptake, particularly phosphorus and nitrogen, which has the potential to reduce the overall waste of nutrients in agricultural applications. Literature has shown that biosolid application can also lead to an increase in the microbial activity within soil that contributes to the uptake of these key nutrients and impact the soil for years after initial application. In order to perform further testing of biosolid application and its effects, a column study was performed using biosolids provided by the Great Lakes Water Authority's Water Resource Recovery facility. Four different types of biosolids were tested, in addition to a commercial fertilizer and control situation with no fertilizer. Water was applied to the columns to simulate rainfall and corn was planted to simulate the effect of crop growth. The corn crop, the soil, and the effluent water over the period of simulation were all tested to determine in detail the fate of the nutrients in the soil with further testing including a microplate assay and genetic testing were included to understand the causes of the nutrient's fate.

PERFORMANCE OF CO-DIGESTION OF FOOD WASTE AND SLUDGE FROM ELECTROCOAGULATION OF BLACKWATER

Presenter(s): Blake Smerigan
Biosystems & Agricultural Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 412
Mentor(s): Wei Liao

Anaerobic digestion (AD) is a traditional method used to break down organic matter via series of biotransformation reactions, namely hydrolysis, acidogenesis, acetogenesis, and methanogenesis reactions to produce a biogas product. Biogas is usually rich in methane (CH_4), and it can be upgraded to renewable natural gas (RNG). Feed materials such as food waste have an abundance of organic matter, but produce a large amount of hydrogen sulfide, an unwanted, highly flammable, and toxic byproduct. In this study, we used iron rich electrocoagulation (EC) sludge from the treatment of high-strength waste water (blackwater) along with food waste in AD reactors to investigate the AD performance and biogas quality. The sludge is acquired from a unit that is operated in a newly established site on the MSU Campus (Kalamazoo Street), which can adjust the wastewater composition to produce blackwater. The co-digesters contained 1:1 and 2:1 ratios of food waste to EC sludge based on dry matter to attain a 4.5% total solids (TS) concentration in substrate. The digesters were operated semi-continuously with a hydraulic retention time (HRT) of 10 days at both mesophilic (35^{o}C) and thermophilic (50^{o}C) conditions with 150 rpm continuous stirring. The biogas production was monitored daily with biogas composition tested weekly using gas chromatography. The AD performance parameters (sCOD, sTN, sTOC, sTP, pH) were monitored as well to link the biogas quality and AD performance. The results from bench-scale semi-continuous AD reactors will be used to design a pilot-scale AD reactor and decide the optimum operational conditions.

IMPROVING IRRIGATION MANAGEMENT IN SOYBEAN AND POTATO FIELDS USING SENSOR TECHNOLOGY

Presenter(s): Catherine Christenson
Biosystems & Agricultural Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 413
Mentor(s): Younsuk Dong

Benefits of proper irrigation management include conserving fresh water and energy, improving disease management, reducing nutrient leaching, increasing crop yield and grain quality, and maximizing return in investments. Improper irrigation management can increase the risk of plant disease, which can negatively affect crop yield, quality of product, sustainability, and economics. Leaf wetness durations and improper irrigation are proven to increase the odds of diseases significantly. White mold is one of the devastating diseases affecting soybeans and potatoes. Sensor technology can help to improve irrigation water use efficiency and monitor environmental conditions that have a potential impact on plant disease development. Our research focuses on monitoring irrigation water use efficiency as well as the environmental conditions that promote plant disease risk in irrigated soybean and potato fields using LOCOMOSs (Low-cost remote sensor monitoring system). LOCOMOS, developed by Michigan State University (MSU) Biosystem and Agricultural Engineering Irrigation Team, is an affordable sensor monitoring system and allows real-time access to sensor data. LOCOMOs will be installed in center-pivot irrigated soybean and potato fields and monitor soil moisture, leaf wetness duration, temperature, humidity, irrigation timings and amount, and precipitation. We hypothesize that proper irrigation, through the use of the LOCOMOS, can increase water use efficiency and decrease the risk of plant disease among soybean and potato crops.

IMPACTS OF COVID-19 ON RESIDENTIAL BUILDINGS ENERGY CONSUMPTION

Presenter(s): Tara Younessi
Biosystems & Agricultural Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 414
Mentor(s): Kristen Cetin

As the Center of Disease Control announced rising COVID-19 cases in the United States, stay at home orders were instilled across the country in an attempt to contain the spread of the virus. With these changes, this generally halted use of many buildings, e.g. theaters, shopping centers, schools, etc. As a result, a majority of the population spent the majority of 2020 at home, including working and going to school remotely. This had significant impacts on the energy use of residential buildings. In this study, high-resolution, disaggregated energy use data is analyzed to quantify shifts in energy use pre- and post-peak pandemic months, and to identify what changes in energy consumption behaviors caused such shifts.

NASA DEEP SPACE FOOD CHALLENGE: GROWING SPROUTS AND GREENS WITH FERTILIZER OSMOSIS

Presenter(s): Joanna Chang *, Olivia Racette *, Victoria Sutherland *
Biosystems & Agricultural Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 415
Mentor(s): Jonathan Maisonneuve *

Creating food systems to supply astronauts with freshly grown food for up to three years has received increased attention in recent years due to renewed efforts for long-duration space exploration. Current food growing systems can supply astronauts food for under a year, and missions have a shorter duration because of the impediment of having to receive shipments

of food from Earth. As astronauts prepare to travel to Mars, the possibility of receiving supplemental food from Earth decreases. The need for an innovative system that requires minimal resources and produces minimal waste, while providing safe, nutritious, and tasty food for long-duration human exploration missions is in high demand. In this presentation, we introduce an innovative space food system that was developed in response to NASA's Deep Space Food Challenge. The food system is designed to grow various types of sprouts, such as alfalfa, red clover, radish, and mustard, in addition to various leafy greens. Our system design includes strips of red, green, and blue (RGB) light-emitting diode (LED) lights that will provide light and energy to the plants. The most unique and crucial element of the system is the fertilizer osmosis design. Fertilizer osmosis is an energy efficient water recovery process that is especially attractive because it produces a clean fertigation solution that can be directly delivered to plants, eliminating the need for draw solution recovery and separation that is typical of most forward osmosis processes. All of the elements together will help to supplement fresh food for the astronauts' diets.

CELL BIOLOGY, GENETICS & GENOMICS

NON-TARGET SITE GENE EVOLUTION IN THE POA ANNUA GENOME

Presenter(s): Hannah Daguinsin *
Cell Biology, Genetics & Genomics, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 501
Mentor(s): Eric Patterson, Nathan Hall

Poa annua (annual bluegrass), is a notoriously difficult to control weed, common in turf grass and other arable lands. It gains resistance to herbicides quickly through both target site (TSR) and non-target site (NTSR) mechanisms. NTSR is of special concern because it is often complex (i.e. not conferred by a single locus) and may impart cross resistance to multiple wildly divergent herbicides. It is key to understand how the resistance is conferred in this species and what genomic elements contribute to its evolution because it can be generalized to many other weeds. Controlling P. annua is a billion dollar industry, it is a ubiquitous pest on lawns and golf courses. P. annua is an allotetraploid: it contains the diploid genomes of two, different progenitors, Poa infirma and Poa supina. Polypoidy may be one explanation for P. annua's extreme weediness. Generally speaking, in polyploids one sub-genome is dominant while the other(s) sits more idle and accumulates mutations; however, polyploidy events also mean a doubling of genetic content and therefore, twice as many genes on which selection can act. The cytochrome P450 (CYPP450) super-family contains several genes that are involved in stress responses and that break down xenobiotics, in some cases, conferring resistance to herbicides. To determine the degree to which allo-tetraploidy contributes to NTSR and a more general stress response, we characterized the CYP450 gene family in terms of expression patterns, duplications, and losses in the tetraploid genome of P. annua. We performed RNA-seq to investigate subgenome dominance in the CYP450s

DEVELOPMENT OF A TRANSFORMATION-FREE METHOD TO PRODUCE THERAPEUTIC DNA MINICIRCLES

Presenter(s): Brian Glowski
Cell Biology, Genetics & Genomics, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 502
Mentor(s): Masako Harada

Gene therapy is a technique to replace, repair, or regulate genes to treat a disease. One of the most common forms of gene therapy uses viral vectors. This is problematic however, due to

their risk of host genome integration and immunogenic responses. Research focused on studying nonviral DNA vectors has illuminated the promising potential to avoid such issues. The use of plasmids as nonviral DNA vectors is one of the approaches. However, it requires the presence of unnecessary bacterial sequences such as an antibiotic resistance gene and origins of replication. The potential risk is that the antibiotic resistance genes can be transferred to the human microbiome and environment. Thus, we investigated a transformation-free method of plasmid production that allows removal of bacterial sequences, producing a significantly smaller DNA vector termed "minicircle" that can improve stability and delivery efficiency.

USING GWAS AND MACHINE LEARNING TO DISCOVER GENE ASSOCIATIONS FOR COMPLEX DISEASES

Presenter(s): Jaewook Lee *
Cell Biology, Genetics & Genomics, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 503
Mentor(s): Alex McKim, Arjun Krishnan

Genome-wide association study (GWAS) is a powerful approach for identifying genetic variants across the entire genome that are associated with complex and polygenic traits. We can use this genetic variant information to gain insights into the molecular basis of each complex disease, such as the genes and biological processes that might play a role in modulating the various traits related to the disease. While a number of previous studies have used GWAS data of a specific trait to identify associated genes and processes, data from hundreds of traits have rarely been used to characterize disease genes. Taking advantage of the genetic basis of multiple traits to study disease genes could have large implications, not just in terms of causality, but also in potential treatment options and strategies. We have developed an approach to compile a large number of GWAS datasets and calculate gene associations from each one of them. Next, we are devising a machine learning approach to use these gene associations across hundreds of traits to predict genes known to be associated with complex diseases. This analysis will point to the combinations of traits related to each disease, and the molecular features that underlie these trait-disease relationships will help chart a path from discovering genetic variants to creating new treatment options.

EFFECTS OF CHLORINATED BENZENE CONGENERS ON INTERCELLULAR COMMUNICATION THROUGH GAP JUNCTION IN A F344 RAT LIVER EPITHELIAL CELL LINE

Presenter(s): Valeria Jurado
Cell Biology, Genetics & Genomics, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 504
Mentor(s): Brad Upham, Lizbeth Lockwood

The primary hypothesis is that interruption of intercellular communication through gap junctions is a necessary early step in cancer and serves as a biomarker for screening environmental contaminants that can potentially contribute to the cancer process. I will determine the in vitro effects of environmental contaminants on gap junctional intercellular communication (GJIC) in a bipotent liver stem cell line, also known as oval cells, derived from Fischer 344 rat livers, which is a primary rodent species used by the "National Toxicology Program". The selected environmental contaminants will be chlorinated congeners of benzene such as hexachlorobenzene, pentachlorobenze, 1,2,4,5-tetrachlorobenze, and 1,4-dichlorobezen. I further hypothesize that there will be observed differences among these congeners on GJIC as a function of dose, time, and molecular mechanisms by which these congeners dysregulate GJIC. GJIC will be measured using the scalpel load-dye transfer (SL-DT) technique where a yellow fluorescent dye is introduced into a group of cells with a

scalpel blade and then the dye is allowed to travel through gap junction channels for three min, after which the cells are fixed. The distance the dye traveled is captured by an epifluorescence microscope equipped with a CCD camera and measured with Image J (NIH). Basic statistical analyses will include measuring standard deviations, and Analyses of Variances and post hoc tests to measure differential effects.

SEQUENCING FOR MUTATIONS IN LUNG CANCER ALTERS EGFR ACTIVITY.

Presenter(s): Sarai Rivera *
Cell Biology, Genetics & Genomics, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 505
Mentor(s): Eran Andrechek

The deadliest type of cancer worldwide is known to be lung cancer; 2020 statistics from UICC showed that 1.435,943 people develop lung cancer. To study cancer, studies have used transgenic mouse models. In our lab we found a recurring mutation in the phosphatase PTPRH using whole genome sequencing. We found that in our genetically engineered mouse models 80% of tumors exhibited a PTPRH mutation. One of its main functions of PTPRH is dephosphorylation of EGFR, essentially turning off EGFR. When EGFR is unchecked, it is known to be a driver of tumorigenesis. Due the PTPRH mutation, EGFR remains in the active phosphorylated state, resulting in unchecked cell growth. According to TCGA data, 5% of the lung cancer population in the USA has a PTPRH mutation. These patients with this type of mutation are not treated with EGFR inhibitors, instated they receive chemotherapy with the associated side effects. We hypothesize in this project, that by can sequencing human lung cancers that, we will find PTPRH mutation and that they will have phosphorylation of EGFR. In addition, we hypothesize that certain PTPRH mutations will cause active EGFR to translocate to the nucleus, changing gene expression. By performing DNA extraction, PCR, electrophoresis, and sequencing for PTPRH mutations we will uncover which mutations are causing the inactivation of the PTPRH gene. Ultimately, identifying PTPRH mutations that result in EGFR activation may allow these patients to be treated with targeted EGFR inhibitors, giving these suffering patients, a targeted therapy.

THE THERAPEUTIC POTENTIAL OF EXTRACELLULAR VESICLES AS IGF-1 GENE DELIVERY VEHICLES IN TYPE 1 DIABETES

Presenter(s): Katherine Lauro
Cell Biology, Genetics & Genomics, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 506
Mentor(s): Masako Harada

Type 1 diabetes (T1D) is an autoimmune condition in which the host's immune system attacks and destroys pancreatic β cells, resulting in reduced insulin secretion and therefore impaired glucose metabolism. The current treatment for T1D involves insulin-replacement therapy, which is only a symptomatic treatment option. To develop a more curative treatment, pancreatic β cells need to be regenerated from islet cell precursors and future autoimmune attack must be prevented. Insulin-like growth factor 1 (IGF-1) is a 70 amino acid long polypeptide hormone that is more than 60% homologous with proinsulin, the precursor to insulin, due to them both being derived from the same ancestral gene. In past studies, the IGF-1 gene has been shown to stimulate β cell regeneration, therefore, the aim of this project is to investigate the IGF-1 gene as a therapeutic for T1D patients. However, targeted delivery of nucleic acids has been proven to be difficult due to their size, lack of stability in body fluids, negative charge, and inefficient cellular uptake. Extracellular vesicles (EVs) are a heterogenous population of small, natural carrier molecules with the potential to overcome the obstacles of gene delivery due to their non-immunogenic properties, currently a challenge

with other gene delivery vehicles. This project focused on transfecting mouse pancreatic β cell line (NIT-1) with a mouse insulin promoter (MIP)-driven gene construct engineered with IGF-1. We have successfully verified transfection and are continuing to investigate the effect of IGF-1 on β cell regeneration in vitro.

UNDERSTANDING THE HISTORY OF MICROBE DIVERSITY IN SOIL

Presenter(s): Mitchell Grinshpun
Cell Biology, Genetics & Genomics, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 507
Mentor(s): James Tiedje

Loess soil deposits are windblown silt-sized sediments. Layers of soil were formed through windblown drifts of glacier-ground rock particles, resulting in layers of soil representing past ages between glacial periods with respect to depth. During the interglacial period, temperature and moisture levels were higher and vegetation grew to form new topsoil thousands of years ago. One hypothesis is that this results in microbes associated with respective time periods trapped in a state of dormancy within individual layers. Given this, a sample from a certain depth of soil would contain a collection of dormant, diverse microbes from when that soil was topsoil. Many soil microbes remain unstudied, an emboldened issue when attempting to identify taxa at great depths. To better understand microbe composition and diversity at different depths of loess soil, cores of 50 to 75 feet were drilled by the Iowa Geological Survey at Hitchcock Nature Center in the Iowa Loess Hills. These cores were cut into 4ft segments, capped and kept on ice until storage in a cold room. DNA was extracted from cores of different depths, checked for quality and quantity, and 16S rRNA amplicons sequenced to identify operational taxonomic units. Microbe taxa and diversity were described at different depths with attention to novel taxa.

EFFECTS OF OXYBENZONE ON THE ESTRUS CYCLE IN BALB/C MICE

Presenter(s): Kloma Cardoza
Cell Biology, Genetics & Genomics, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 511
Mentor(s): Anastasia Kariagina, Richard Schwartz

Oxybenzone (Benzophenone-3, BP-3) is commonly used in topically applied sunscreens and is a potential endocrine disrupting chemical. The CDC detected BP-3 in 98% of urine samples from the United States population. Previous studies found that BP-3 has diet-dependent effects on mammary tumorigenesis. In this study, we investigated BP-3 effects on the mouse estrus cycle. We used BALB/c mice transplanted with p53 knockout mammary tissue, which eventually will develop mammary tumors. To determine whether there is a significant relationship between different dietary regimens, BP-3, and the estrus cycle, one group of mice was fed with low-fat diet (10% kcal fat) their entire life (LFD), and another group was started with a low-fat diet and then switched to a high-fat diet (60% kcal fat) after puberty (LFD-HFD). These two groups were further divided into those treated with or without BP-3 to comprise a total of four experimental groups. Vaginal swabs were taken from all groups to determine the phase of the estrus cycle in each mouse, proestrus, estrus, metestrus, or diestrus. We previously observed that BP-3 increases the proportion of tumor-bearing mice in diestrus in mice fed LFD. The current study determines if this alteration of the estrus cycle occurs before tumor development. Because BP-3 was previously observed to be protective toward tumorigenesis in mice fed LFD, increased length of diestrus prior to tumor development would implicate this in the protective effect. Cellular differentiation and apoptosis of the mammary epithelium occur during diestrus, and these processes might inhibit tumorigenesis.

RECONCILING MULTIPLE CONNECTIVITY SCORES FOR DRUG REPURPOSING

Presenter(s): Kewalin Samart
Cell Biology, Genetics & Genomics, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 512
Mentor(s): Arjun Krishnan, Janani Ravi

The key principle of recent drug repurposing methods is that an efficacious drug will reverse the disease molecular 'signature' with minimal side-effects. This principle was defined and popularized by the influential 'connectivity map' study in 2006 regarding reversal relationships between disease- and drug-induced gene expression profiles, quantified by a disease-drug 'connectivity score.' Over the past 15 years, several studies have proposed variations in calculating connectivity scores towards improving accuracy and robustness in light of massive growth in reference drug profiles. However, these variations have been formulated inconsistently using various notations and terminologies even though various scores are based on a common set of conceptual and statistical ideas. Here, we present a systematic reconciliation of multiple disease-drug similarity metrics and connectivity scores by defining them using consistent notation and terminology. In addition to providing clarity and deeper insights, this coherent definition of connectivity scores and their relationships provides a unified scheme that newer methods can adopt, enabling the computational drug-development community to compare and investigate different approaches easily. This resource will be available as a live document coupled with a GitHub repository to facilitate the continuous and transparent integration of newer methods. We are currently developing a computational drug repurposing approach that reconciles these multiple connectivity scores to predict drug candidates against infectious diseases.

EVOLUTION OF STAPHYLOCOCCAL ANTIBIOTIC RESISTANCE SYSTEMS ACROSS GRAM-POSITIVE BACTERIA

Presenter(s): Elliot Majlessi
Cell Biology, Genetics & Genomics, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 513
Mentor(s): Janani Ravi

The bacterial cell envelope serves as the primary defense mechanism against external environmental threats, including antibiotics. Bacteria continuously evolve and adapt to their environment - when pathogens encounter antibiotics administered to the host, they evolve further, giving rise to antibiotic resistance. Envelope stress-response systems (ESRs), which protect and maintain cellular integrity, are critical for antibiotic resistance. Evolution of ESRs in the Staphylococci has led to disparate lineages and new antibiotic-resistant strains. Here, we are applying a computational approach to uncover the evolution of antibiotic resistance mechanisms in Staphylococci. This approach is based on a novel computational framework for characterizing bacterial genomes and operons using comparative genomics, pangenomics, molecular evolution, and phylogeny. Specifically, we are studying the conservation and modularity of Staphylococcal ESRs involved in antibiotic resistance by mapping the constituent domains in terms of their i) ancestry, ii) lineage- and environment-specific variations, and iii) diverse specialized protein/operon functions. Our findings will establish the nature and course of evolution of Staphylococcal antibiotic resistance systems within Staphylococci and key Gram-positive lineages.

THE GENOME ANNOTATION OF STEVIA REBAUDIANA

Presenter(s): Mimi Ughetta *
Cell Biology, Genetics & Genomics, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 514
Mentor(s): Kevin Childs

The plant species Stevia rebaudiana is a member of the sunflower family Asteraceae, which is native to Brazil but commercially cultivated around the world today. Due to the presence of steviol glycoside molecules within its leaves, it is valued as a crop for its use as an artificial sweetener. Modern breeding programs wish to control S. rebaudiana's synthesis of this compound along with the plant's vegetative development rate and resistance to environmental stressors such as disease. Doing so would allow for the improvement and control of its taste profile and agricultural output. By using the specific structural annotation engine MAKER-P, this study aims to improve the current understanding of the S. rebaudiana genome, by streamlining the complicated process of creating gene models for the species. We will do so by employing repeat masking, transcript and protein alignment, transcriptome assembly, and gene prediction software to explore structural features along with their phenotypic relevance in collected cDNA reads of the plant. This resulting assembled and annotated genome of S. rebaudiana can be used by breeders to genetically improve it as a crop. By giving researchers the best information to successfully produce and work with genetic variants of S. rebaudiana, we can help develop the stevia industry in the United States.

DEVELOPING A CURE TO SCHIZOPHRENIA AND BIPOLAR

Presenter(s): Kirandeesh Kaur
Cell Biology, Genetics & Genomics, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 515
Mentor(s): Varinderjeet Kaur

According to World Health Organisation, schizophrenia and bipolar are chronic mental disorders that affect 20 million people worldwide. They develop as a result of tissue damage in some areas of the brain. The idea is to analyse the potential of regenerative medicine- usage of therapeutic stem cells and tissue engineering to repair damaged parts by specifically using neural stem cells(NSCs) to facilitate neural repair by the secretion of growth factors- to combat these chronic illnesses. The other thing is to understand the requirement of high dopamine levels in these patients by encouraging voluntary G-coupling in the dopamine receptors to enhance behavioural sensitization(reducing stress) and exploring suitable laboratory methods for activation of the same- using appropriate allosteric modulators that are able to bind to dopamine receptors and change the shape to allow easy release of dopamine by binding to more proteins.

BIOLOGICAL FEATURE SETS FOR ACCURATE COMPARISON OF EXPRESSION SAMPLES ACROSS SPECIES

Presenter(s): Sneha Sundar
Cell Biology, Genetics & Genomics, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 516
Mentor(s): Arjun Krishnan

Researchers traditionally study certain genes in model species, such as mice or zebrafish, and obtain expression data to later apply to humans because ethically many of the experiments that further our understanding of the genetic mechanisms that cause disease can't be performed in humans; however, expression profiles consisting of thousands of genes are

often generated in these experiments, but are not directly comparable to human gene expression. Usually researchers rely on sets of directly comparable genes (one-to-one orthologs) to translate these results in humans, but only a subset of genes in each species fall into this category. In this work, we utilize biological pathway information and groups of orthologous genes to cast all the samples in the same feature space. These methods allow for the use of a greater number of genes when applying what is learned from model organisms to humans. A critical step is to create a gold standard to evaluate the different feature spaces, utilizing expression data from humans, mice, zebrafish, worms, flies, and yeast, which was further divided into tissue types -- heart, brain, blood, liver, intestine, and lungs. From there, to determine whether using one-to-one orthologs, biological pathways, or orthologous groups as features are the best way to compare samples across species, we use them in multiple machine learning methods. Based on these comparisons, we have found that orthologous groups are better features than biological processes for accurately distinguishing samples from different tissues across species.

CLASSIFYING BIOLOGICAL ENTITIES BASED ON CONTEXTUAL RELATIONS

Presenter(s): Filip Jevtic
Cell Biology, Genetics & Genomics, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 517
Mentor(s): Christopher Mancuso

Gene technologies have enabled researchers to analyze large amounts of data in hopes of gaining a greater understanding of biological systems and relations. It is therefore essential that gene expression samples be labeled appropriately to the single cell, tissue, or disease they belong to. We present a method to annotate both seen and unseen gene expression samples. The method entails using graph based dimensionality reduction combined with deep learning to annotate cells, diseases, or tissues based on the hierarchical structure of the respective ontology. There are more than 1 million human gene expression samples that are publicly available. These samples together constitute an extremely valuable resource that any researcher can use to gain new biological insights about genes and cellular mechanisms. However, most of these samples lack systematic annotation of the exact tissue and cell type they originate from. In our approach, we train a single unified model and not one per individual tissue, thereby leveraging both the relationship between gene expression signals and between tissues. After training this model, we can use it to predict the tissue or cell type annotation of any new gene expression sample, including tissues that we did not have any training data for. We have compared a number of methods for creating term representations and identified the most appropriate technique for the sample annotation task. Our results demonstrate that the dimensionality reduction technique used is the most accurate at determining a gene expression sample's label, even if it wasn't present in the training data.

CHEMICAL ENGINEERING & MATERIALS SCIENCE

ELASTICITY STUDY OF THE THERMOELECTRIC (GESE)1-X(AGBISE2)X SERIES (X = 0, 0.05, ..., 0.40)

Presenter(s): Megan Rylko
Chemical Engineering & Materials Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 601
Mentor(s): Alexandra Zevalkink, Mario Calderoncueva

$(GeSe)_{1-x}(AgBiSe_2)_x$ has been shown to change crystal structures with composition and exhibit promising thermoelectric performance in part due to its intrinsically low lattice

thermal conductivity, κ_L. Although it has been shown that this material exhibits lattice instabilities that may explain the low κ_L, a detailed explanation of the origin of the structural features in connection with κ_L is still pending. To better understand this, polycrystalline $(GeSe)_{1-x}(AgBiSe_2)_x$ samples where x = 0, 0.05, 0.10, 0.15, 0.20, 0.25, 0.30, 0.35 and 0.40 were synthesized via spark plasma sintering (SPS) to measure the elastic constants using Resonant Ultrasound Spectroscopy (RUS). Additionally, x-ray diffraction with increasing temperature was performed on the samples to determine the coefficient of thermal expansion for each composition. These experiments serve to elucidate the alloy's performance and, ultimately, design more efficient thermoelectric materials.

THE APPLICATION OF CYCLIC VOLTAMMETRY USING GC AND CONDUCTING DIAMOND ELECTRODES IN DETECTION OF THE ANTIOXIDANT POWERS OF VITAMINS C, B2, B6 AND B12

Presenter(s): Victoria Robinson
Chemical Engineering & Materials Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 602
Mentor(s): Greg Swain

Various vitamins have been touted as having antioxidant properties that are beneficial for human health. The antioxidant power of a vitamin can be assessed through electrochemical methods based on the oxidation and reduction reaction potentials. In this project, the electrochemical behavior of vitamins C, B2, B6 and B12 are being investigated at glassy carbon (GC) and conducting diamond electrodes. The goal of the project is to determine if the carbon electrode type significantly influences the oxidation and reduction potentials of the vitamins in phosphate buffer, pH 7.2. The electrochemical method being used in this work is cyclic voltammetry (CV). Cyclic voltammetry is a method that records the current flowing at a working electrode due to redox reactions as a function of the applied potential. In this presentation, the cyclic voltammetric results for the different vitamins at the two electrodes will be reported on. The antioxidant power of the vitamins will be ranked based on the electrochemical data. Differences in the carbon electrode responses will also be discussed. Overall, this project will assist in the prevention and recovery of humans who experience oxidative stress. Antioxidants can aid in the removal or neutralization of free radicals, which are organic molecules that can damage our tissues and even cause some diseases.

THE ROLE OF RIDD IN TMZ RESISTANCE OF GBM

Presenter(s): Caleb Sandum
Chemical Engineering & Materials Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 603
Mentor(s): Christina Chan, Kevin Chen

Glioblastoma multiforme (GBM), the most aggressive and common adult brain cancer, is frequently treated with temozolomide (TMZ) which induces toxicity by creating Single Stranded-Breaks (SSB) and Double Stranded-Breaks (DSB) in DNA. The development of TMZ resistance in patients has become a problem in recent years, possibly explained by MGMT removing the methyl group induced by TMZ. In TMZ resistant GBM cells, kinase/endoribonuclease transmembrane protein, IRE1 was upregulated compared with the wild type. Once activated, IRE1 helps regulate cells during ER stress through multiple mechanisms, but specifically the Regulated IRE1-Dependent Decay (RIDD) pathway by cleaving mRNA's and miRNA's. Multiple studies suggest hsa-miR-370-3p regulates MGMT. Another study noted that RIDD cleavage typical targets molecules with a 6-nucleotide endomotif. miR-370 contains that sequence, providing a possible explanation for the mechanism of the TMZ resistance of GBM. Experiments will be run on GBM (U87 and T98G)

cells to test if the miRNA's (such as miR-370-3p) that regulate MGMT are downregulated during ER stress/RIDD activation. This would result in increased MGMT levels, repairing many of the DSB and SSB created by TMZ. The connection of TMZ resistance to the RIDD pathway would provide a new way to combat TMZ resistance through inhibition of IRE1.

THERMAL RECYCLING OF POLYLACTIC ACID (PLA)

Presenter(s): Tytus Sewell
Chemical Engineering & Materials Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 604
Mentor(s): Badal Lodaya, Mo Alhaj

As the world moves further towards environmental awareness, the need to replace petroleum-based plastics has become increasingly important. One promising replacement is polylactic acid (PLA). Made from renewable resources such as corn and soybeans, PLA is a biodegradable polymer with multiple commercial applications due to its impressive mechanical properties. Unfortunately, PLA degradation requires specific composting conditions that are only met by a limited number of composting centers. This limitation on degradation suggests a need for other end-of-life options for PLA. Previous research has proven that the polymerization of lactide (PLA's monomer) to PLA is a reversible reaction under controlled conditions. By reversing this reaction, "used" PLA can be converted directly back into its monomer lactide. The collected lactide can further be polymerized into "fresh" PLA. The goal of this project is to optimize and scale up PLA depolymerization in a lab-scale batch reactor. Tin(II) 2-ethylhexanoate (stannous octoate) is used as a catalyst and tested at various monomer to catalyst ratios ([M]/[C]) between 5,000 and 10,000. Additionally, the reaction is run at a range of temperatures between 180 and 200°C. Two challenges this project presents involve lactide purity and chirality. Both PLA and lactide are chiral molecules, and racemization can occur during depolymerization, jeopardizing the purity and chirality of the product. Differential scanning calorimetry (DSC) is used to confirm the collection of pure lactide, while polarimetry is used to determine the lactide's chirality.

FLEXIBLE POLYURETHANE FOAMS UTILIZING LIGNIN AS A PARTIAL POLYOL SUBSTITUTE

Presenter(s): Kevin Dunne
Chemical Engineering & Materials Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 605
Mentor(s): Akash Gondaliya, Mojgan Nejad, Saeid Nikafshar

Flexible polyurethane (PU) foams are a ubiquitous material with many different consumer applications. PU foams are created by reacting a polyol, a class of organic compounds with multiple hydroxyl (OH) groups, with an isocyanate, blowing agent, and catalysts. Lignin is a complex aromatic compound found in the cell walls of plants and is a byproduct of paper production. Lignin contains many hydroxyl functional groups, allowing it to potentially be an substitute for conventional polyols in PU foams. A commercial petroleum-derived polyol was partially replaced with softwood kraft lignin at various concentrations (0, 10, 20, and 30 wt%) and reacted with methylene diiphenyl diisocyanate, water, and catalysts to synthesize flexible PU foams. The foams were characterized mechanically in accordance with ASTM standard 3574 to compare performance parameters including compression set, sag factor, tensile strength, and tear resistance. Thermogravimetric analysis was used to measure the thermal degradation of the PU foams, while scanning electron microscopy was used to compare cell sizes and microstructures of foams with and without lignin. Compared with controlled foams, it was found that foams with lignin generally had higher densities, smaller cell sizes, increased mechanical properties, and thermally degraded at higher temperatures. Successfully

incorporating lignin, a low cost and sustainable raw material, into flexible polyurethane foams, would have substantial benefits to foam manufacturers and consumers.

PREPARATION ON AN ELECTROCHEMICAL-BASED ACETYLCHOLINE BIOSENSOR FOR BIOANALYTICAL APPLICATIONS

Presenter(s): Ariana Miller *
Chemical Engineering & Materials Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 606
Mentor(s): Greg Swain, Skye Russell

Use of microelectrode sensors for electroanalytical measurements in biological media is a common and useful tool for neuroanalytical studies. Neurotransmitters act as chemical messengers to transmit signaling messages from neuron to target cell. Proper neurosignaling within the nervous system is crucial to human health, and any disruption in this activity could result in the development of severe mental disorders such as Parkinson's disease, achizophrenia, and Alzheimer's disease. Cholinergic neurotransmission is mediated by neurotransmitter acetylcholine (ACh). The evaluation of cholinergic transmission in healthy and diseased models requires rapid in situ detection of extracellular levels of ACh. Electrochemical microelectrode sensors offer enhanced spatiotemporal resolution that is useful for detecting dynamic concentration changes near sites of neurotransmitter release, although this method is limited to electroactive analytes. This is problematic for detection of ACh, which is not electroactive. To combat this, an enzyme-based sensors which relies on the production of electrochemically active H2O2 for indirect electrochemical detection of ACh. To enhace selectivity, a poly(m-(1,3)-phenylenediamine) non-conducting polymer film will be electrodeposited on Pt microlectrodes before immobilization of a multienzyme layer based on the work by Kim M. Mitchell [Mitchell,2004]. This polymer film acts to restrict permeability of potential neuroactive interferents while remaining permeable to H2O2. The film also acts as anchoring point for immobilization of choline oxidase (ChOx) and acetylcholinesterase (AChE) with inert protein bovine serum albumin using cross linkage with glutaraldehyde. This presentation will focus on preparation and characterization of these enzyme-based sensors, and how they could be utilized in bioanalytical applications.

THE SYNTHESIS OF PYRIDINIUM SALTS FOR ELECTROCHEMICAL APPLICATIONS

Presenter(s): Johnny Drozd *
Chemical Engineering & Materials Science, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 607
Mentor(s): Thomas Guarr

Pyridinium salts are particularly interesting materials due to their unique electrochemical properties which can be exploited for a variety of applications, including electrocatalysis and the development of anolyte materials for organic battery technology. In this study, the synthesis and redox properties of various pyridinium salts are explored. We have identified a cost effective and environmentally safe method for the synthesis of pyridinium salts using a Pyrilium intermediate. This synthetic method is also advantageous because it avoids the introduction of halogen ions which can negatively impact electrochemical performance. Novel Pyrilium salts were synthesized and characterized via NMR spectroscopy and mass spectrometry. These Pyrilium salts were then converted into Pyridium salts through an efficient condensation process with a primary aromatic amine. The pyridinium products were also characterized via NMR and mass spectrometry. Their electrochemical properties were studied using Cyclic Voltammetry (CV) and Differential Pulse Voltammetry (DPV).

MALT ANALYSIS FOR CRAFT BREWING AND DISTILLING

Presenter(s): Brooke Fanale
Chemical Engineering & Materials Science, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 611
Mentor(s): Nicole Shriner

Malt analysis is a necessary part of determining the quality of cereal grains and malt. Various types of malt will be analyzed in order to determine how different malts can vary based on the processing steps to develop the specific malt. In malt color, total and soluble protein, diastatic power, free amino nitrogen, and moisture can have a direct effect of the quality no matter the type of malt being utilized. To implement this experiment, several different procedures for determining moisture, extraction, diastatic power, and free amino nitrogen will be implemented. The ability of the malt to be used in brewing and distilling is based on several different calculations that will determine the quality of the malt. Hopefully, the results of this experiment will show what the optimal results of each factor for creating a good malt will look like for any malt type.

DESIGN OF A LASER-CUT INSERT FOR SMALL-SCALE LIQUID-LIQUID EXTRACTION

Presenter(s): Sarah Caldwell
Chemical Engineering & Materials Science, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 612
Mentor(s): Maddalena Fanelli

Process intensification, the development of new processing equipment and techniques that allow safer, more energy efficient, and sustainable chemical processing, has received significant attention in recent years. In many instances, intensification is made possible by performing large-scale chemical processing on a small scale. Continuous liquid-liquid extraction is a process that has been challenging to intensify. Typically, gravity is a governing force in large-scale extraction, but at small scales, surface forces dominate. In this study, we investigate the use of a laser-cut assembly—an insert for a 1-inch inner diameter tube—to facilitate liquid-liquid extraction on the small scale. The small insert is designed with the CAD software Siemens NX. A mixing section upstream of the insert promotes mixing of two immiscible fluids, oil and water. The new insert promotes separation of the phases. The insert consists of eight unique pieces, mainly brackets and clamps, which provide axial and radial compression for a central, stacked shim assembly. The shims are small, thin rectangular pieces of PTFE and 316 stainless steel, cut to allow flow along the tube axis. Intermittent 1/16-inch thick PMMA pieces between the shims help create five individual, parallel axial flow channels. The attraction of oil droplets to the hydrophobic PTFE and water droplets to the hydrophilic stainless steel should facilitate separation between oil and water at the outlet of the assembly.

DIRECTED EVOLUTION OF HALOALKANE DEHALOGENASE ENZYMES USING ANCESTRAL PROTEIN SEQUENCE RECONSTRUCTION

Presenter(s): Ashley Maloney
Chemical Engineering & Materials Science, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 613
Mentor(s): Daniel Woldring

Ancestral sequence reconstruction (ASR) is a computational technique that engineers thermodynamically stable and robust proteins for numerous industrial bioengineering applications such as, pharmaceuticals and medicine. ASR constructs a phylogenetic tree that leverages multiple sequence alignment data to illustrate possible ancestral protein sequences

based on the modern collection of amino acid sequences. With a wide range of applications in protein engineering, proteins with existing utility have the potential for integrating improved or novel functionalities. The engineered haloalkane dehalogenase, a self-labeling protein tag derived from the haloalkane dehalogenase enzyme, is highly versatile and a valuable component for protein analysis technology development, such as clinical therapeutics and diagnostics. Rather than using randomized mutations to achieve the desired properties of the engineered haloalkane dehalogenase protein, ASR computes various combinations of feasible sequences that can then be tested and screened for functionality, stability, and changeable properties for fluorescent substrates. However, there are many uncertainties about the engineered haloalkane dehalogenase such as, the presence of other residues that affect the interactions of the HaloTag-HaloLigand system, and whether the functionalities are dependent on the engineering of the Ligand or the engineering of the protein itself. To combat these obstacles, ancestral sequence reconstruction was utilized to reveal the evolutionary trajectory of haloalkane dehalogenase (HLD-II) enzymes, displaying the conserved and amenable regions of predicted ancestors.

PATTERNING HYDROGELS TO FORM SURFACE FEATURES DURING SWELLING

Presenter(s): Ryan Huynh
Chemical Engineering & Materials Science, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 614
Mentor(s): Allie VanZanten, Caroline Szczepanski

With the ever-growing need for innovation in high-performance technology, scientists look for inspiration in nature. For example, the shell of the Namib desert beetle features a rough pattern that enables fog harvesting, which could be useful if applied to current research. Establishing a material where this rough pattern could be easily switched on and off in response to external stimuli would allow for the development of a smart surface with the ability to capture and release water droplets. Previous work has shown that surface features form on hydrogels when they are swelled in water and that cross-link density affects the stiffness and therefore the swelling properties. Other studies have also shown that by adding a light sensitive molecule into a hydrogel matrix, the structure of the gel can be remotely controlled on-demand. In this research, we aim to synthesize PEGMA/PEGDA hydrogels to investigate the surface features that form during swelling. By manipulating cross-link density, we can successfully influence the swelling ratio and therefore the surface features that form, thus providing a straight-forward platform for surface patterning. More complex patterning will also be explored using multi-layered materials and photopatterning, with the overarching goal of creating unique and tailorable surface features. The addition of a light sensitive domain will be investigated as an alternative method of patterning. This complex hydrogel structure will be very useful in the development of water capturing surfaces. Smart surfaces such as this could provide drinkable water for those who live in water scarce regions of the word.

SCALABLE PURIFICATION METHOD OF LACTIDE FOR CONTINUOUS MANUFACTURING OF PLA

Presenter(s): Andrea Delgado Jimenez
Chemical Engineering & Materials Science, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 615
Mentor(s): Mo Alhaj, Ramani Narayan

Polylactic acid (PLA) is one of the most prominent bioplastics for substituting petrochemical-based polymers. It is a biobased and biodegradable material, which is obtained by polymerizing lactide, a cyclic dimer. As a result of impurities found in lactide (such as water, lactic acid, and linear lactic acid oligomers), a low molecular weight PLA is produced, giving a

decay in the material properties. The optical purity of lactide is also a significant factor in the production of PLA since its properties are affected by the three lactide isomers, L-lactide, D-lactide, and meso-lactide. For this project, lactide is purified to L-lactide, since it has the highest potential to produce a highly crystalline PLA, whereas a higher percentage of meso-lactide decreases the extent of crystallization achievable, producing an amorphous PLA. L-lactide has to be at least 97% by weight to be considered pure. For targeting optical purification, a hydrolysis process will be used. High purity of the L-lactide can be achieved by causing a mixture of lactide isomers to contact with water. Meso-lactide is hygroscopic, making it dissolve in water and hydrolyze faster than L and D-lactide, effecting in the hydrolysis of meso-lactide and therefore removing it. The temperature of the reaction, the time of mixing, and the ratio of lactide and water are to be experimented with to look for which conditions will result in the purest product. A differential scanning calorimeter (DSC) and optical rotation analysis will be used to evaluate the purity of the resultant L-lactide.

EFFECTS OF POLYETHER-ELECTROLYTE COMPOSITION ON SPONTANEOUS PHASE SEPARATION IN A SALT SOLUTION

Presenter(s): Sarah Fisher *
Chemical Engineering & Materials Science, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 616
Mentor(s): Robert Ferrier

Complex coacervation is a spontaneous phase separation driven by the self-assembly of oppositely charged polymers in a salt solution. It has myriad applications including in the areas of wastewater treatment, protein purification, drug delivery, and underwater adhesives, and aligns with many green chemistry goals including low consumption of organic solvents, non-volatility, and nonflammability, as well as simple and efficient synthesis procedures. Despite the promise of this phenomenon, much is currently unknown regarding how polymer structure - including charge density, polymer architecture, and counterion identity - impact coacervation properties. The purpose of our study is to explore and quantify these relationships in order to further understand polyion coacervation. We synthesized a series of co-polyethers from functional epoxide monomers epichlorohydrin (ECH) and propargyl glycidyl ether (PGE), with varying molecular weights and compositions. After purification, we post-modified the polymers in order to impact charge via thiol-yne click chemistry for the polyanions and amine quaternization for the polycations. We investigated the phase behavior of salt solutions containing the synthesized polyether-electrolytes through turbidimetry in order to understand composition-phase behavior relationships. Our findings help to elucidate the polyether-electrolyte interactions and assembly as well as inform polyelectrolyte design. My presentation will report on the synthesis, post-modification, and characterization of the polyions synthesized as well as our findings regarding coacervation properties.

CIVIL & ENVIRONMENTAL ENGINEERING

EVALUATING THE ENVIRONMENTAL IMPACT OF ELECTRIC AUTONOMOUS VEHICLES THROUGH AN ANALYSIS OF TRAVEL PATTERNS

Presenter(s): Adeline Huack *, Cassie Starr *, Natalie Kelly *
Civil & Environmental Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 701
Mentor(s): Annick Anctil, Mehrnaz Ghamami, Sharlissa Moore

The introduction of autonomous vehicles (AVs) will affect driver transportation patterns and Vehicle Miles Traveled (VMT). An anticipated rise in AV travel demand, thereby increasing

VMT, will reduce vehicle lifetime and increase energy consumption and greenhouse gas (GHG) emissions. Given the potential for AV usage in the future and its undetermined environmental effects, this research aims to identify adoption and use factors contributing to society level VMT and the resulting implications for a life cycle assessment (LCA) of autonomous vehicles. Previous environmental assessments have not considered changes in travel patterns or effects of human behavior in analyzing the environmental impact of AV introduction. This research relies on (1) an initial survey gathering participants' current travel behavior and willingness to adopt AVs, followed by (2) the utilization of a traffic simulation (VISSIM) to determine travel patterns for various locations in Michigan and AV repercussions. These outcomes will inform (3) a LCA of the use-stage of AVs to determine the net environmental impact in terms of GHG emissions and energy consumption. Analysis will be applied to Michigan residents and simulate mid-sized (SUV) fully electric AVs. Results will contribute to further understanding the behavioral implications of AVs and their related environmental impacts.

USER-CENTERED NEEDS ASSESSMENT OF FIRST-MILE LAST-MILE FOR AGING POPULATIONS

Presenter(s): Chizaram Ugboh *, Jessica Ullom-Minnich *, Laura Nagle *, Michael Hernandez Lamberty *
Civil & Environmental Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 702
Mentor(s): Chu-Hsiang Chang, Elizabeth Mays, Elizabeth Pollack, Justin Scott, Michele Grimm, Tamara Bush

Emerging technology has brought the deployment of autonomous vehicles (AVs) closer to reality than ever before. AVs could be integrated into a First-Mile Last-Mile (FMLM) transportation system as the link between public transit and the start or end of a trip. In an empathetic design process, it is important to identify diverse populations' user needs as design criteria. Aging populations may benefit the most from AVs in a FMLM system due to AV's increased safety features and lower reliance on user driving skills. This project evaluates the needs of aging populations regarding FMLM challenges and AVs. This research investigates the user needs of two target populations in a FMLM system. Those in the current-elderly group (66+) already experience the mobility challenges of age. The future-elderly group (56-65) make up those likely to need the system by the time fully-autonomous vehicles are available, but who do not currently experience mobility challenges. We have developed an initial user needs list based on existing literature. We will improve these user needs by performing 30 minute, telephone or zoom interviews with members of the general population and the two target populations. The interview data will be transcribed and examined through qualitative analysis methods, and we will use interview data to update and finalize the user needs of each target population. These results aim to compile a comprehensive user needs list of an AV that can address the challenges of those who currently may have and those who will eventually have FMLM challenges.

HYDROLOGICAL IMPACT OF UPSTREAM DAM OPERATIONS IN THE LOWER MEKONG REGION

Presenter(s): Jac Stelly
Civil & Environmental Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 703
Mentor(s): Dang Huy, Yadu Pokhrel

The Mekong River in southeast Asia has seen a spike in large-scale hydropower dam construction that began in 1992 and accelerated since 2010. This spike has led to hydrological alterations with the potential to destabilize the region's agriculture, fisheries, and ecosystems.

Both the ecology and economy of the Lower Mekong region rely on a seasonal cycle between wet and dry seasons, defined by discharge rates increasing roughly 600% during wet season. Ecosystems such as the highly productive Tonle Sap floodplain rely on this increase of discharge to maintain fish populations, vegetation growth, and soil fertility; however, dam operations have begun to disrupt the Mekong's seasonal cycle and dampen the annual flood pulse. The aim of this study is to examine the downstream propagation of dam operations and quantify the change in annual discharge cycles between Pre-dam (1960-1992), Transition (1992-2009), and Mega-dam (2010-2021) periods. Beginning at the border between China and Thailand, five hydrological stations are selected to assess the impact upstream dams are having on the Lower Mekong's hydrology. As tributaries and local water cycles replenish the Mekong's mainstream, the results of this study determine a breakpoint in distance at which dams significantly alter the river's seasonal cycle. Upon these results and a collection of academic literature, projections are made concerning the degradation of ecological systems and potential drought scenarios. To date, dams have been implemented on a project-by-project basis, and this study emphasizes the need to transition into a standard of long-term, international coordination for the Mekong region's food-water-energy security and ecological integrity.

LIFE CYCLE ASSESSMENT OF EARLY PHOTOVOLTAIC MODULE RETIREMENT IN THE UNITED STATES

Presenter(s): Mallika Kothari
Civil & Environmental Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 704
Mentor(s): Annick Anctil

The state of California is the foremost leader in solar photovoltaics (PV) installations in the United States. With 1,297,412 installations and 23.57% of the state's energy coming from solar, the demand for PV modules is steadily increasing. Most PV modules have an expected lifetime of 25-30 years. However, due to replacing older modules with newer, more efficient ones (repowering) or early module failure, module lifetime can often be shorter than anticipated. Current studies calculate the environmental impact of PV systems based on ideal installation conditions and a full 25-year module lifetime. This study considers the impact on the life cycle of PV systems from early PV module retirement and actual system installation in California. Using the life cycle cumulative energy demand and greenhouse gases, we evaluate the energy payback time (EPBT) and carbon payback time (CPBT). Data from various PV module rooftop residential installations in 2019 were collected from the California NEM database. Information on the system design (tilt, azimuth, and module model) and module specification sheets were used to calculate the cumulative electricity generated in kilowatt-hours (kWh) over the system's lifetime. We expect the EPBT and CPBT to be shorter than the system's lifetime, and therefore, have positive environmental benefits. Although the rapid movement towards solar energy is promising and essential as reliance on greener energy increases, attention must be paid to the diverse lifespans of PV modules, system design, and performance to substantiate or reject the assumption that PV always have a positive impact on the environment.

THE PREDICTED FUNCTIONAL GENES FOR THE BIODEGRADATION OF XENOBIOTICS IN GROUNDWATER AND SEDIMENT AT TWO CONTAMINATED NAVAL SITES

Presenter(s): Andrea Vera
Civil & Environmental Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 705
Mentor(s): Alison Cupples

Bioremediation is the biological decomposition of contaminants in situ, primarily by bacteria. However, little is known concerning the functional abilities of bacteria at the majority of sites. To address this, the overall objective here is to determine which functional genes are present, in both soil and groundwater at two sites. The research focuses on 16S rRNA gene amplicon sequencing data analysis. The work takes advantage of PICRUSt2 (Phylogenetic Investigation of Communities by Reconstruction of Unobserved States), a software for predicting functional abundances based only on marker gene sequences (16S rRNA gene). The functions studied include the genes associated with the xenobiotic degradation pathways within the KEGG (Kyoto Encyclopedia of Genes and Genomes) database. Data manipulation, analysis, statistics and the generation of figures are being conducted in RStudio involving packages such as phyloseq, microbiome, data.table, tidyverse, ggpubr, rstatix, forcats, readxl, forcats, ampvis2 and ComplexHeatmap. Taxonomy is being investigated over a range of sediment depths (5, 10, 20, 25, 30 ft) as well as in groundwater both upstream and downstream of a biobarrier. The study will also examine sequencing data from microcosms amended with RDX (key contaminant at both sites) and sediment or groundwater from these sites. The analysis will involve a comparison of gene abundances (as determined by PICRUSt2) in microcosms amended and not amended with RDX. The results should provide a wealth of data concerning the abundance of specific functional abilities at both sites, contributing to our understanding for the potential for bioremediation.

ANALYZING THE EFFECT OF CLEANING AND FOULING ON PVDF MEMBRANES

Presenter(s): Steven Beuther *
Civil & Environmental Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 706
Mentor(s): Volodymyr Tarabara, Xunhao Wang

The Earth's population poses a growing problem of water shortage. As the supply of high-quality water is reduced, higher emphasis is placed on water reuse. Membrane filtration enables reuse of water. A polymeric material employed in making water filtration membranes is polyvinyl difluoride, or PVDF. When membranes are used and cleaned over a long period of time, they deteriorate. With this in mind, this project aims to analyze the surface chemistry of the PVDF membrane as it ages. Membranes deteriorate over the course of approximately a decade, so for the purposes of this experiment membranes were subjected to an accelerated aging procedure to reduce the time scale necessary. A membrane's age can be quantified as the product of the concentration of the cleaning agent and the duration of cleaning. These two variables can be viewed as contributing on approximately equal footing so that increasing the concentration can shorten the cleaning time proportionally. The procedure will commence by casting a PVDF membrane to simulate those used in industry. This membrane will also be subjected to humic acid to simulate fouling by feed water. Once the fouling has occurred, it will be soaked in bleach, rinsed, soaked in citric acid, and rinsed again. After all of the cleaning, contact angle measurements and Atomic Force Microscopy measurements will be performed on the surface. Once the surface is analyzed, the surface chemistry will shed light on the qualities of the membranes during multiple stages of their operation.

COMPUTER SCIENCE & ENGINEERING

FOREIGN OBJECT MODELING

Presenter(s): Zach Morris
Computer Science & Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 801
Mentor(s): Lalita Udpa

A program that allows for foreign object to be modeled on top of a tube for advanced modeling.

COMPUTATIONAL WORKFLOW FOR CELL/TISSUE/DISEASE CLASSIFICATION

Presenter(s): Filip Jevtic
Computer Science & Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 802
Mentor(s): Christopher Mancuso

Gene technologies have enabled researchers to analyze large amounts of data in hopes of gaining a greater understanding of biological systems and relations. It is therefore essential that gene expression samples be labeled appropriately to the single cell, tissue, or disease they belong to. We present a method to annotate both seen and unseen gene expression samples. The method entails using graph based dimensionality reduction combined with deep learning to annotate cells, diseases, or tissues based on the hierarchical structure of the respective ontology. There are more than 1 million human gene expression samples that are publicly available. These samples together constitute an extremely valuable resource that any researcher can use to gain new biological insights about genes and cellular mechanisms. However, most of these samples lack systematic annotation of the exact tissue and cell type they originate from. Previous studies have shown that the tissue of origin of samples can be predicted with reasonable accuracy using the expression profile corresponding to that sample. However, these previous methods do not intrinsically take into account the fact that tissues and cell types are related to each other in terms of anatomy and physiology. Also, based on the way these methods are designed, one cannot make predictions for tissues or cell types that did not have a substantial number of manually annotated samples to begin with. Here, we have developed a method that represents tissues and cell types as numerical vectors that encode their biological meaning and relationships based on tissue ontology

AUTOMATIC EMOTION RECOGNITION USING DEEP LEARNING

Presenter(s): Morgan Sandler
Computer Science & Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 803
Mentor(s): Arun Ross

Emotions play a large part in human decision-making. Understanding the emotions associated with any human interaction can provide valuable insights into its possible outcomes. Like humans, computers can perform emotion recognition from human speech samples, also known as automatic emotion recognition. In this work, we perform automatic emotion recognition using convolutional neural networks (CNN) and long short-term memory models (LSTM). We perform our experiments on Mel-Frequency Cepstral Coefficients (MFCC) based speech representation of 2264 speech samples obtained from the RAVDESS dataset. We achieve an accuracy of 83.1% via this method. The RAVDESS dataset comprises speech samples from 24 professional actors (12 male, 12 female) vocalizing two lexically matched

statements in a neutral North American accent. Speech samples are classified into 6 emotion classes: neutral, happy, sad, angry, fearful, surprise, and disgust. We integrate the trained model in a user-friendly graphical user interface to infer a user's emotional state from their input speech audio.

REEXAMINING TRANSFER LEARNING IMAGE SEGMENTATION HYPOTHESIS BY SCALING UP

Presenter(s): Nate Britton
Computer Science & Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 804
Mentor(s): Dirk Colbry

Image segmentation is a process in which an image is separated into foreground (areas of interest) and background regions. Image segmentation is used as a first step in many research fields, which is why the SEE-Insight Team has decided to focus on it as one of its primary scientific image analysis workflows. Building upon years of software developed by the SEE-Insight Team as well as previous work, this research will further explore how transfer learning (using previous results to inform better future ones) can help facilitate the search for segmentation algorithms. This work builds off prior research with transfer learning that used a low number of iterations. This prior work found that there was little to no difference in results between transfer learning and randomized algorithm/parameter selection in image segmentation accuracy. As there is still good reason to expect that transfer learning should yield better-than-random results, the goal of this project is to continue the research by experimenting with finding better baseline algorithms by exploring more iterations and greater population sizes. Research on this project has been and will continue to be implemented using Python and shared as an open-source project on GitHub. In the presentation of this research, I will explore the additional progress that has been made thus far in researching and implementing transfer learning.

THE IMPACT OF HYPERSTIMULATION ON INNERVATION DURING PREGNANCY

Presenter(s): Tierra Foley *
Computer Science & Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 805
Mentor(s): Ripla Arora

According to the CDC, approximately 1 in 10 women struggle with infertility and as a result many have to seek out medical intervention such as In Vitro Fertilization (IVF). Prior to IVF in women, hyperstimulation using gonadotropins is performed for egg retrieval. Gonadotropin treatment leads to higher systemic levels of ovarian hormones - estrogen and progesterone. Previous studies suggest that estrogen causes degeneration while progesterone promotes regeneration of nerves. To determine if there is a change in nerve abundance in response to hyperstimulation of the uterus, mouse pregnancy day 3 uteri will be evaluated. Uteri from both normal and hyperstimulated pregnancy will be stained using immunofluorescence with ?-tubulin, a generic nerve marker. Stained uteri will be segmented and a 3D surface will be created using image analysis software (IMARIS). For each uterus, evaluation will be done in three sections : (1) near the ovary, (2) near the cervix, (3) in the middle of the horn. Nerve density will be quantified per unit length assessing variables such as nerve thickness, volume, and branching. Statistical analysis of the quantified data will be performed to assess any differences between the normal and hyperstimulated uterine samples. We anticipate a change in nerve density as a result of elevated hormone levels. We predict that changes in uterine innervation will result in alteration of uterine contractions ultimately impacting embryo spacing and compromising pregnancy outcomes.

SIMULATION STUDY OF PHYLOGENETIC TREES

Presenter(s): Brianna Martinson *
Computer Science & Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 806
Mentor(s): Kevin Liu

The field of phylogenetics, which seeks to characterize the evolutionary history of taxa, has advanced drastically due to improving computer hardware and software algorithms. The technology enables biologists to better understand the evolutionary patterns and have more confidence in their accuracy. This study intends to continue this progression through a simulation study, in which a model tree is created using a simulation process under the Jukes-Cantor substitution mathematical model. The created tree will then be used to create gene trees under a multi-species coalescent model, and the created gene trees will be used to generate evolutionary sequences. The sequences will be used to create an estimated gene tree under the Jukes-Cantor substitution model. The created trees will then be analyzed with statistics to quantify the topological difference between the created trees and estimated trees and then report the experimental-replicate-aggregated distribution of gene tree errors to determine how successful the simulation study's approach was at producing a phylogenetic tree. This procedure will be repeated for each model condition, e.g., birth/death rate, tree height, mutation rate, etc., to create its respective experimental replicates. This study will investigate the types of mistakes the phylogenetic tree estimation algorithm makes to analyze its strengths and weaknesses. This will provide more reliability and accuracy to enable biologists in their research to know what computational approaches will be useful for their respective research.

PREPROCESSOR

Presenter(s): Emmaline Arter *
Computer Science & Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 807
Mentor(s): Dirk Colbry

In order to improve the quality of See-Segment a preprocessor will be added. This preprocessor includes image filters such as a median filter, gaussian smoothing, and histogram equalization. Scikit-image will be used to import these filters. When an image is imported that does not require or benefit from the preprocessor the null option will be chosen, allowing the image to continue unfiltered. The addition of this preprocessor will ascend the program into a higher accuracy and diversify its range of applicability.

EXPLORATION AND ANALYSIS OF GENE-DISEASE ASSOCIATIONS FROM MULTIPLE SOURCES AND ASSOCIATION TYPES

Presenter(s): Arun Agarwal *
Computer Science & Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 811
Mentor(s): Anna Yannakopoulos, Arjun Krishnan

The trillions of cells within the human body are each sustained by the activities of thousands of genes in the genome. Genetic mutations prevent one or more of these genes from working properly; moreover, many diseases arise from the contribution of disruptions in multiple genes. To work towards cures for such complex diseases, the human genome has been studied through various experimental methods, each of which provide distinct understandings of the disease's genetic cause. We hypothesize that the genomic basis of complex diseases can be understood holistically through data exploration and combination

from many distinct sources, experimental methods, and association types. In this project, we obtained these data from the DisGeNET database, which integrates human gene-disease associations and variant-disease associations from expert-curated repositories, GWAS catalogs, animal models, and scientific literature mapped to over 30,000 diseases. With this data, we define and compare sets of genes associated with each disease to quantify the overlap in genes contributed by different association types. Since we expect low overlap, we devise supervised machine learning approaches, including logistic regression, to determine if, for a given disease, genes from an association type can be used to accurately predict genes from another type based on their interaction patterns in a gene network. Finally, we combine the machine learning models built for each association type into an ensemble model that discovers novel genes across the human genome associated with that disease. Such results can lead to the design of drugs that target and reverse the disease-related signals.

DEVELOPMENTAL COMPUTER STEREO VISION

Presenter(s): Arden Knoll , Jacob Honer
Computer Science & Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 812
Mentor(s): Juyang Weng *

Autonomous robots rely on many sensors, such as lidar and cameras, to become spatially aware and navigate their environments. While Lidar has become a popular option, it is expensive, large, and lacks the rich information that is available to cameras. Stereo cameras could be low-cost, highly mobile, solutions if computer vision algorithms could adequately utilize the wealth of information provided by the cameras. Traditional stereo vision algorithms, however, are brittle, as they struggle to handle complex distortions provided by real-world image pairs such as lighting differences between cameras, differences between viewing angels, and occlusion. Neural networks can address these problems by learning real-world representations, and have found success in many visual tasks (including disparity detection). However, neural networks are used similarly to traditional stereo-disparity detection algorithms, where they generate a disparity value for each pixel and provide a depth map as input for another algorithm. Developmental Networks (DNs) are capable of attention, meaning they are not only able to predict desiparity, but can also determine where to look. Furthermore, the DN can act as a full vision system by learning tasks that require both monocular and binocular visual information. This work provides a method for learning stereo-disparity detection and for integrating binocular cues with monocular cues. We discuss the inner workings of the DN algorithm in terms of disparity detection and explore how the DN can learn to implicitly detect disparity through unsupervised updates.

IMAGE PROCESSING OF PATHOGENS FOR THE RAPID DETECTION

Presenter(s): Sedrick Billups *
Computer Science & Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 813
Mentor(s): Evangelyn Alocilja, Saad Sharief

Rapid and accurate identification of harmful pathogens is necessary to prevent disease outbreaks. Common methods to detect bacteria include biochemical tests, DNA based assays and visual identification. Biochemical and DNA based tests and can prove to be time consuming and expensive, requiring sophisticated equipment. While Microscopy is a reliable technique to visually identify harmful bacteria, it requires a scientific skillset for both isolation and visualization of pathogens which may not be easily available. Here, we attempt to rapidly isolate pathogens using Magnetic Nanoparticles (MNPs) and automate their classification so dependence on skilled labor is minimized. In this study, images of bacteria isolated using MNPs were processed by the removal of background using MATLAB. MATLAB is a computer

software that allows manipulation of images and analyze data. Multiple images of 2 common pathogens- B. cereus and S. enteritidis were processed to remove background and prepare them for classification. The procedure starts with importing an image into MATLAB followed by its conversion from RGB (color scale) to Grayscale. Next, a mask is applied to remove the background following which the thresholds are optimized. Two threshold types were considered in this study, Binary Scale Threshold, and Open Threshold for eliminating large and small objects respectively which constitute noise. Finally, the images of bacteria are converted back into the color scale. The resultant images have their noise and background removed and can now be fed to a classification algorithm for their identification.

SIMPLE EVOLUTIONARY EXPLORATION IN CLASSIFICATION ALGORITHMS FOR SUPERVISED LEARNING

Presenter(s): Davin Lin *
Computer Science & Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 814
Mentor(s): Dirk Colbry

Genetic algorithms (GAs) find good solutions to search problems through a process inspired by evolution. Solutions are randomly selected and tested using a fitness function. The best solutions undergo changes (mutations) over multiple iterations (generations) to try and find better solutions. There have been several studies that use GAs to search over hyper-parameters of machine learning algorithms to learn values that work well for specific problems. For example, one popular study performs genetic search over breast cancer data to find the best supervised learning classification algorithm (Dhahri 2019). One of the main benefits of using genetic search is that it can be domain independent. Any scientist can use this method to find a well-performing classification algorithm for their dataset. In this work an existing GA framework was extended to search over different classifiers and their hyper parameters. This will allow scientists from any field to search a classifier "algorithm space" to find a specific classifier (Support Vector Machine, Forest of Decision trees, Neural Networks, etc) that works best for their problem. We will test our software and perform a proof-of-concept by attempting to partially reproduce the experimental results of previous works.

OPEN STORAGE RESEARCH INFRASTRUCTURE IMPROVEMENTS

Presenter(s): Jackson Riggle, Ryan Chang
Computer Science & Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 815
Mentor(s): Andrew Keen

OSiRIS is a transparent and high-powered storage infrastructure that provides services to the campuses in Michigan State University, the University of Michigan, Wayne State University, and the University of Indiana for the purpose of scientific research. We will build tools to allow others to replicate our model at other institutions or regional partnerships. The end goal would be to permit the creation of so-called "mini-OSiRISes" in order to allow institutions interested in deploying their own OSiRIS hardware to test the OSiRIS configuration without needing to invest in all the hardware components that would make up an actual OSiRIS implementation. We will use multiple services to accomplish the goal, includiOpeng the tool Puppet to set up newly deployed OSiRIS hardware and virtual machines (VM). In addition, the services ElasticStack (ELK), Prometheus, and Grafana will be used to collect, monitor, and visualize data about the new and existing systems. We will develop tools and/or configure those services to ensure that both of these goals will be obtained.

NOVEL ALGORITHMS AND TOOL DEVELOPMENT FOR COMPARATIVE GENOMICS AND PHYLOGENOMICS

Presenter(s): Daniyal Dar
Computer Science & Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 816
Mentor(s): Kevin Liu

Genomics and phylogenomics can be analyzed using different algorithms and the analysis can be put to specific purposes and used to create research paradigms. The primary purpose of this research is to better understand how and to what extent these algorithms can ease the life of researchers. New computational methodologies need to be created for efficient and accurate comparative genomic analyses, especially in the context of complex evolutionary scenarios. We will then need to connect the resulting in-depth insights to phenotype and function. To do this, we use different softwares to find the similarities and dissimilarities between phylogentic trees and gene trees. The trees are a very helpful method to formulate algorithms based on mathematical models to create different scales of comparison and reduce the computational time of technical differences and similarities to a minimum. We need to understand the function and formulation of these trees and to assemble all the data into methodical ideas and move forward therefrom.

MRI IMAGE RECONSTRUCTION USING LOCAL MODELS

Presenter(s): Ashwin Sreevatsa *
Computer Science & Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 817
Mentor(s): Saiprasad Ravishankar

A major shortcoming of MRI machines is the long duration needed to accurately capture the data to construct MRI images, which results in patient discomfort and lower patient throughput. One technique to address this challenge is to have the MRI machine sample less data and use a deep learning model to reconstruct the original image, which would allow a speedup of the MRI data collection process. We propose a novel technique using local models based on the UNet architecture to reconstruct the original MRI images. The key advantage of using local models to reconstruct images as opposed to global models is that training is significantly faster since only a subset of the dataset is used. A block-matching algorithm is implemented to select the subset of the data used to train the local models. We also experiment with the conjugate gradient method to perform data-consistent image updates. The FastMRI dataset, which contains multi-coil and single-coil MRI knee images, is used to train and test our models. Our goal is to compare the performance of local models with global models across standard MSE and PSNR benchmarks.

QUANTIFYING GENERAL AND DISCIPLINE-SPECIFIC WORD UNDERSTANDABILITY TOWARDS BETTER SCIENCE COMMUNICATION

Presenter(s): Matthew Artuso
Computer Science & Engineering, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 821
Mentor(s): Anna Yannakopoulos, Arjun Krishnan

Science literature contains jargon to facilitate efficient communication between experts in an increasingly specialized research space. However, this jargon also makes research inaccessible to non-experts who follow these sciences. To break down this barrier in making science research findings broadly-accessible, we propose a new measure that quantifies a word's likely understandability. To develop this new measure, we used Wikipedia articles and

their category tags to generate statistical distributions of individual words across categories. Then, for each word, we calculated the uniformity of its distribution and combined it, using dimensionality reduction, with that word's median frequency to get a single word complexity score. We also repurposed this procedure to develop a novel method to automatically identify basic terminology specific to a scientific field. This field-specific complexity score combines how non-uniform a word is in science but common in a specific field to a single score. Combining both of these word lists creates a dictionary of basic English and elementary scientific terminology with a very adaptable method that can be applied to nearly any scientific field, without requiring any manual curation of a word list.

DEEP LEARNING FOR MODELING MULTIVARIATE EXTREMES IN SPATIOTEMPORAL DATA

Presenter(s): Andrew McDonald
Computer Science & Engineering, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 822
Mentor(s): Pang-Ning Tan

Extreme weather is becoming more frequent, costly and dangerous due to the effects of climate change. For instance, the Atlantic saw a record 30 named storms in 2020; wildfires burned millions of acres across an anomalously hot western United States in 2020; and a sequence of three intense winter storms caused an estimated $200 billion in damages across the state of Texas in February 2021. Physics-based climate and weather models perform particularly well in forecasting average-case scenarios, but often fail to capture the risks posed by extreme events and their disproportionate effects on society. In addition, physics-based climate and weather models are computationally expensive, difficult to parameterize, and rely on idealized assumptions which may not hold in practice. Recent advances in deep learning on spatiotemporal data provide a promising avenue towards data-driven weather and climate modeling. Statistical extreme value theory provides a principled, theoretically-sound framework for modeling the distribution of extreme events. Statistical copula theory allows one to characterize the dependencies among random variables in a simplified framework. Together, these tools allow us to construct physically-consistent joint distributions of meteorological variables in extreme settings, learned from data. We propose a new class of deep extreme value copula models, analyze their theoretical strengths and weaknesses, and apply them to tasks of detection, prediction and generation on meteorological data. Early results are promising, and indicate that subsequent refinements of these deep extreme value copula models will prove valuable in humanity's adaptation to climate change.

DETECTING FACE MASK USAGE TRENDS IN SOCIAL MEDIA WITH MACHINE LEARNING

Presenter(s): Seth Ockerman *
Computer Science & Engineering, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 823
Mentor(s): Erin Carrier *

The use of face masks to prevent disease spread among the general population has become widespread with the COVID-19 pandemic. The ability to accurately detect and monitor the trends in face mask usage is crucial to understanding and predicting hotspot areas for both current and future pandemics. In this work, we investigate the detection of face masks in social media images using deep learning, specifically convolutional neural networks (CNNs). The use of CNNs for face mask detection has been explored by the research community; however, a common limiting factor has been the lack of a large, diverse image dataset of masked individuals. Current datasets are typically too small and limited in diversity or artificially created by superimposing medical masks onto faces. These approaches fail to

reflect the diversity of real life and unrealistically assume CNNs can always perfectly see the target's face. This project investigates the creation of a social-media-based face mask image dataset that reflects the scale needed for deep learning and the diversity (mask types, positions of people, and ethnicity) of real life. We have gathered approximately 120k images containing people tweeted from different cities. Mechanical Turk is used to label the images based on the presence of a face mask. Using this dataset, we will train a CNN model to detect the presence of face masks in social media images and compare the results to existing approaches. In the future, we will deploy our model to detect trends in face mask usage in a city over time.

BENCHMARKING OF THE SHACKLETON GENETIC PROGRAMMING FRAMEWORK FOR LLVM COMPILER OPTIMIZATION

Presenter(s): Stella Li *
Computer Science & Engineering, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 824
Mentor(s): Wolfgang Banzhaf

LLVM IR (low-level virtual machine intermediate representation) is an intermediate step in the compilation of computer code. LLVM compilers allow optimization by using a sequence of steps (passes) to improve run-time or other criteria. Genetic Programming (GP) is an algorithm that is inspired by the natural selection process and can automatically generate computer programs with better performance throughout generations. The Shackleton Framework employs a Linear Genetic Programming (LGP) algorithm to automatically search for close-to-optimal sequences of LLVM optimization passes. In preliminary testing, Shackleton is able to evolve a pass sequence that resulted in up to 20% improvement in execution speed over base pass sequences when applied to LLVM IR. We aim to investigate the effects of LGP systematically on a variety of parameter settings and use cases. The goal of this research is to improve the performance of the Shackleton Framework by finding close-to-optimal parameter settings; and to apply the framework to these benchmarks and compare various performance criteria amongst the benchmarks and to a hand-written baseline optimization sequence. The Taguchi Method - a cost-effective way to tune the performance of each parameter - is used to implement the benchmarking experiments. The benchmarking process is done primarily on the Ant Colony Optimization Algorithm for the Traveling Salesman Problem, which is to be extended to additional benchmarks in the next stage. Finally, runtime analysis is performed using the standard Taguchi analysis method to determine the efficacy of the optimization framework.

RANSOMWARE DETECTION AND MITIGATION BASED ON MACHINE LEARNING

Presenter(s): Geko Ezekiel Jimenez *, Marcus Boney *
Computer Science & Engineering, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 825
Mentor(s): Huirong Fu *

Ransomware is one of the fastest-growing cybersecurity threats and is classified into two types. It can either prevent access by locking your device, or it can prevent access by encrypting your files. The recent ransomware attack on the US Colonial Pipeline shows how disruptive and impactful ransomware attacks can be. Many states in the southeast experienced gas shortages due to the colonial pipeline shutdown spanning from Florida to Pennsylvania. Our growing reliance on information and technology, in addition to the growing number of ransomware families, is becoming a big problem that we can no longer ignore. To fight this growing threat, detection and prevention tools must keep up with the growing number of ways that ransomware can attack and evade. This project will timeline recent ransomware attacks by describing the methodology of the malicious code and describe the

impact it has on companies and the rest of society. The goal of this project is to create an effective solution that can detect ransomware and provide countermeasures to a ransomware attack.

AN INVESTIGATION TO ENHANCE USER'S INFORMATION SECRECY AND SECURITY UNDER A BACK-END RETARGETABLE PROGRAMMING INFRASTRUCTURE TO FACILITATE DATA SCIENCE

Presenter(s): Aidan Egan *, Shelnesha Taylor *
Computer Science & Engineering, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 826
Mentor(s): Hua Ming *

Across science and engineering disciplines, it is becoming increasingly common to make use of large datasets, which make it possible for researchers to produce profound new discoveries and contributions. However, most of these scientists and engineers do not specialize in data science. As a result, they may experience technical barriers when trying to make discoveries about their data. DVf is a domain specific functional programming language designed with general engineers and scientists in mind, offering a set of declarative language-based facilities that address this problem. In working with data sets and machine learning models, DVf must consider the way it handles potentially sensitive information. As a foundational design principle, the functional DVf programming language uses a state-of-the-art scientific workflow framework. Research efforts to improve common security issues under scientific workflow, such as provenance access control policies, should also be extended to the DVf infrastructure. Furthermore, a user of DVf may use their domain knowledge to determine which features would result in the most successful model, which essentially characterizes the related DVf program as user-associated intellectual property. The exposition of such information to unauthorized people would result in a violation of their intellectual property rights. Finally, some adversaries may attempt to reverse engineer a model to learn about the data set used to train the model. The aim of this project is to investigate and enhance the security and confidentiality of information within this programming infrastructure with the goal of protecting personal data and intellectual property.

A SLIDING WINDOWS METHOD OF MEASURING PLAYER ENGAGEMENT ON STEAM

Presenter(s): Prithvi Kalkunte *, Sean Bergen *
Computer Science & Engineering, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 827
Mentor(s): Elizabeth Munch, Firas Khasawneh

Our research focuses on methods to observe the growth and death of player engagement of video games on Steam utilizing methods from topological data analysis. We are specifically utilizing the Sliding Windows 1D Persistent Structures (SW1PerS) method, which aims to break our time series data on player engagement down into windows, and then observe how the homology structure, the loops which signify a periodicity within the data reflective of a steady player engagement, solidifies or disintegrates over time. We have two scopes of interest within this topic: the first is an investigation of games-as-a-service, particularly games popular with esports, to observe the effects of new games within the same series as well as esports participation on player engagement. The other scope of interest is in indie games, and what engagement structures exist within games with no major regular online component. We hypothesize that we can use the sliding persistent score to create a threshold for gaming community and decay. Ultimately, this research can be used to further understand video

game player psychology, and inform game creators, game marketers, and community builders of their players overall habits in trends.

SECURE AND DYNAMIC SERVICE RECOMMENDATIONS IN IOT APPLICATIONS

Presenter(s): Emily Hamrick *, Saman Bhat *
Computer Science & Engineering, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 831
Mentor(s): Amartya Sen *

User-centric service recommendation for Internet of Things (IoT) applications can be defined as identifying, recommending, and provisioning IoT devices that can optimally satisfy any user's personalized service requests. The nature of these IoT services involve users renting out the available IoT devices to either access the sensed data or deploy and execute their applications on these devices. In doing so, users provide their personalized preferences on two different input categories—functional attributes and non-functional attributes. Functional attributes like region of interest or service duration establish the basic requirements of the service. Whereas non-functional attributes like network latency or security personalize the service further and enhance the user's overall experience. The objective of this project is to research the provisioning of network security as a dynamic parameter during user-centric service recommendation for IoT applications. This is because, different users may have varying security requirements for their services which may also change over time. Furthermore, the strength of network security measures inversely affects network quality of service (QoS) metrics like bandwidth or latency. As such, security should not be provisioned as a predetermined static parameter following a universal one-size-fits-all policy. The research tasks involve doing a comprehensive survey of existing lightweight security protocols proposed for IoT applications, designing the scheme for provisioning dynamic network security, integrating its machine learning algorithm to perform service recommendation, and simulating a dynamic and secure IoT service recommendation scenario using an IoT emulator tool like CupCarbon.

GTA V SELF DRIVING CAR WITH MOTION

Presenter(s): Evan Miller *
Computer Science & Engineering, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 832
Mentor(s): Alex Redei *

In this project, we set out to create an autonomous driver for the game Grand Theft Auto V. This will be accomplished by training a Neural Network on a set of images taken from actual players driving in the game. As a secondary goal, we aim to integrate the game's telemetry data tracking into a program that controls a motion simulator in our lab.

STATIC ANALYSIS OF JAVASCRIPT AND REACT PROGRAMS

Presenter(s): Ameer Qaqish *, David Frost *
Computer Science & Engineering, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 833
Mentor(s): Lunjin Lu *

React is a JavaScript library that is widely used in web programs. JavaScript is a dynamically typed programming language that adheres to the ECMAScript specification. SAFE 2.0 is a static analysis tool used to analyze JavaScript programs written in the ECMAScript 5 specification. But JavaScript's syntax significantly changed during the switch from ECMAScript 5 to ECMAScript 6. Thus, SAFE cannot be used to analyze most React programs,

as many developers have incorporated features from ECMAScript 6 into their code. Good static analysis of React programs is important for improving Internet security because of the prevalence of React and the dynamic nature of JavaScript which can lead to unpredictable outcomes. We will develop methods for statically analyzing new features of ECMAScript 6 which will be an important step towards understanding modern JavaScript programs, particularly React programs.

CYBERSECURITY RISK ASSESSMENT FRAMEWORK USING COMPLEX PROBABILITIES

Presenter(s): Benjamin Swenson *, Ivan Mo *
Computer Science & Engineering, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 834
Mentor(s): Amartya Sen *

The process of security risk assessment aids in understanding what vulnerabilities exist in computer systems and networks along with the likelihood and impact of the exploitation of these vulnerabilities. This process is of great importance to large organizations and individual users as it helps to design and develop cost-effective and efficient security measures. Traditionally, one way of performing risk assessment is by using Bayesian Attack Graphs. However, there are several limitations of this approach such as, scalability, attack backtracking and graphical cycles, tracking and representing multiple attack states, and representing and quantifying colluding and non-colluding attacks. The objective of this project is to design and develop a risk assessment framework in the growing domain of connected and autonomous vehicles (CAV). Scenarios such as vehicle-to-vehicle and vehicle-to-internet inter-connectivity increase the number of attack surfaces. Further, vehicular infrastructure may not support resource-intensive security measures to prevent attacks. The solution lies in developing lightweight security measures and evaluating their potency, the prerequisite to which is performing security risk assessments. The novelty of this research lies in its proposal of using complex probabilities for Bayesian Attack Graph modeling instead of real positive numbers. Based on initial exploratory research, modeling risk assessment using complex probabilities might be able to address the challenges mentioned in the previous paragraph. The research contributions involve creating a CAV attack repository, modeling Bayesian attack graphs using complex probabilities for CAV, and creating a prototype tool deployed through a web-application.

GPU ACCELERATED 2-D IMAGE CONVOLUTION

Presenter(s): Charles Yoo *
Computer Science & Engineering, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 835
Mentor(s): Shadi Alawneh *

Image processing is an important technique that is used in many fields, such as remote sensing in self-driving vehicles or facial recognition. One method is known as image convolution, which involves many calculations that manipulate the pixel data of an original image to produce a new image with the desired effect. This can be computation intensive and requires a significant amount of time when run on a traditional computer processing unit (CPU). Since image processing is used for real-time applications, such as those mentioned above, it is essential that convolution algorithms run as quickly as possible. A common way to speed up image convolutions algorithms is to take advantage of the highly parallel structure of graphical processing units (GPU) to perform concurrent calculations. One problem with GPU applications is that they are often limited by the latency delays associated with transferring data between the CPU and the GPU. Previous research has looked into reduce the time spent transferring data by performing the transfer before the calculations are performed and by reducing the number of redundant transfers. For this research project, we

have used NVIDIA's CUDA to implement different variations of a 2D image convolution algorithm. While, memory-related optimization techniques have been the focus of previous research, we will also be looking at other non-memory related techniques to further boost the performance of the algorithm. This research will explore the ideal combination of optimization techniques that will make 2D image convolution fast enough to use in real-time image processing applications.

DEVELOPMENTAL ROBOT LEARNING THROUGH MULTIPLE TEACHING MODES

Presenter(s): Arden Knoll, Jacob Honer
Computer Science & Engineering, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 836
Mentor(s): Juyang Weng *

Building robust autonomous systems through a traditional engineering approach is challenging - if not impossible. Recently, machine learning has been a solution to this difficulty, as it allows robots to learn the complex dynamics of their environment and actions through either direct supervision or reinforcement. Both learning modes have their drawbacks; motor supervision is tedious for the trainer and reinforcement takes increased time. Reinforcement learning promises to make the training process easier and allows for better generalization. The pairing of the two may create a more efficient training process. Here, in addition to the above learning modes, we introduce an unsupervised learning mode, or practice mode, where the system generates its own actions and learns by observing the effects of said actions. Our robot learning framework uses multiple teaching modes (motor-supervision, reinforcement, and practice), and we demonstrate its capabilities through a series of experiments involving navigation tasks using a single stereo-camera. Unlike most neural networks, Developmental Networks (DNs), used in this work, do not rely on gradient descent based learning algorithms, and are therefore able to learn optimally, through real-time interactions with their environment, across a single lifetime. In this work we analyze and discuss the effects of each training mode on a DN's performance of a navigation task.

DEEP LEARNING FOR GRAPH COMMUNITY DETECTION

Presenter(s): Alexander Rambasek *
Computer Science & Engineering, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 837
Mentor(s): Abdullah Karaaslanli, Selin Aviyente

Community detection is a heavily-studied problem in graph theory, and many different algorithms and methods have been proposed. With the advent of deep learning, neural networks have become a preferred approach to capture deep nonlinear graph features to improve on existing linear methods such as spectral clustering and generalized Louvain. In particular, the autoencoder has received considerable attention for its ability to discover useful low-dimensional graphical representations, more amenable to clustering algorithms. In this paper, we explore the application of autoencoders to community detection on both static and dynamic graphs. We propose an autoencoder based learning framework that can learn from multiple input graph matrices including modularity, normalized Laplacian and Dice similarity. We first implement this ensemble learning approach for static networks and then extend the framework to dynamic networks. Following current trends in dynamic community detection , we adapt an evolutionary autoencoder-based method, relying on a temporal smoothness assumption between graph snapshots. For both static and dynamic CD, the latent space representation is clustered with k-means and normalized mutual information (NMI) is used to evaluate the cluster labels with respect to the ground truth labels. We compare the results with other popular techniques for community detection and highlight important unresolved issues.

DIVERSITY & INTERDISCIPLINARY STUDIES

BLACK BUSINESS OWNERS' JOURNEY THROUGHOUT THE COVID-19 PANDEMIC IN WASHTENAW COUNTY

Presenter(s): Bianca Ramsey *
Diversity & Interdisciplinary Studies, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 901
Mentor(s): Bianca Ramsey *

My Undergraduate Symposium research project focuses on how local Black businesses were affected by COVID-19 in Washtenaw County, particularly downtown Ypsilanti. Throughout my research, I gathered data by arranging one-on-one interviews with five local Black business owners and analyzed statistics regarding small businesses in Michigan. Throughout the interviews, I asked about how the pandemic affected their businesses regarding rent, clients, and income. Many Black business owners discussed how their business made a positive impact on residents in the community. This research project will bring more awareness to how African American businesses promote unity during a time of crisis.

DIVERSITY AND INCLUSION IN ACADEMIA: WORKPLACE CLIMATE CORRELATED WITH TURNOVER INTENTIONS AND MENTAL HEALTH

Presenter(s): Arika Hawkins, Lexi Nadolsky
Diversity & Interdisciplinary Studies, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 902
Mentor(s): Guizhen Ma

At all levels of academia, there is substantial evidence that negative workplace climate disproportionately affects people of color (POC) and women, who experience notions of gender norms and incompetence, negative stereotypes, societal differences, and mistreatment. Careers of these groups are affected by the diversity and inclusion climate of their workplace, which may differ greatly at the research group, departmental, and field level. Hostile climate only perpetuates disparity in the workplace, possibly impacting hiring, promotion decisions, and turnover intentions. These factors support underrepresentation in academia, an ongoing concern for POC, where underrepresentation from the graduate school level progressively worsens through higher academic ranks. To understand academic climate and turnover intentions, we used survey data from an international pilot study of graduate students, postdoctoral fellows, and assistant professors (N = 192) to investigate the effect of workplace climate on mental health and turnover intentions at three levels of academia by race. Intentions to stay in academia, in addition to mental health, were significantly correlated with a positive climate at all levels. Interestingly, while there were no significant differences in turnover intentions and mental health by race, underrepresented minority groups experienced a more negative climate in their professional field and department. These results show despite no differences in intentions to leave academia, the persistent negative academic climate that POC experience led to higher turnover intentions. Furthermore, we discuss the need and importance of establishing safe, inclusive workplaces at all levels of academia to ensure lower turnover and improved mental health among POC and women.

EMOTIONAL LABOR OF IMMIGRANTS AND NON-IMMIGRANTS IN THE WORKPLACE

Presenter(s): Denise Zavala *
Diversity & Interdisciplinary Studies, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 904
Mentor(s): Angela Hall

Immigrants are the primary workers of service industries compared to non-immigrants. The service industry includes healthcare, personal care, hospitality, retail, and all consumer services. While non-immigrant workers must also engage in emotional labor for their jobs it is hypothesized that other barriers such as discrimination and reduced job opportunities may increase the emotional labor demand of immigrants. Discrimination could include unfair wages and not having equal access to health benefits, whether for physical health or mental health. Research has shown that the emotional labor in service roles leads to adaptation of mood and attitude towards the role they place within an organization. Non-immigrant workers also account for emotional labor in the service industry. Emotional labor could mean having to fake a smile or attitude to please the company and its customers. The purpose of this study is to understand whether there are meaningful differences between the emotional labor of immigrants versus non-immigrant in the workplace.

DEVELOPING ALGORITHMS TO EVALUATE GROUP COMPATIBILITY FOR IMPROVED TEAM-BASED LEARNING

Presenter(s): Alice Krupczak
Diversity & Interdisciplinary Studies, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 905
Mentor(s): Adam Alessio

Collaboration is an essential component in any classroom. Team composition benefits from detailed analysis of different members' backgrounds and preferences. This work will develop different strategies for automatically creating teams based on attributes of class members. This utility, which can take into consideration any number of factors and questions imposed by an instructor, offers advantages compared to teams composed by random assignment or self-selection. A commonly used team building software called CATME offers a solution to some aspects of a team building problem. It creates teams by random selection and repeated swapping until a minimum criteria is met. Our project will improve upon prior methods by offering instructors wide-flexibility to incorporate custom criteria for team formation as well as manually impose aspects of a team's composition. We will simulate several pseudo classes with students from diverse backgrounds. In addition to using CATME heuristics, we will implement different algorithms for group formation and the calculation of group compatibility. Rather than random formation, we propose the creation of a comprehensive dataset of potential groups and use search algorithms to identify optimum subsets of acceptable teams. We expect this will help identify the global optimal grouping instead of simply acceptable team composition. Additionally, we will explore different approaches to compatibility. We will systematically compare different models for compatibility grading (objective functions) and group formation (optimization) that will result in a more effective team learning experience.

THE FUTURE OF CRASH PREVENTION: ASSESSING THE POTENTIAL OF AUTOMATED EMERGENCY BRAKING IN PASSENGER VEHICLES

Presenter(s): Cleveland Yancovitz *, Katelyn Rousch *, Nrushad Joshi *
Diversity & Interdisciplinary Studies, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 906
Mentor(s): Eva Kassens Noor, Josh Siegel, Peter Savolainen

In 2019, the United States experienced 6,756,000 crashes, resulting in 2,740,000 injuries and 36,096 deaths. Research suggests around 94% of crashes are caused by human behaviors such as recognition errors, decision errors, and overcompensation. In recent years, vehicle manufacturers have made improvements in advanced driver assistance systems (ADAS) such as the automatic emergency brake (AEB), which demonstrates promise for mitigating crashes by providing a superhuman reaction time to slow or stopped objects ahead of the vehicle.

However, there are currently no models bridging these experimental data with naturalistic, real-world data. This study cross-examines experimental AEB test data, naturalistic driving data, and self-reported survey data to gain a clearer picture of how ADAS technology may mitigate crashes. Current test data shows that AEB is 75.2% effective at preventing crashes in controlled conditions. Naturalistic driving data used in this study shows that around 70.9% of crashes occur within the ideal weather and lighting conditions. Of these crashes, around 54% of these are rear-end striking, meaning that the vehicle operator was unable to decelerate in time to avoid hitting the vehicle in front of them. These statistics provide context as to the potential crash savings that could be realized by AEB systems. However, survey data indicates a potential disconnect as 20.6% of respondents were very comfortable and 37.6% who are somewhat comfortable with AEB technology. Collectively, these numbers will be used to simulate a long-term projection on the number crashes AEB could prevent.

THE ROLE THAT NATIVE CULTURE INTEGRATION PLAYS IN THE PSYCHOLOGICAL WELFARE OF INDIVIDUALS WITH A THIRD CULTURE IDENTITY

Presenter(s): Sithembile Dube *
Diversity & Interdisciplinary Studies, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 907
Mentor(s): Stephen Colarelli *

Third-culture kids and adult third-culture kids are people who have spent a significant portion of their lives or developmental years in culture(s) outside of their native culture. These individuals develop a sense of relationship to all the cultures they have been exposed to while not having full ownership of any (Van Reken, 2009). We know very little concerning a third-culture kid's life experiences and how this mixed identity affects their daily lives, relationships, and overall well-being. This study examined the life experience of third-culture kids to determine whether those who integrate into their native culture (i.e., celebrating traditions, speaking native language) exhibit greater psychological well-being than those who do not. There was a total of 61 participants ranging from ages 17 to 28. Participants were selected through social media and asked to complete a Cultural Integration survey following a Psychological Well-being survey ("Psychological wellbeing Scale" n.d.). The Cultural Integration Scale was developed as part of this study and included seven questions based on common-culture characteristics. The Psychological Well-being Scale included 18 questions divided into six subscales that measured the participants' self-efficacy and current welfare. The results found no relationship between cultural integration and psychological well-being. The main hypothesis for the study - that cultural integration would positively correlate with well-being was not supported. This study suggests that the well-being of third-culture kids depends on more than integration into their native culture. Future studies should examine whether personality profile and acculturation strategies have a greater effect on the well-being of third-culture individuals.

EDUCATION

MAPPING INSTITUTIONAL RESOURCES AND CHARACTERIZING INSTITUTIONAL PRACTICE FOR DIVERSITY, EQUITY, AND INCLUSION AMONG STEM MAJORS

Presenter(s): Vidhula Srinivasan
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1001
Mentor(s): Ryan Sweeder

Institutions across the nation have adopted diversity, equity, and inclusion programs and efforts to provide equal access and opportunities to every part of the student population. For example, this could be through clubs/student organizations, learning communities, and cultural offices. In order to increase representation and success for students in STEM fields specifically, there needs to be a strong understanding of what DEI efforts involve, knowing the demographics that data is being collected from and how these groups are being represented. This project talks directly to students about their experiences in introductory STEM courses and these conversations focus on diversity, equity, and inclusion in STEM. By reviewing existing literature and institutional resources, developing a relevant interview protocol, conducting interviews, engaging in qualitative coding of the interview transcripts, and analyzing current efforts universities engage in, student perception of STEM courses can be learned. The results of the interviews help us understand factors that are important to students for their STEM courses, what might act as barriers to the feeling of representation, and what they would hope to see in future courses.

ACADEMIC ACHIEVEMENT: AN INVESTIGATION INTO THE BUDGET SPENDING OF LAUSD

Presenter(s): Chai Luong *
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1002
Mentor(s): Terry Flennaugh

In the general public, most people agree that increased spending on education is good, but there are some critics opposed to this idea. In the case of the Los Angeles Unified School District (LAUSD), the district agreed that increased spending on education is good. According to LAUSD 2020-2021 Revised Budget Report, the average K-12 per-pupil expenditure was $19,151 and $17,827 for high school seniors. The national average is $12,612. This research is an investigation into the fundings of the Los Angeles Unified School District, 2nd largest school district in the U.S, whether increasing per-pupil spending increases academic outcomes, specifically graduation rates. The important focus will be on the allocation of funds distributed within LAUSD. This research is built and inspired upon the existing research of Gloria Ladson-Billings' journal article titled From the Achievement Gap to the Education Debt: Understanding Achievement in U.S. Schools. In the research, Gloria offers an alternative definition to the concept of achievement gap in American schools while reframing the structure of how scholars should study the achievement gap. Gloria suggests that the achievement gap should shift to "educational debt" in four categories: historical, economic, sociopolitical, and moral decisions and policies. In order to understand the economic aspect of Ladson-Billings research, I am primarily interested in and focusing on the economic and socio-political aspects of Gloria's research and asking the question: Whether increasing per-pupil spending increases academic outcomes, specifically graduation rates? If increasing per-pupil spending indeed increases graduation rates, is the spending maximizing students' outcomes and performances

UNDERSTANDING TECHNOLOGY IN K-12 CLASSROOMS

Presenter(s): Christina Ware *
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1003
Mentor(s): Rebecca Jacobsen

Technology plays a vital role in developed education systems of the 21st century, yet opportunities to engage with technology varies across racial and economic groups of students (Warschauer et al., 2004, Warschauer & Matuchniak, 2010, Bray, 2017). The digital divide defines the gap between racial and socio-economic groups regarding access and

engagement with technology. High socio-economic status (SES) schools are more likely to have access to higher quality technology and administration support to aid teachers in their usage and implementation of technology (Warschauer, et al., 2004). Research suggests that technology utilization in mathematics classrooms can have a positive impact on students learning (Mouza & Barret-Greenly, 2015). The value of technology in the classroom depends not just on the presence of technology in the classroom, but on how students use these technologies (Leinwand et al., 2014) to engage with mathematics. My research extends to focus on how technological programs and resources were utilized during the COVID-19 pandemic school year. A survey addressed to mathematics teachers at any public school district will be sent using snowball sampling. I will analyze how teachers utilized technology in their classrooms and the factors included, such as the use of mathematical applications and student satisfaction with technology. The equitable usage of technology will continue to be an important topic of discussion to leaders in education.

LEARNING LANGUAGES IN EUROPE

Presenter(s): Sophie Hooper
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1004
Mentor(s): Heather Shea

The purpose of this project was to explore differences in language course curriculum and retention. English is considered a core subject within education systems in Belgium and the Netherlands, which requires students to begin learning English as a second language in primary school. Studies have shown that the younger a student begins learning a language, the more likely they are to retain it. Post-secondary education students from the United States, Belgium, and the Netherlands, through virtual interviews and group discussions reflected upon their primary and secondary education years, specifically focusing on second language learning. Language curriculum in primary and secondary schools in Belgium and the Netherlands concentrated on real-world scenarios and activities, which was more beneficial to students' retention. In contrast, students from the United States found their retention of a second language to be lacking, as a result of assessment-focused language curriculum. Together, these findings suggest that hands-on second language curriculum has a greater positive impact on overall student retention than testing. Ultimately, the research indicates that participating in activities to enhance learning (like simulations of interactions) was more effective than rote memorization and then later recalling from memory is not as effective.

MAPPING INSTITUTIONAL DIVERSITY PRACTICE: A CASE STUDY OF DIVERSITY, EQUITY & INCLUSION (DEI) EFFORTS IN A STEM UNDERGRADUATE EDUCATION

Presenter(s): Ashley Atkinson
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1005
Mentor(s): Nikeetha Farfan D'Souza *

It has been shown that institutions of higher education have historically and systematically excluded students with marginalized identities. While many universities have now issued statements and policies on diversity, equity, and inclusion (DEI) to address this exclusion, it is important to evaluate whether or not these policies and stated actions actually create a more inclusive and equitable campus. In this case study, we are investigating a mid-western public R-1 university's DEI efforts in undergraduate STEM (science, technology, engineering & mathematics) education using mapping methods and Disability Critical Race Theory (DisCrit) as guiding framework. DisCrit theory provides researchers tools to analyze DEI work at both individual and structural levels and asserts that students of nondominant identities must be

centered in the analysis in higher education. This enables us to evaluate if DEI programs in higher education institutions are inclusive and equitable. To begin, we first took stock of DEI efforts. We created an inventory of STEM courses and all programs related to DEI in undergraduate STEM. Then, using the inventory of courses and programs, we designed visual maps to demonstrate the structure of and relationships between the DEI programs. We are currently in the final process of analyzing the maps and programs in detail using quantitative and qualitative methods, including interviews and surveys. Our preliminary findings indicate that while this university has a large number of programs, they may not be frequently utilized by the student body and therefore not be as effective as intended.

ANALYSIS OF STUDENT THINKING ABOUT FUNCTIONS WHEN SOLVING COMPUTATIONAL SCIENCE PROBLEMS

Presenter(s): Emily Tobias *
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1006
Mentor(s): Danny Caballero, Devin Silvia, Rachel Frisbie

Functional programming, where programs are written through the composition and application of functions, is a programming paradigm that pervades much of computational science. However, students in introductory computational modeling courses, like Michigan State University's CMSE 201, often struggle with how, when, and why they should use functions to solve problems. Literature suggests that functions are a threshold concept in computer science courses, meaning that an understanding of functions is crucial to understanding computer science because functions change the way that students regard the topic as a whole. We develop this idea further by exploring functions as a threshold concept in computational science, which we consider distinct from computer science. To better understand how students think about functions, we explore how students decide when to use functions as well as how students' prior coding experience influences student thinking. We expect that students with a greater depth of computational experience are more likely to employ functions in solving problems and better articulate when and why they use functions in their work. Sixteen think-aloud interviews were conducted with former CMSE 201 students who were each given two computational science problems to complete. To highlight the distinctions that exist in how students regard functions, we present two contrasting cases that demonstrate varying levels of proficiency using functions. With this research, we can better understand the hesitancy that some students have about functions and improve the way that functions are introduced and taught in CMSE 201.

CHS 102 PROFESSOR ZHOU'S CHINESE GRAMMAR

Presenter(s): Benjamin Strelzoff
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1007
Mentor(s): Wenying Zhou

This project is a set of 47 educational videos relating concepts of Chinese Grammar from Wenying Zhou's CHS 102 course. These videos are being made to replace the set of videos that were used in the Spring 2021 Semester for CHS 102. This poster presentation also covers preliminary research and considerations vital to the creation of effective videos, an overview of production and project management, and an analysis of student response to the new grammar videos.

RURAL STUDENTS' COLLEGE KNOWLEDGE AND POSTSECONDARY ACCESS: A LITERATURE REVIEW

Presenter(s): Skylar Duke *
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1008
Mentor(s): Frimpomaa Daagye Ampaw *

To identify directions for future research regarding rural students' college-going motivations and enrollment in postsecondary institutions, it is important to uncover gaps in existing literature on the subject. The current study is being proposed for the purpose of assessing the current state of literature concerning factors that influence college-going among rural students. Specifically, literature discussing the educational implications of rurality, rural students' college knowledge, and these students' postsecondary access will be the focus of this review. Using the search terms "rural", "postsecondary enrollment", "college knowledge", and "college-going", Google Scholar and the Educational Resources Information Center's (ERIC) database will be used to identify literature published within the last 15 years focused on American rural students. These pieces of literature will be synthesized into a literature review to evaluate the collective significance of recent research addressing rural students. It is expected that this investigation will highlight the need for further exploration within the body of literature on rural students' college-going motivations and behavior. In recognizing these areas for development, future researchers will better be able to identify meaningful directions for inquiry.

SUPPORTING DIVERSE STUDENTS IN SPATIAL-HEAVY GEOSCIENCE CURRICULUM

Presenter(s): Grace Brekke
Education, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1009
Mentor(s): Susannah Dorfman

Geoscience degree programs and careers are among the least diverse of STEM fields. Research suggests that this lack of diversity may stem from: underexposure to outdoor activities, lack of knowledge about earth systems careers, and narrow, predefined pathways for entry into geoscience education and careers. One core skill that characterizes much of geoscience instruction is spatial reasoning, especially in visual-heavy fields like mineralogy and structural geology. Spatial reasoning is an ability with roots in both innate and acquired factors; preferencing spatial abilities in our courses may limit students' choice to continue in geoscience education and careers. Explicit instruction that recognizes the importance of spatial skills for performance in gateway courses may help enhance student ability to achieve and persist in the field. Thus, this work asks: How do students perceive spatial reasoning instruction and how does this instruction impact student self-esteem and sense of belonging in geosciences? We consider this question through analysis of several years of pre-post assessments of students' self-efficacy, academic goals, academic satisfaction, sense of belonging, career goals, spatial ability (rotation, penetration, and transformation) and working memory as well as performance on spatial-heavy course activities. We will present results comparing these data to identify the relationships between spatial training, student affect, and student performance. These results will help educators design geoscience curriculum to recruit and support students of different backgrounds and abilities.

ELECTRICAL & COMPUTER ENGINEERING

ASSESSING THE IMPACT OF ELECTRIC VEHICLES WITHIN A SMART GRID

Presenter(s): Delton Spencer *, Maitreyee Majumdar *
Electrical & Computer Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1201
Mentor(s): Ali Arefifar *

As the number of electric vehicles (EVs) within society rapidly increases, the concept of maximizing its efficiency within the electric smart grid is crucial. This research presents the impacts of integrating EVs within a smart grid through a vehicle to grid (V2G) program. It also observes the circulation of electric charge within the system on a time schedule so that the electric grid does not become exhausted during peak hours. This presentation will cover several different case studies and will analyze the best and worst scenarios for the power losses and voltage profiles in the power distribution system. Specifically, we seek to find the optimal location as well as the optimal number of EVs in the distribution system while minimizing its power losses and optimizing its voltage profile. Verification of the results will be primarily conducted using MATLAB GUIs. These simulations aim to develop a better understanding of the potential impacts of electric vehicles in smart grids, such as monetary benefits for utility companies and electric vehicle users as well as environmental impacts.

THE STATE-OF-ART DEVELOPMENT OF WIRELESS PRESSURE SENSORS FOR MEDICAL APPLICATIONS

Presenter(s): Nassar Taleb *
Electrical & Computer Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1202
Mentor(s): Chunqi Qian

Physiological pressure measurement is one of the most common applications of sensors in healthcare. Particularly, continuous pressure monitoring provides key information for early diagnosis, patient-specific treatment, and preventive healthcare. Heart blood pressure is an important standard for estimating the status of patients. According to the American Hear Association, nine in one thousand people in the United States are born with congenital heart defects and sixty percent die before one year old. So, it is very important for them to get monitored all the time using an implantable sensor in patients. This research project focuses on improving the efficiency of a heart blood pressure sensor by proposing a new design of an implantable blood pressure sensor system which allows the pressure data to be transmitted wirelessly by inductive coupling between the sensor circuit and measurement device. The proposed sensor is battery-free and bio-implantable. The Sensor was simulated using COMSOL simulation software.

DEEP AND SMOOTH REACTIVE ION ETCHING OF SINGLE CRYSTAL DIAMONDS WITH INDUCTIVELY COUPLED PLASMA

Presenter(s): Darrell Harry *
Electrical & Computer Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1203
Mentor(s): Shannon Nicley

Single Crystal Diamond (SCD) is a material with high transparency and the ability to host a wide range of technologically interesting color centers. These properties make it a very attractive functional material in the field of nanophotonics, especially for quantum computing

and optical quantum memory applications. However, diamonds hardness and chemical inertness makes it difficult to process thin films and etch features necessary for this type of application. Fortunately, Reactive Ion Etching (RIE) with Inductively Coupled Plasma (ICP) has proven great success in this area. Therefore, we have decided to attempt the deep and smooth etching of SCD substrates with a shadow-masking process using this method, with the aim of achieving minimal surface roughness. To implement these experiments, various gas mixtures like O2, O2/Ar and O2/CHF3 at fixed flow rates will be utilized in producing the chemically reactive plasma necessary for etching the diamond substrates. ICP RF power, bias power and gas chamber pressure will be kept constant as well. AFM and profilometry will be utilized to determine the surface morphology of these substrates after etching, and their etching rates will be calculated. It is expected that the O2/CHF3 gas plasma will produce the fastest etching rate and lowest surface roughness because of the presence of H ions that aid in rapid diamond etching.

A SIMULATION ENVIRONMENT FOR HUMAN-ROBOT COLLABORATIVE SEARCH AND RESCUE

Presenter(s): Pratik Joshi
Electrical & Computer Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1204
Mentor(s): Ankur Ankur, Vaibhav Srivastava

Search and Rescue (SaR) missions involve operations in dangerous, uncertain, and complex environments. A significant effort has focused on the development of autonomous technology for SaR missions; however, the complexity of these missions and the huge cost of mission failure, in terms of failing to rescue a victim, warrants a human-robot collaboration approach to these problems. In such an approach, the human supervises the robotic operations by monitoring sensory data collected by robots, teleoperating robots, designing paths to be followed by the robots, etc., while the robot performs the low-level tasks of autonomously executing these high-level commands from the human partner. Towards systematic study and design of such SaR mission, the goal of this project is to create a robust SaR simulation environment. We build a three-dimensional (3D) SaR environment using the Gazebo simulator that renders realistic 3D SaR environments, allows to take human inputs, and is capable to implementing low-level autonomy. The demonstration of the simulator will illustrate its ability to take human input and will showcase an autonomous victim search algorithm.

A HYBRID STABILIZATION AND REGISTRATION ALGORITHM FOR STRUCTURED LIGHT SENSORS BASED ON INERTIAL MEASUREMENT DATA AND 3D FEATURES

Presenter(s): Adithya Rao
Electrical & Computer Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1205
Mentor(s): Yiming Deng

Pipelines play an important role in the gathering, transmission and distribution of oil and natural gas in the United States. The aging of these high-pressurized pipelines combined with external factors like excavation and soil movement lead to premature failure from material, structural and system levels. A paradigm shift from time-based periodic inspection to data-driven condition-based inspection is necessary and integral to finding damage precursors and preventing the high cost of human and economic losses associated with pipeline failure. In this poster, we are presenting a hybrid stabilization and registration algorithm for a structured light based sensor that can generate high-solution and high-sensitivity data for robust 3D reconstruction of these pipelines. The sensor will be mounted on a robotic platform which complicates the registration process due to factors like vibration and wheel slippage.

The proposed algorithm is intended to resolve this problem by incorporating inertial measurement data to estimate the position of the sensor inside the pipe and then perform an iterative cloud point algorithm on the 3D features to provide a very precise reconstruction. Ultimately, this poster is presenting an optimized approach to 3D registration by implementing a hybrid algorithm incorporating inertial measurements and feature based registration.

DESIGN AND IMPLEMENTATION OF AN AUTONOMOUS WHEELCHAIR SYSTEM

Presenter(s): Daniel McDermott
Electrical & Computer Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1206
Mentor(s): Subir Biswas

Manual operation of a wheelchair is impossible for some disabled individuals. Their mobility is dependent upon assistance from another person. An autonomous wheelchair, which operates without any user input, can give these disabled individuals more independent mobility. This poster presents the experimental design and deployment of an autonomous wheelchair. We define wheelchair autonomy as having complete self-navigation capabilities, which can be broken down into the following two components. One component is the ability to maneuver within an environment using the information of its current state. We address this component by designing a navigation algorithm which integrates a real-time localization system and Kalman filtering. The second component to wheelchair self-navigation is the ability to detect and safely avoid obstacles in the environment. We address the detection problem by equipping the wheelchair with multiple ultrasonic sensors, which measure the distance to an object in front of them. To address the avoidance problem, we propose a reinforcement learning approach which provides the wheelchair a method for iteratively learning how to best avoid obstacles. We present experiments which evaluate the performance of the navigation algorithm and obstacle avoidance system, which show that our design can serve as a practical autonomous wheelchair implementation.

CONTINUAL ERROR CORRECTION IN DEAD-RECKONING NAVIGATION FOR UNDERWATER DRONES

Presenter(s): Edward Corlett *, Timothy Mayer *
Electrical & Computer Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1207
Mentor(s): Osamah Rawashdeh *

Hurricane modelling research requires oceanic measurements taken before and during hurricanes, and improving these models requires more widespread datapoints. The ultimate motivation of this project was the creation of an Autonomous Underwater Vehicle (AUV) in the National Oceanic and Atmospheric Administration's (NOAA) Ocean Observing Prize, a competition aimed at developing innovative oceanic monitoring platforms. Our research focused on creating the navigation system, while the electronics and body of the AUV were being designed by the other teams. The deep ocean environment prevents the use of the ocean floor as a reference for oceanic navigation due to the relatively shallow depth at which the AUV will operate. Instead, a dead reckoning approach was used to determine heading and distance between navigation waypoints based on an inertial navigation system (INS).The INS measured the drone's position based on the initial GPS coordinate obtained before submerging and measuring the acceleration of the drone over time. Inertial navigation systems, however, are vulnerable to error accumulation over time due to sensor noise. This error was accounted for with continuous correction by the drone resurfacing and reading its current GPS position. The navigation system presented here was developed for a Robot Operating System (ROS) control platform, enabling performance evaluation within the UUV

Simulator Gazebo package. Through the simulation of sensor inputs and ocean conditions, we developed and tested the error correction prior to the assembly of a prototype AUV. The structure of ROS also enabled algorithm verification with a car-like ground vehicle without significant modification.

DEVELOPMENT OF A NOVEL GRAVITATIONAL ROUTING PROTOCOL FOR COMMUNICATION NETWORKS

Presenter(s): Yida Yang
Electrical & Computer Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1211
Mentor(s): Subir Biswas

The objective of this project is to develop a novel Gravitational Routing Protocol for wireless networks with reduced overhead compared to the standard routing protocols. The standard routing protocols, such as source and destination routing, possess inherent drawbacks of high memory usage (maintaining a routing table) and high data packet overhead. The idea behind the concept of gravitational routing is that the trajectory of any object in space is controlled by the gravitational force it is experiencing along with the initial speed and angle of projection. By modeling a wireless network as a discrete gravitational space and the packet as an object in motion, the goal is to show that the packet can be routed to its destination simply by defining the initial speed and the angle. This will reduce the complexity in terms of memory usage and packet overhead in the traditional routing algorithms.

ROBUST DECISION MAKING FOR DATA-DRIVEN BASED AUTONOMOUS SYSTEMS

Presenter(s): Andrew DeBaker
Electrical & Computer Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1212
Mentor(s): Sandeep Banik, Shaunak Bopardikar

Current autonomous vehicles heavily rely on data from local and global sensors (infrastructure) to create Deep Neural Networks (DNNs), which enable the vehicle to perform a variety of tasks. A misclassification of any road sign can have severe consequences compromising the stability and safety of the vehicle and its occupants as well as the pedestrians on the road. In the current work, we create a DNN, namely, sense-DNN using (a) local data from a TurtleBot and (b) global data from an Optitrack Motion Capture System (OMCS) representing the infrastructure. We study the influence of malicious data on sense-DNN originating from either a local (TurtleBot) or global (OMCS) sensor and integrate sense-DNN with the existing work on attack-resilient path planning. The dynamic decision-making framework takes a step toward creating a principled approach to incorporate trust in combining different sources of data at different points in the trajectory.

EVALUATION OF SODIUM NANOPARTICLES FOR IMPLEMENTATION IN AUTOMOTIVE PHOTONIC SENSORS AND CIRCUITS

Presenter(s): Sylvia Lupa *, William Welch *
Electrical & Computer Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1213
Mentor(s): Ankun Yang *, Laila Guessous *

Modern processing technologies are coming up against major issues: the heat generated by microprocessors due to electrical resistances wastes energy and risks damaging delicate components; additionally, the speed of processing power is leveling out, failing to reach historical averages of doubling every 2 years. Nano-photonics, the manipulation and

modulation of light at nanometer scale, may provide a solution to these problems. Because nano-photonics is still a nascent field, suitable materials to permit reliable operation are still under research. Noble metals like silver and gold are commonly used, due to minimal light energy losses. However, their losses are still too large to be economically viable. Better solutions with minimized energy losses will vastly improve the usability of photonics in circuits, and sodium is an ideal material for this purpose. In fact, recent work in Nature shows sodium films have superior performances and stability in solid-state devices. This research study simulates sodium nanoparticles, another equally important model system as films, using the Finite-Difference Time-Domain (FDTD) method to determine their resonances and losses. This research aims to answer whether sodium possesses a material advantage over the current benchmark materials and whether sodium nanoparticles can serve as building blocks in photonic sensors and circuits for automotive applications.

INVESTIGATING THE USE OF AR FOR ASSISTING WITH END-USER DEVELOPMENT FOR SOCIAL ROBOT APPLICATIONS

Presenter(s): Joshua Wong *, Kelvin Hamilton *, Pourya Shahverdi *, Sean Dallas *
Electrical & Computer Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1215
Mentor(s): Wing-Yue Geoffrey Louie *

This research is seeking to better the ability of health care professionals to use socially assistive robots to assist people with autism spectrum disorder (ASD) to better read and understand verbal and non-verbal communication. The main goal is to find if remote assistance of a technician, by means of augmented reality, is a viable option to assist healthcare professionals in programming robots. This is in contrast with having a technician in-person assisting the healthcare professional. Robots, like SoftBank Robotics' Pepper and NAO, are being developed to deliver robot-mediated interventions to those with ASD to teach them human to human communication skills. However, programming robots can be a challenge for those with minimal robotics experience. It is a natural challenge for a human to instruct another human to complete a task with verbal instructions alone. Even if a healthcare professional is holding a camera for a remote technician to watch from, there are many problems that are likely to arise. To alleviate these issues, the use of augmented reality will be employed using the HoloLens so a healthcare professional can visually see how to choreograph a robot through a representative virtual hologram. The health care professional will equip the HoloLens and stream their viewpoint to the remote technician's computer, and the technician will control the hologram of the virtual robot that healthcare professional sees, while also giving instructions and answering questions as needed.

PARALLEL IMPLEMENTATIONS OF COMPUTER NEURAL NETWORKS

Presenter(s): Jacob Nelson *, Shrutee Rakshit *
Electrical & Computer Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1216
Mentor(s): Daniel Llamocca *

In the world of image analysis, object identification and processing time can be critical. A Convolutional Neural Network, or CNN, can be used to classify digital images through a series of mathematical calculations in successive layers. Inside a neural network, 80% of the computations occur in the Convolutional Layers, and 20% occur in the Fully Connected Network (FCN). Our aim is to expose the parallelism in the CNN workload using Intel's Threading Building Blocks (TBB) library. We investigate i) the optimal combination of TBB functions in order to speed up the CNN computations, and ii) the circumstances under which certain combination of TBB functions are better than others (e.g.: CNN architecture, input

size). We seek to implement these CNN parallel implementations. Verification will be carried out in both a normal PC and an embedded system (Intel Atom® development kit).

ENVIRONMENTAL SCIENCE & NATURAL RESOURCES

DEFINING THE EARTH'S GROUNDWATER MICROBIOME

Presenter(s): Jocelyn Brito *
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1301
Mentor(s): Matthew Schrenk

Microbiomes, or the aggregate of microorganisms in a specific environment, provide critical functions to varying ecosystems on the planet. As the planet changes rapidly due to human intervention and Earth's natural activities, we face environmental changes particularly in groundwater. Most of the groundwater used today is less than 50 years old, making it vulnerable to environmental changes. This young groundwater is located along the Earth's upper continental crust making it physically and chemically diverse. Describing the groundwater microbiome has not been systematically done. This raises the question of whether one or many groundwater microbiomes exist. Addressing this question will allow us to fill in the gaps in the information that already exists and incorporate these data into modeling efforts. My research project involved identifying and extraction key data out of existing groundwater microbiome publications and public databases. I then examined these data for evidence of key genetic markers in the different groundwater environments. One challenge that arose in our literature survey is that groundwater microbiome studies use different ways to collect and analyze the microbial communities. Another challenge is that many groundwater environments have not yet been studied, specifically as they change over time. After analyzing data, we have documented an emerging picture of multiple different groundwater microbiomes that exist in locations such as hard rock or areas with anthropogenic influence. This information can be used to better understand the genetic markers in the different microbiomes and use them to trace potential contamination and understand environmental changes.

LIVING ON THE "HAZARDS FENCELINE" IN MICHIGAN

Presenter(s): Jazmin Hernandez Perez *
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1302
Mentor(s): Julie Libarkin

This project seeks to understand which communities in Michigan are living in proximity to environmental hazards - and specifically, hazards enacted by superfund sites, resource extraction, and/or contaminated soil, water, or air. It will offer a current and past historical analysis of possible community engagement organizing efforts against these issues. To perform this analysis, I will utilize geographic spatial analysis tools and existing databases. This study will emphasize the severity of impact on local communities and will highlight current and past community engagement efforts. By conducting a spatial analysis of the proximity of environmental hazards to low-income, Black, Indigenous, and Latinx communities, this study will inform how environmental organizations and consultants approach resource extraction and site remediation.

TESTING NRF2 ACTIVATORS IN REVERSING TOXICITY FROM NITROGEN MUSTARD EXPOSURE IN MOUSE SKIN EPIDERMAL CELLS

Presenter(s): Fabiola Fuertes *
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1303
Mentor(s): Neera Tewari-Singh

Nitrogen Mustard [NM; bis(2-chloroethyl) methylamine (HN2)] was developed as a chemical warfare agent in the 1930s and 1940s, and stockpiled by several countries during World War II. This alkylating chemical vesicant causes skin and mucous membrane damage. NM (Mustragen) is also used as a chemotherapeutic agent, especially for the treatment of cutaneous T- cell lymphoma. At present, there are no effective therapies to treat skin injuries from NM exposure. The understanding of mechanisms of skin injury from NM is vital for the development of effective targeted therapies. Studies have shown that skin toxicity from NM exposure can cause macromolecular damage and activation of signaling pathways, mainly those related to DNA damage, oxidative stress, and inflammation. Therefore, targeting oxidative stress and inflammatory pathways can be fundamental to prevent epidermal injuries from this vesicant exposure. The nuclear factor erythroid 2- related (NRF2) is a pathway triggering cellular protective mechanisms against oxidative stress and inflammatory responses. Thus, activating NRF2 pathway can be an approach for the treatment of NM skin toxicity. For this project, we'll be using mouse epidermal skin (JB6) cells and skin tissue from C57BL/6 mice exposed to NM. Using Western Blotting and PCR analysis, we hope to identify NM toxicity biomarkers related to NRF2 pathway. Based on the positive outcomes from these studies, efficacy of the NRF2 pathway activators, can be further analyzed, for the treatment of NM-induced skin toxicity in the JB6 cells and in in vivo studies in mice.

IDENTIFYING SIGNALS OF SEPTIC CONTAMINATION IN GROUNDWATER MICROBIAL COMMUNITIES OF THE GRAND TRAVERSE BAY WATERSHED

Presenter(s): Maria Berry
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1304
Mentor(s): Matthew Schrenk

Microbial communities in groundwater adapt to their local physical and chemical environment. When this environment contains contaminants, it may be reflected in the genetic content of resident microbial communities. This project explores the utilization of environmental DNA to record the influence of septic fields and other potential contaminants in the Grand Traverse Bay watershed by linking microbiological, geochemical, and hydrological approaches. A total of 13 wells were sampled and analyzed for microbial cell counts, taxonomic diversity using the 16S rRNA gene, and genetic content using metagenomics. These data were explored for correlations with physical-chemical indicators of septic contamination (e.g. Br:Cl, Boron, xenobiotic compounds, antibiotic resistance genes, and human fecal microflora). Populations within the orders Betaproteobacteria and Chloroflexi were prevalent within the wells. Metagenomic data was used to construct metagenome assembled genomes from these clades that were then examined for the presence of functional and physiological adaptations to septic contamination. These included comparison to databases of antibiotic resistance genes, and searches for metabolic pathways involved in biogeochemical cycling and organic matter degradation. Knowledge about the composition of groundwater microbial communities, their relationship to potential contaminants and to hydrology is critical to the potential use of eDNA as an environmental tracer. In Michigan, there are approximately 1.3 million septic systems, and at least 10 percent of those systems are failing. Developing a unique "fingerprint" for septic contamination can

inform mitigation and management strategies that can protect important water resources in the state, including the Grand Traverse Bay Watershed.

IMPROVING CURRENT ENVIRONMENTAL DISTURBANCE DETECTION MODELS WITH REGION-GROWING CLUSTERING

Presenter(s): Chakata Hart
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1305
Mentor(s): Jasper Van doninck, Phoebe Zarnetske

To quantify how disturbances are affecting biodiversity and ecosystem functions across space and time, it is critical to accurately detect disturbances in different land cover types and across ecoregions. Many methods to detect disturbances with remotely sensed imagery exist, yet these methods have varying success across land cover and disturbance types. Furthermore, most of these are based on temporal segmentation of individual pixel time series, thereby ignoring the potentially valuable information provided by spatial context. Our technique uses a region-growing clustering method to group pixels based on their metrics, and additionally, it accounts for spatial relationships between adjacent and nonadjacent pixels from different bands of time series images. We developed an approach that first groups adjacent pixels from Landsat time series images, 1984-2019, with a "similar" temporal trajectory into homogeneous, contiguous clusters. Similarity between pixels can be expressed by several metrics (e.g., correlation, Euclidean distance), so we investigated the influence of using different similarity metrics on clustering results. We then applied a disturbance detection and attribution on these clusters, using the spatial information to improve detection and attribution accuracies compared to pixel-based analysis. We validated our methodology through the US National Ecological Observatory Network (NEON) and over bamboo-dominated forests in Southwestern Amazonia, with varying land use types and disturbance regimes. This clustering technique improves the accuracy of detecting and attributing disturbances, ultimately providing more robust information on where disturbances are taking place and how they are changing over time.

MSU WOODLOT SURVEYS

Presenter(s): Matt Pena, Rachel Ray
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1306
Mentor(s): David Rothstein

We performed fixed-area plot surveys across various woodlots and natural areas on campus while analyzing the overstory, sapling, and seedling layers. Collecting this information will help us analyze both how diverse our forests are currently, and to predict how diverse these woodlots will be in the future. Doing so will help us manage our forests to be more biodiverse which will increase the overall well-being of the forest.

ASSESSING FOOD SECURITY OF AGRO-PASTORALISTS IN ETHIOPIA

Presenter(s): Sarah Slinkman
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1307
Mentor(s): Jennifer Hodbod

The construction of the Gibe III hydro-electric dam and associated environmental changes have disrupted food systems in Ethiopia's Lower Omo, including the potential for flood-recession agriculture and the corresponding balance of livelihoods and food security in the

region. To address food insecurity, households employ different coping strategies. Surveys such as the Household Food Insecurity Access Scale and the Coping Strategies Index can assess food security via the frequency and severity of the coping strategies used. However, these surveys are often inadequate for agropastoralist contexts and lack severity weightings for individual strategies, potentially giving an inaccurate representation of food security. This study developed the Coping Strategy Index-Agro-Pastoralist (CSI-AP), with coping strategies first articulated by communities in Nyangatom, Ethiopia during focus groups, followed by being implemented into a survey. The results were analysed with both a severity and frequency weighting. Across the three villages that were studied, food security was a major concern - 65.8% of households reported low food security and 24.1%, very low food security. Different strategies were utilized by different villages based on their traditional livelihood options, but included frequent use of the most severe strategies - adults and children skipping meals. Children eating less does not tend to be accounted for in other surveys and indicates how high the food insecurity in the region is, as households prioritize feeding children and workers first. Overall, this work can help inform measuring food security in agro-pastoralist contexts and provide information for understanding future adaptive capacity in the region.

AMAZONIAN DEFORESTATION AND LAND USE TRANSITIONS WITHIN CONSERVATION UNITS AND INDIGENOUS RESERVES

Presenter(s): Emmanuel Salas *
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1308
Mentor(s): Nathan Moore

Deforestation for land development throughout the Amazon has threatened the stability of our climate and biosphere. Although the Brazilian government sanctioned Conservation Units and Indigenous Reserves in part to protect forest cover, localized deforestation within these areas continues to spread. Because deforestation and land development continues to expand within protected areas (PAs), the mechanisms behind deforestation hotspots within PAs need to be addressed. By identifying these mechanisms and comparing the deforestation rates between land uses, further action for protecting the Amazon can focus on the leading causes and vulnerabilities of deforestation. This research organizes the causes of illegal land development within the most vulnerable PAs. Illegal land grabbing, whether it be for cattle farming, logging, or agriculture, is the leading cause of land change within PAs of the Xingu Basin, the area most affected by immediate and widespread deforestation. Through examining the most recent GIS data provided by INPE, non-profit NGOs, and research organizations, this geospatial analysis estimates patterns of deforestation and land use change in PAs over the last decade. Further analysis of this data can locate hot-spots in which deforestation is high, and where potential wildfires are more likely to occur. While remote sensing data was used in this project, higher resolution imagery (drones, LEOs etc) in identified hotspots would provide more accurate information. Nevertheless, working with the public data available provided clear trends in deforestation and causes. In addition to these findings, previous studies also reinforced the hypothesized leading causes of past deforestation. Recent policy changes under

INTEGRATING CHEMICAL OCEANOGRAPHIC DATA ON TO SCIENCE ON A SPHERE TO EXPAND OCEANOGRAPHIC OUTREACH

Presenter(s): Corina Osorio *
Environmental Science & Natural Resources, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1309
Mentor(s): Dalton Hardisty

Science on a Sphere is a widely available and popular platform developed by NOAA researchers for outreach/teaching of the earth sciences and oceanography to people of all ages around the world. Images of atmospheric storms, ocean temperature, along with climate change are displayed on a six foot diameter sphere and used to help visually explain complex environmental processes. There are currently about 72 modules displaying Earth system processes, however the SOS contains few chemical oceanographic data (e.g. O2, nutrients) despite their widespread availability from platforms such as the World Ocean Atlas. Our research aims to create and add geochemical datasets/modules to the SOS that can complement pre-existing oceanographic modules on the SOS such as El Nino, temperature, salinity, and chlorophyll. Specifically, we plan to add the abundance of oxygen and nutrient concentrations (N, P, Si) at the sea surface and at different depths through the creation of a textured dataset/map and imported on to the SOS. This will provide a path forward for the integration of more chemical oceanographic data which can be used in tandem with existing physical and biological SOS modules, and better portray and teach mechanisms and processes driving large scale biogeochemical gradients.

HEALTH SCIENCES

THE IMPACT OF COVID-19: A QUALITATIVE PERSPECTIVE

Presenter(s): Alicia Fraser *
Health Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1401
Mentor(s): Linda Keilman

COVID-19 has immensely impacted society, it was declared a public health emergency by WHO in January 2020. It affected the way people think, socialize, and behave. This research focuses on the psychosocial and spiritual impact of COVID-19 on African American adults living in Brooklyn, New York; a state that was affected significantly by the pandemic. As a minority group, African Americans were systematically impacted by COVID-19, in a psychosocial aspect, considering social determinants of health such as socioeconomic status, biological factors, behavioral factors and psychosocial factors. This research is pertinent to understand the psychosocial and spiritual impact on African Americans during COVID-19 to provide a more holistic approach to care and create a basis for further evidence-based research in developing new ways to support the psychosocial and spiritual aspect of people's lives; especially, in times of distress. To conduct this project, a convenient sample of 25-35 individuals will be recruited via word-of-mouth to participate in a semi-structured interview regarding participants' life experience since the onset of COVID-19. Interviews will be conducted with one participant at a time. The participants will be asked to complete a demographic questionnaire and the Moral Distress Thermometer in relation to the events they describe. Interviews will be analyzed using qualitative data analysis techniques and themes will be found. All data will be de-identified regarding participants and individuals they describe. It is expected that the changes brought about by COVID-19 were morally distressing, causing people to develop feelings and behaviors that were unique to their experience.

ARTIFICIAL INTELLIGENCE PREDICTIONS IN MAGNETIC PARTICLE IMAGING IN MICE MODELS

Presenter(s): Viry Leon *
Health Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1402
Mentor(s): Ping Wang

Type 1 diabetes (T1D) is an autoimmune disease where pancreatic beta cells halt the production and distribution of insulin. Although no cure has been found, experimental therapies such as pancreatic islet transplantation are on the rise and hope to deliver lasting results. A limitation of pancreatic islet transplantation is the inability for MRI to clearly distinguish the number of viable islets in the pancreas post transplantation due to the lack of sensitivity which may lead to a potential bias of a radiologist when presented with an image. A way to combat this is to use a PET, which has greater quantification values, to account for the radioactivity in the islets post-transplantation. The sensitivity would then be enhanced, and artificial intelligence would be able to account for signal decay in the injected pancreatic islets. The hypothesis being, can deep learning reliably predict the radioactivity in a PET image as compared to a dose calibrator using pancreatic islets? In order to present a functional standardized method for counting the radioactive islets, we must first use in-vitro methods to prove functionality of the method. Phantom mice were evaluated using a dose calibrator before and after they were implanted with pancreatic beta cells under the left kidney area. The phantoms were then observed using PET. An image was then analyzed with the algorithm. A region of interest (ROI) was selected through unsupervised machine learning. The data was then able to be quantified using CNN.

MORAL DISTRESS IN NURSES: A QUALITATIVE STUDY OF NURSES CARING FOR PATIENTS WHO FOREGO CARE DUE TO COST

Presenter(s): Amarilis Santiago *
Health Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1403
Mentor(s): Linda Keilman

Healthcare in the United States (US) is costly, creating financial burden for some patients. High out-of-pocket costs may adversely impact care and influence individuals to forego needed treatment for a variety of health conditions. In the US, nursing practice is guided by the American Nurses Association Code of Ethics that states healthcare is provided based on need, without prejudice toward a patient's individual characteristics including financial burdens and whether or not they accept the prescribed treatment plan. Therefore, nurses caring for patients foregoing treatment due to financial constraints may experience moral distress (MD). MD encompasses morally challenging situations/events and the emotional feelings arising from the experience of psychological distress often caused by constraints that prevent one from doing what is right (moral). MD has been linked to negative consequences including burnout, job turnover, depression, emotional problems, poor sleep, and substance abuse. The development of this pilot research was created to test if nurses experience MD because their patients forego care due to factors such as the inability to pay. As part of the study, the team is going to employ a qualitative method that will focus on open-ended interviews with nurses. Approximately 20 nurses will be interviewed; interviews will be recorded and transcribed. Nurses will also be asked to fill out a Moral Distress Thermometer to describe their stress levels when feeling morally distressed. This data will allow the team to look for key analytical themes. In all, the team hopes the results can be used to expand the research on the experiences of MD that nurses may undergo in the care of patients. Additionally, the team hopes to create effective practice policies related to advocacy for nurses and patients receiving care.

RESEARCH ANALYSIS AND METHOD DEVELOPMENT FOR WASTEWATER SURVEILLANCE MODELS FOR SARS-COV-2

Presenter(s): Adam Harris
Health Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1404
Mentor(s): Jade Mitchell, Ryan Julien

Wastewater based epidemiology (WBE) in the vein of identifying and modeling the trends of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in a given population is a promising, yet experimental, topic of interest. That interest stems from monitoring COVID-19 cases in a non-invasive way, while being more representative of a larger population. This new research and data could possibly provide useful information towards understanding public health implications. Categories were made to properly interpret that research and data across differing procedures and the groups performing them. Some of the more important categories include the sampling locations (wwtp, catchment, building), model and method type (linear regression, RT-qPCR), and gene target (N1, N2, E). The deliverable is to take elements from the different methods/models and produce one conducive model to better relate the route of fecal viral shedding to a defined area with consistency. Overall presenting a modeling process from the building level with the critical components and parameters established. Several models have been presented in the peer-review literature, though methods differ in complexity and evaluation of the models; sensitivity of parameters to temporal and spatial scales, and appropriateness to the data collected. This exploration of the current state of science, results of model implementation, and research data implications on public health will provide new insight on this rapidly developing topic.

MINIMIZING CONCURRENT TRAINING INTERFERENCE WHEN DESIGNING STRENGTH AND CONDITIONING PROGRAMS FOR ELITE ATHLETES

Presenter(s): Brittany Maldonado *
Health Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1405
Mentor(s): Roop Jayaraman *

This research aims to examine the interference between concurrent resistance and endurance training in elite athletes. More specifically, the adaptations, limitations, and variables. A systematic review was conducted to understand better skeletal muscle molecular biology and the role of different training variables that may play a role in the attenuated response in muscle mass, strength, and power when incorporating both resistance and endurance training in a periodized program. A review of the strength and conditioning and the exercise physiology literature established the science-based recommendations and overall health benefits of physical activity for the general population. We found limited studies focusing on recommendations and guidance for concurrent training for an elite population. Our purpose is to use our systematic review to develop a science-based strength and conditioning program for elite athletes participating in concurrent training programs. Our strength and conditioning program will be designed based on a progressive overload model of concurrent training that will minimize the interference effect and maximize the benefits of concurrent training in elite athletes.

PILOTING A NOVEL STRATEGY TO ASSESS GLUTEN FREE LABELING

Presenter(s): Diallo Patterson *
Health Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1406
Mentor(s): Alyssa Harben

Gluten-free labeling provides consumers with a standardized label for managing their dietary needs, especially celiac disease, or any autoimmune reaction from eating gluten. Therefore, we are investigating the effects of label design variations on the usability of gluten warning labels. Specific design treatments include the presence or absence of a Front of Package Label, presence, or absence of a graphic icon with the warning, and whether or not the warning is framed positively ("gluten-free") versus negatively ("warning contains gluten"). The purpose of the study is twofold, first to pilot test a new methodology for studying food labels and investigate if there are differences between different styles of food labels and if a new method for collecting this type of data is feasible for future work. Participants will be asked to do an online experiment about gluten-free labels, during which they will be shown a series of labels and asked if the product contains gluten. We hypothesize that placement on the front of the package and the inclusion of an icon will increase accuracy. There will be 30 trials in the study where participants (adults 18+) are shown one version of the label design at a time and asked, "Does this product contain Gluten?" Participants will remotely complete the experiment using the Qualtrics platform, which will record the responses and the time to respond. In addition to the 30 trials, demographic questions about age, race & ethnicity, education level, and whether or not they eat a gluten-free diet will be included. We hypothesize that placement on the front of the package and the inclusion of an icon will increase accuracy.

ACOUSTIC TWEEZING CYTOMETRY HOLDS PROMISE FOR TYPE 1 DIABETES

Presenter(s): Kambrial Love *
Health Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1411
Mentor(s): Ping Wang

Directed differentiation of stem cells into insulin-producing β and β-like cells hold great promise for cell replacement therapy for type 1 diabetes patients. Despite advances in the differentiation of insulin-producing cells from stem cells, the generation of islet organoids in vitro has remained elusive. In this study, we use a novel method called Acoustic Tweezing Cytometry (ATC) to force human-induced pluripotent stem cells (hiPSCs) via integrin-bound MBs for enhancing the stem cell differentiation of islet organoids differentiation. In ATC, RGD-peptide-functionalized lipid microbubbles (MBs) are first attached to live cells via RGD-integrin binding. Ultrasound (US) pulses are then applied to generate volume pulsation and translational movement of the integrin anchored MBs, thereby exerting external forces to the cells at the location of MB attachment. ATC application generated increased contractile force, enhanced calcium activity, as well as decreased expression of pluripotency transcription factors Oct4 and Nanog, leading to rapid initiation of stem cell differentiation and characteristic epithelial-mesenchymal transition (EMT). We used ATC to apply targeted cyclic subcellular forces to hiPSCs via integrin-bound microbubbles (MBs) for enhancing the islet organoids differentiation from hiPSCs. We conducted qPCR immunofluorescence, and western blot to detect and compare the stem cell marker and beta cell marker of ATC treated group and nontreatment group. To analyze the function of the β-cells, we used glucose-stimulated secretion and dynamic insulin secretion. With the capability of applying controlled dynamic mechanical stimuli to stem cells, ATC enhances the differentiation of islet organoids by the mechanoregulation of stem cell behaviors.

VITAMIN D AS A CO-FACTOR FOR NEURODEVELOPMENT AND COGNITIVE FUNCTION

Presenter(s): Michael Kaven
Health Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1412
Mentor(s): Ilce Medina Meza

"Vitamin D" refers to a group of closely related secosteroid metabolites- calcidiol, ercalcidiol, and others- with demonstrated roles in bone and immune health in humans. These molecules are hypothesized to contribute to human neurology and cognition. Within this class, types D_2 and D_3 pose significant structural similarities yet differing sources. While D3 results from the photosynthesis of 7-dehydrocholesterol in mammalian skin under UV-B radiation (sunlight), D2 is acquired from dietary sources like mushrooms, fatty fishes and red meats, and egg yolks- all foods known for cholesterol content- by irradiation of plant ergosterol. Nutritionally, Vitamin D deficiency has already been associated with major health outcomes including renal failure, rickets, and dysregulated bone mineralization. This study aimed to review the current status of chromatography and mass spectrometry (LC-MS/MS) techniques for quantification of Vitamin D and offer insight on bioavailability of the most active isoforms of Vitamin D: 1α,25-dihydroxyvitamins D_2 and D_3. For example, the mechanisms of absorption in mammalian cells for each of these isoforms were reviewed as bioavailability factors. The aim was most directly attained by critically reviewing peer findings for a multitude of cytochrome P450 proteins- intracellular (and intranuclear) receptors, transport enzymes, and other globulins of relevance to Vitamin D metabolism. A long-term goal of this project is to implement on-site quantification of D isoforms in human plasma samples and identify associations between calcitriol (1α,25-(OH)2D3) deficiency and neurological wellness, defined by the presence (or absence) of diagnosed cognitive, developmental, and degenerative disorders.

TECHNOLOGY BASED YOGA AND STRESS REDUCTION IN NURSING STUDENTS

Presenter(s): Rachel Kamp *
Health Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1413
Mentor(s): Maria Roche-Dean *

This study aims to identify if a technology-based yoga program is an effective stress reduction technique for nursing students attending school during the COVID-19 pandemic. Nursing students experience high levels of stress due to the academic and clinical demands of nursing school. The ongoing pandemic has potentially exacerbated this stress by taking essential, hands-on experience away from the students. Throughout nursing school, students learn about the importance of teaching their patients about health promotion so that they can achieve their highest-level of well-being, but often neglect implementing health promoting activities into their own lives. Before nurses can take care of their patients, they need to be able to take care of themselves, and that begins in nursing school. Yoga is a health-promoting activity demonstrated to be effective in reducing stress in nurses and college students; this intervention could have the same effect in nursing students. The pandemic makes it difficult to attend in-person yoga classes, so the effectiveness of a technology-based yoga program should be examined. A systematic literature review was conducted to obtain information about nursing students stress levels, stressors, and stress reduction techniques. This study will assess participants perceived stress levels before and after a 6-week technology-based yoga intervention. The data showing how often participants accessed and participated in yoga over the 6-week period will be collected anonymously. The anticipated outcome of this study is a significant reduction in the perceived stress levels of nursing students attending school during a pandemic.

THE IMPACT OF COVID-19 ON THE LIVED EXPERIENCE OF THE HISPANIC/LATINX POPULATION IN THE COUNTY OF YAKIMA IN WASHINGTON STATE

Presenter(s): Elisa Mariscal *
Health Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1414
Mentor(s): Linda Keilman

The COVID-19 pandemic affected the health and lives of millions of individuals. It also affected every aspect of individuals' day-to-day life. Whether the pandemic had a positive or negative impact, it vastly affected access to healthcare, social institutions, mental health, global economy, and spirituality. However, there were several populations that suffered more throughout the pandemic because of social determinants of health and health inequities. This study will focus on the lived experiences of Hispanic/Latinx individuals 18 years and older living and/or working in the Yakima County in Washington during the pandemic. Data will be obtained with a demographic survey, a moral distress thermometer to assess the level of distress related to the pandemic, and a semi-structured interview that will consist of five open-ended questions. These five questions will consist of the participants recounting their experience living and/or working in the Yakima County; describing a situation that was difficult for them to deal with related to the pandemic; if they or anyone they knew were diagnosed with COVID-19; if they answer yes, they will be prompted to describe their experience; if they answer no, they will be asked to describe how they felt about COVID-19 overall; and how it has impacted them. We will gather a sample of 25 participants via word-of-mouth. We anticipate that participants will indicate that COVID-19 negatively affected many aspects of their lives and interrupted their daily practices. We hope to bring forth the lived experiences of this population and bring awareness, recognition, and advocacy towards the holistic needs of this community.

META-ANALYSIS OF VIRAL LOAD SHEDDING IN SARS-COV-2 PATIENTS WITH VARYING SEVERITIES

Presenter(s): Gwyneth Dunbar
Health Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1415
Mentor(s): Jade Mitchell, Ryan Julien

Since late 2019, COVID-19 quickly spread throughout the globe; now in June 2021, 33.3 million people in the United States have been infected with SARS-CoV-2, leaving almost 600,000 Americans dead. To better understand how to decrease microbial risk, it is essential to gain knowledge on viral loads—the amount of virus in a person's given sample—and how it can be used in exposure and surveillance. In October 2020, an initial literature search was conducted that helped yield 83 articles spanning from January 1st, 2020, to December 20th, 2020, on SARS-CoV-2 viral loads across 8 different sample types: nasopharyngeal, throat, fecal, saliva, sputum, urine, blood, and ocular. Out of those reviewed articles, 30 of them included severity or symptoms of patients. If the paper did not separate patients by severity category, they were grouped by symptoms. Three t-tests were conducted to compare the categories to test for statistical differences. In both genome copies and cycle threshold (Ct) values, the mild-severe and the mild-moderate comparisons were inferred to be statistically significant based on alpha = 0.05. The moderate-severe comparison was statistically significant for Ct values but not for genome copies. An analysis on SARS-CoV-2 viral loads over time based on symptoms will also be completed. The p-values from the t-test and plots to show the relationships between severity groups will be reported. Future work includes looking into modelling the viral load differences between these categories with respect to exposure assessment.

SARS-COV-2 VIRAL LOADS OVER TIME AND ACROSS SAMPLE MATRICES

Presenter(s): Kaitlyn Hutchins
Health Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1416
Mentor(s): Jade Mitchell

SARS-CoV-2 has proven it will continue to cause illness and death, warranting further research and preparation. Thousands of papers are being published by the month on SARS-CoV-2 research with a significant lack of standardization. A particular interest within microbial risk assessment is the viral load of SARS-CoV-2 a patient has, i.e. the amount of virus present in a patient's body. A variety of sample matrices are approved for measuring viral loads, and yet these matrices generate different results due to varying shedding rates across the body and over the course of disease. There is also an issue with how these values are reported, since cycle threshold (ct) values cannot be assumed to directly indicate viral load. This meta-analysis was conducted of SARS-CoV-2 research containing viral loads to study how viral loads progress over time while taking into account the sample matrix. The systematic review of the literature was conducted for papers published from 2019 to October 2020. Out of over 100 studies reviewed, 32 studies fit the criteria for data analysis. This analysis is vital not just for assessing if a person is positive or negative, but also for exposure assessment and surveillance measures. An evaluation of trends for viral load measurements over time according to 8 manually combined categories of sample matrices- nasopharyngeal, throat, fecal, saliva, sputum, urine, blood, and ocular- will be presented with statistical analyses. Future work will evaluate the futility of this data to inform quantitative microbial risk assessment.

IMPACT OF THE DOUBLE BURDEN OF MALNUTRITION ON HUMAN MILK MICRONUTRIENT LEVELS AND INFANT DEVELOPMENT

Presenter(s): Amulya Vankayalapati
Health Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 1421
Mentor(s): Masako Fujita

Mothers' milk serves a critical role in providing infants with the nutrients they need. If these nutrients are not provided in enough quantity, it can impact infant growth and development. This can occur when mothers are under nutritional stress. The limited, yet growing, literature suggests that maternal nutritional stress is increasingly complex and may encompass micronutrient deficiency co-occurring with obesity, referred to as the double burden of malnutrition. The purpose of this study was to review the existing literature on the nutrient content of mother's milk from those affected by the double burden of malnutrition. Accessing PubMed and Web of Science, we found studies that compared human milk nutrient content to maternal status of the same nutrient as well as studies that analyzed the effects of obesity on lactation. It was found that mothers who are obese can endure complications with lactation, including lower likelihood of initiating lactation and shorter breastfeeding periods. Additionally, different studies showed that low nutrient levels in the milk may not correlate with maternal nutrient deficiencies. Although both aspects of the double burden of malnutrition—obesity and nutrient deficiency—were addressed between these studies, very few evaluated how the combination of the two within individual mothers influences milk's nutritional value. Given the growing complexity of nutritional stress and the double burden of malnutrition among mothers, further research is needed to understand how it may impact human milk nutrient content, and alleviating maternal nutritional stress and improving their dietary quality should be a priority.

RELATIONSHIP BETWEEN PSYCHOLOGICAL WELL-BEING AND VIGOROUS-INTENSITY PHYSICAL ACTIVITY AMONG COLLEGE STUDENTS

Presenter(s): Chloe Catallo *
Health Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 1422
Mentor(s): Catherine Gammon *

Among college students poor mental health is common and is detrimental to academic success. Physical activity (PA) positively influences mental health; examining whether different intensities of PA are differentially associated with mental health would allow for optimal PA recommendations to support college students' mental health. The purpose of this study was to examine the relationship between psychological well-being and engagement in different amounts of vigorous-intensity PA (VPA) among college students. Study participants were 757 Eastern Michigan University students who completed the American College Health Association's National College Health Assessment during Fall 2019. Participants responded to questions assessing (i) weekly levels of moderate-intensity PA (MPA) and VPA, and (ii) mental health indicators (psychological well-being, resilience, distress, loneliness). A one-way analysis of variance was used to examine mental health scores among participants who (a) did not meet the national aerobic PA guidelines for adults (≥150 minutes of MPA or ≥75 minutes of VPA per week), (b) met PA guidelines and did <75 minutes of VPA per week, and (c) met PA guidelines and did ≥75 minutes of VPA per week (α=.05). Students who met PA guidelines had better mental health scores than students who did not ($p<.05$). Among students who met PA guidelines, those engaging in more VPA had higher resilience scores ($p<.05$) and lower psychological distress scores ($p<.05$) than students who met PA guidelines but engaged in less VPA. The findings support the promotion of PA, and in particular, higher-intensity PA, to support the mental health of college students.

DEVELOPING COMPUTER MODELS OF NEONATAL INJURIES RELATED TO THE BIRTH PROCESS

Presenter(s): Lily Craigmalich
Health Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 1423
Mentor(s): Michele Grimm

Birth-related brachial plexus injuries occur in 1/1000 births. Brachial plexus injuries occur when the nerves in the neck (brachial plexus nerves) are overstretched or torn during the birthing process. It is believed that these injuries occur by either clinician-applied forces or the maternal forces of labor. This specific birth-related injury can cause loss of movement or total paralysis of the infant's arm as a result of this nerve damage. Brachial plexus injuries can be long-term and severe; however, infants can also recover fully (90%) through normal healing processes or recover partially through surgery. Three-dimensional modeling can help understand how different aspects of labor and delivery affect the stretch in the brachial plexus and the risk of injury. Utilizing a combination of CAD and meshing software, combined with a multi-body model, the forces exerted on an infant during birth can be simulated and the model can be used to help understand the cause of birth-related brachial plexus injuries. This project focused on developing the uterine component of that model. Once the uterine component was developed it was placed into existing fetal and pelvic models to analyze the uterine forces during birth.

MAPPING KEY ETHICAL ISSUES SURROUNDING ELECTROCEUTICAL TREATMENTS FOR DEPRESSION

Presenter(s): Eleni Varelas, Marissa Cortright
Health Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 1424
Mentor(s): Aaron McCright, Eric Achtyes, Laura Cabrera Trujilo, Robyn Bluhm

Failure of first-line treatments for some patients with depression has mobilized scientific communities to look toward electroceuticals - interventions which employ electric and magnetic stimulation therapeutically. A growing body of literature investigates how to

improve clinical protocols for electroceuticals like electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), and deep brain stimulation (DBS) in depression. While this literature recognizes that electroceuticals raise significant ethical questions, little research has focused on the interrelations of ethical issues across these interventions. We are developing an analytic map to identify shared concerns, interrelations, and differences across interventions. Here we present examples of the analytic map we are developing based on our literature review. To illustrate the benefits of using this approach we present two key areas - informed consent and clinical guidelines. For example, patient capacity to consent is an overarching argument throughout the electroceutical literature, while patient selection criteria is a topic heavily discussed in clinical guidelines. This map will form part of a larger project that includes the creation of analytic maps from interview results and national survey results with three stakeholder groups. Using this information, we will create a final map that integrates different sources of information, and that accounts for multiple stakeholder's perspectives and views on different modalities. This map approach can help anticipate ethical issues that need consideration, strategize methods to address these issues, and provide rich and diverse information in a way that promotes meaningful engagement.

QUALITY IMPROVEMENT: SEPSIS EXEMPLAR

Presenter(s): Megan Kopicko *
Health Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 1425
Mentor(s): Moira Visovatti *

Quality improvement is the systemic process that leads to measurable improvement in health care services and the health status of a patient. Quality improvement assists in improving patient outcomes and implementing proactive processes that recognize and solve problems before they occur. The purpose of this project was to create a presentation that reviews the concept of quality improvement and use an exemplar of sepsis to provide a greater understanding of quality improvement. Sepsis is a life-threatening condition that can ultimately lead to death. Sepsis is the third most diagnosed case at Michigan Medicine. Early recognition and management of sepsis can prevent adverse clinical outcomes. Literature was reviewed and interviews conducted with the Michigan Medicine Sepsis Committee to gain insight into how they are screening for and preventing sepsis. The sepsis committee created screenings that need to be done upon admission and every shift as needed in order to detect any signs of sepsis. Data from screenings match a patient to a sepsis bundle and creates interventions to treat it. Using the correct sepsis bundle is crucial as it reduces risk for mortality for the patient. Introduction to sepsis screening began through the Surviving Sepsis Campaign in 2007. Quality improvement is significant in the medical world as it can save someone's life while implementing new processes that will ensure our systems of care are reliable and predictable. Nursing students need to understand the significance of quality improvement as it will prevent further harm to their patients while decreasing mortality rates.

INTEGRATIVE & ORGANISMAL BIOLOGY

DEVELOPING A FUNCTIONAL TRAIT REPOSITORY FOR HERBIVOROUS INSECTS THROUGH TEXT ANALYSIS

Presenter(s): Minali Bhatt
Integrative & Organismal Biology, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1501
Mentor(s): Dan Turner

Functional traits are defined as quantifiable characteristics of individual organisms that affect and respond to their surrounding environment. Functional trait analyses are important in the field of ecology because a diversity of characteristics, like diet breadth or dispersal ability, can affect ecological interactions. In this project, I employed novel methodology through text analysis to collect insect functional traits in existing literature. First, I coded an existing dataset containing natural history notes about insects into a form that could run through text mining. Second, I applied text mining analysis code to distill paragraphs into condensed, short phrases and numbers for analysis. Finally, I generalized the text mining analysis code to draw data from many bodies of literature that describe insect morphology and natural history. The tools for text analysis I used included the tidytext and stm R packages. From a repository of literature for nearly 1,000 herbivorous insect species of agricultural and ecological importance, I collected information on the following insect functional traits: body size, feeding mode, host plant specialization, and voltinism. With these techniques, I will contribute to the development of a database of insect functional traits that will help predict herbivore use of host plants, and advance knowledge on the subject of data mining for use in the field of functional ecology.

BACTEROIDES IS ASSOCIATED WITH ARCHETYPAL CONSTITUENTS OF THE WESTERN DIET AND DECREASED URINARY GLYCOCHOLATE IN PREGNANT WOMEN.

Presenter(s): Eliot Haddad
Integrative & Organismal Biology, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1502
Mentor(s): Jean Kerver, Sarah Comstock

The human organism is better classified as a holobiont due to its mutualistic associations with vast populations of microorganisms. Specifically, the gut microbiota is associated with numerous health outcomes and metabolic functions. Diet is a major influence on the gut microbiota, which in turn can produce microbially-derived metabolites that have downstream effects on host physiology. However, many of these interactions have yet to be sufficiently characterized for future mechanistic exploration. As such, our aim was to identify associations between urinary metabolites, dietary intake information, and fecal microbial samples to elucidate potential biomarkers and metabolic interactions in a sample of pregnant women. Of n=27 women enrolled in the Pregnancy Eating and Postpartum Diapers study, n=23 provided fecal samples, n=26 provided urine samples, and n=18 completed 24-hour dietary recalls at 36 weeks gestation. A resulting pool of 342 taxa, 100 dietary constituents, and 277 urinary metabolites were statistically analyzed in R. Bacteroides was negatively correlated with urinary glycocholate, a bile salt used to facilitate the absorption of fats. Bacteroides also explained most of the variation in beta diversity between participants and was therefore deemed a taxon of interest. Participants exhibiting Bacteroides dominance consumed more total fats, sodium, and protein, which are archetypal constituents of the Western pattern diet. These results suggest that Bacteroides may be associated with unhealthy dietary choices and decreased urinary excretion of glycocholate, which has implications for future studies examining links between the gut microbiota, diet, and overall health.

WILDLIFE RESEARCH METHODS USED TO PROTECT THE PLACENCIA LAGOON

Presenter(s): Ness Benjamin
Integrative & Organismal Biology, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1503
Mentor(s): Marisa Tellez *

Wildlife conservation is a major component of the Crocodile Research Coalition (CRC) where the promotion of the conservation of crocodiles, their habitat, and adjacent wildlife is conducted. Although the species highlighted by the CRC are crocodilians, the whole

ecological system of crocodiles is recognized. The region being taken into consideration by the CRC is the Placencia Lagoon: a 17 km long narrow lagoon located in Southern Belize. The CRC is leading to protect this territory because there are many critically endangered species utilizing the lagoon as a home, breeding hotspot, and feeding ground. The research will be conducted through a variety of techniques including camera traps, drone surveys, and population surveys of wildlife. These techniques being used are critically important as they will aid in our understanding of the ecology of the wildlife utilizing the lagoon. Through this, we will discuss how this research being done helps support the CRC's long-term goal of gaining government protection for the Placencia Lagoon as a wildlife sanctuary.

LIVE FAST DIE YOUNG: A TEST OF THE PACE-OF-LIFE SYNDROME SYPOTHESIS ON GROWTH ALLOCATION IN AFRICAN TARANTULA

Presenter(s): Peter Landor *
Integrative & Organismal Biology, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1504
Mentor(s): Cara Shillington *

Pace-of-life syndrome (POLS) proposes a correlation among life history, behavior, and physiology in animals. POLS predicts that fast-paced species have higher growth rates (GRs) and metabolic rates (MRs) than slow-paced species. Fast-paced species also have shorter lifespans. We investigated POLS in two tarantula species, comparing GRs and MRs while varying food availability. We hypothesized that the fast-paced species with high food availability have higher GRs and MRs than slow-paced species. We also predicted that fast-paced species would be more impacted by food limitation due to differences in energy allocation over shorter lifespans. Results are discussed in the context of the POLS.

KINESIOLOGY & NUTRITION

THE INFLUENCE OF EARLY LIFE MOTOR BEHAVIOR INTERVENTION AND PHYSICAL ACTIVITY GROWTH-RESTRICTED MICE

Presenter(s): Rood Pierre *
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1601
Mentor(s): David Ferguson

Early life growth restriction affects 15 million children each year. Importantly, growth-restricted mice and humans engage in less physical activity in adulthood. Engaging in less physical activity can increase the incidence of chronic disease in adulthood. Previous literature indicated that growth-restricted mice do not respond to a physical activity intervention in adulthood, thereby to counteract the deleterious effects of growth-restriction on physical activity interventions must be deployed in early life. The aim of the study was to determine the influence of an early life motor behavior intervention on physical activity engagement. We hypothesize that growth-restricted mice engaging in an early life intervention to promote motor skill acquisition will stimulate physical activity engagement in adulthood as measured by running wheels. Using a cross-fostering, protein restricted nutritive model, mice were growth restricted during either gestation or postnatal life. From days PN10 to 21 mice were placed on the motor intervention for 30 minutes per day. At 45 d of age, mice were individually housed in cages with free moving running wheels to assess physical activity engagement. Understanding the influence of an early life motor behavior intervention on physical activity engagement in growth restricted mice could make clear its ability to

develop neuromuscular connection in early life growth-restricted mice which improves physical activity engagement.

THE INFLUENCE OF POSTNATAL GROWTH-RESTRICTION ON HEART MORPHOLOGY

Presenter(s): Christina Rouhotas *
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1602
Mentor(s): David Ferguson

Growth restriction caused by undernutrition following birth is associated with a variety of chronic diseases, with cardiovascular disease being the most common. Cardiovascular disease includes a variety of pathologies, but in growth-restricted mice, it has been observed that the heart displays functional signs of fibrosis and eventual heart failure. In order to develop therapeutic countermeasures to reduce the incidence of mortality from cardiovascular disease it is necessary to evaluate the heart of growth-restricted mice for structural (size of the left ventricle), functional (metabolic profile), and fibrotic characteristics. To accomplish our objective, a cross-fostering model was used where the pups born from control mice dams were nursed on control dams (20% protein) or dams on a low protein diet (8% protein) from birth to postnatal day (PN21). Following PN21, all pups were fed the control diet till adulthood. At PN70 mice were euthanized and the hearts paraffin-embedded for histological analysis. The hearts were stained with Hematoxylin and Eosin (H&E) to determine the size of the right and left ventricle, Trichrome to determine the presence of cardiac fibrosis, and Periodic-Acid Schiff (PAS) to quantify the amount of glycogen in the heart cells. With this technique, we hope to understand the development and structural changes the heart undergoes following a growth restriction diet.

EFFECT OF COOKING METHODS ON THE LIPID PROFILES OF HOME-COOKED MEATS

Presenter(s): Ashley Xu
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1603
Mentor(s): Ilce Medina Meza

Bringing a home-cooked meal to school, work, or even on a leisure trip to avoid a higher consumption of fast foods and other commercially pre-prepared meals has become a common practice among US citizens. However, changes in temperatures and the use of other ingredients have been related to fat content changes in foods which alters the overall nutritional value of these meals. Trans-fatty acids and other saturated fatty acids formed from the oxidation triggered by different cooking parameters are related to cardiovascular diseases, diabetes, obesity, and other chronic conditions. In this study, 2 home-cooked methods (microwave and oven-roasted) were evaluated to determine their impact on fatty acid composition in 4 commonly-consumed meats (pork chop, pork loin, ground beef, and chicken breast). In addition to varying meats and cooking methods, the addition of seasoning following popular recipes was also evaluated. Fatty acid content was determined using gas chromatography - FID detector (GC-FID) technique. Results will define how different cooking methods and the addition of other ingredients can affect the lipid stability in foods. It is expected that higher temperatures will increase the amount of saturated fats present and that the addition of spices may exert an antioxidant effect. These results will create a fatty acids baseline which will help to develop future studies that can further expand current knowledge on lipid oxidation with a focus on other molecules, such as cholesterol oxidation products (COPs), that are also considered harmful molecules for human health because of their direct association with different chronic diseases.

THE INFLUENCE OF POSTNATAL GROWTH-RESTRICTION ON MEAN ARTERIAL PRESSURE IN MICE

Presenter(s): Reneisha Sweet *
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1604
Mentor(s): David Ferguson

Postnatal Growth-Restriciton is thought to be one of the mechanisms that promotes cardiovascular disease in rats. However, the role postnatal growth restriction has on mean arterial pressure is controversial in mice. Growth restriction is said to be one of the leading causes of cardiovascular disease. In this study, we tested to see what impact growth restriction has on postnatal mice and the long-term effects of this disease. These studies are done in the mice model because animals can be invasively treated, the results can be read faster, and the nature of the study. The weight of the growth-restricted mice were monitored daily, and the blood pressure was monitored hourly. The data was then converted into daily blood pressure recording. The blood pressure was used, and we monitored the systolic and diastolic pressure to compare the two groups. Each group were composed of three mice each at seventy days old. The mice were stored together by groups of three and each were implanted with a forced transducer in the femoral artery. The data showed that in the Postnatal Growth-Restricted mice was inversely related to the cardiovascular disease. The increase in systolic pressure proves that postnatal growth restriction is associated with an increase in cardiovascular disease. The standard deviation was also taken to show the variance between the two groups. Our data suggests that the birth weight play an important role in the long-term effect of the growth-restricted individuals when they are older. It shows that growth restricted mice are prone to developing cardiovascular disease in latter years.

EXAMINING THE ASSOCIATION BETWEEN EXERCISE MODALITY AND MENTAL HEALTH AMONG UNIVERSITY STUDENTS

Presenter(s): Riley Patzsch *
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1605
Mentor(s): Catherine Gammon *

Poor mental health is common among university students and negatively impacts quality of life and academic performance. Physical activity (PA) improves mental health; examining whether engagement in different types of PA is differentially associated with mental health could optimize PA recommendations for university students. This study examined the relationship between mental health and engagement in different types of PA (aerobic and strength training) among university students. During Fall 2019, 757 university students completed the American College Health Association's National College Health Assessment. Participants answered questions about weekly engagement in aerobic PA and strength training, and indicators of mental health (psychological wellbeing, resilience, loneliness, distress). Participants were categorized as meeting/not meeting the aerobic PA guidelines (≥150 minutes of moderate-intensity PA or ≥75 minutes of vigorous-intensity PA per week) and strength training guidelines (strength training ≥2 days per week). A one-way analysis of variance was used to examine differences in mental health between: participants meeting both aerobic and strength training guidelines, participants meeting neither guideline, participants meeting only the aerobic guideline, and participants meeting only the strength training guideline (α=.05). For all mental health indicators, students meeting both guidelines reported more favorable scores than students meeting neither guideline ($p<.05$). Meeting the aerobic PA guideline was associated with greater resilience ($p<.05$). Psychological wellbeing, distress, and loneliness were not differentially associated with meeting the aerobic PA vs

strength training guidelines. Engagement in a variety of exercise modalities (aerobic PA and strength training) was most consistently associated with better mental health among university students.

EFFICACY OF WEB-BASED MINDFULNESS MEDITATION TO DECREASE FEAR AND IMPROVE CONFIDENCE IN PATIENTS AFTER ACLR

Presenter(s): Luis Ybarra *
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1606
Mentor(s): Shelby Baez

Anterior cruciate ligament (ACL) tears are a common sport related knee injury. As ACL reconstruction (ACLR) can be physically and mentally demanding, an array of psychological factors may influence an athlete's ability to return to sport or engage in physical activity. Two psychological factors that have been demonstrated to influence return to sport or physical activity engagement are kinesiophobia (i.e. fear of movement and/or reinjury) and knee self-efficacy (i.e. confidence). In other knee pathological populations, mindfulness meditation interventions have been shown to decrease kinesiophobia and increase knee self-efficacy. Therefore, the purpose of this study is to examine the efficacy of a 4-week web-based mindfulness meditation to decrease kinesiophobia and increase knee self-efficacy in individuals with a history of ACLR. Participants will complete the Tampa Scale of Kinesiophobia-11 (TSK-11) and the Knee Self-efficacy Scale (K-SES) before and after a 4-week mindfulness intervention via HeadspaceTM. Participants will complete three 10-minute mindfulness meditation sessions weekly for 4-weeks (i.e. 12 sessions total). Descriptive statistics will be calculated for the TSK-11 and KSES. Paired t-tests will be used to examine differences in pre-intervention scores compared to post-intervention scores. We hypothesize that participants will exhibit decreased kinesiophobia and increased knee self-efficacy at the post-intervention when compared to the pre-intervention.

ASSOCIATION BETWEEN PHYSICAL ACTIVITY AND SLEEP AMONG COLLEGE STUDENTS

Presenter(s): Rachel Nowosad *
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1607
Mentor(s): Catherine Gammon *

Regular physical activity (PA) and adequate sleep have beneficial effects among students, including improved mental health and academic performance. Therefore, it is important to identify factors that promote PA and sleep among college students. Research indicates that PA is a driver of good sleep habits among adults, but less research has examined this relationship among college students. The purpose of this study was to examine the relationship between PA and sleep in college students. During Fall 2019, 757 college students completed the American College Health Association's National College Health Assessment. Participants answered questions about (i) engagement in aerobic PA and strength training, and (ii) their sleep over the past week, including how often they felt tired during the day and how often they got enough sleep so that they felt rested. Independent samples t-tests were used to examine differences in sleep scores between participants who (a) did and did not meet the aerobic PA guidelines (≥150 minutes of moderate-intensity PA or ≥75 minutes of vigorous-intensity PA per week), and (b) did and did not meet the strength training guidelines (≥2 days per week; α=.05). Compared to students who did not meet guidelines, students who met the aerobic PA or strength training guideline reported fewer days when they felt tired or sleepy ($p<.05$). In addition, students meeting the aerobic PA guideline reported feeling rested on more days than students who did not ($p<.05$). Promoting PA,

particularly aerobic PA, to college students may help improve their sleep, and consequently, overall wellbeing.

ASSOCIATION BETWEEN PHYSICAL ACTIVITY AND DIET AMONG COLLEGE STUDENTS

Presenter(s): Hannah Bracken *
Kinesiology & Nutrition, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1608
Mentor(s): Catherine Gammon *

Physical activity (PA) and dietary habits influence physical and mental health. Among adults health behaviors cluster together (i.e., inactive people tend to eat less healthily). Engaging in multiple unhealthy behaviors increases chronic disease risk; health promotion efforts should target groups that demonstrate these unhealthy behavior patterns. Limited research has explored whether unhealthy behaviors cluster together in college students, as such, the purpose of this study was to examine the relationship between PA and diet in college students. In the Fall of 2019, 757 university students completed the American College Health Association's National College Health Assessment. Participants responded to questions about (i) engagement in aerobic PA, and (ii) recent intake of healthy and unhealthy foods (fruits, vegetables, energy drinks, and sugar-sweetened beverages). Independent samples t-tests and chi-square tests of independence were used to examine differences in the intake of healthy and unhealthy foods between participants who did and did not meet the PA guidelines (≥150 minutes of moderate-intensity PA or ≥75 minutes of vigorous-intensity PA per week; α=.05). Students who met PA guidelines reported greater consumption of fruits and vegetables and lower consumption of sugar-sweetened beverages than less active students ($p<0.05$). The findings suggest that healthier exercise and dietary habits tend to cluster together among college students. Campus health promotion efforts should target students who engage in multiple unhealthy behaviors; this is particularly important because establishing healthy habits during this transitional life stage increases the likelihood of the healthy behaviors continuing in adulthood, thereby reducing chronic disease risk.

MECHANICAL ENGINEERING

HUMAN FACTORS BASED SHARED CONTROL FOR SAFER AUTOMATED DRIVING

Presenter(s): Jemone Cochran *
Mechanical Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1701
Mentor(s): Vaibhav Srivastava

Human driving performance is known to be a complex function of driver's cognition such as alertness, situational awareness, workload, and fatigue. We present a shared control technique in which the autonomy captures the driver's alertness through their facial expressions and eye tracking and aids the human driver by ensuring safety and improved driving performance. We simulate multiple driving scenarios using MATLAB's Driving Scenario Designer in which a human driver manually controls the vehicle, so that the autonomy can infer the driver intent using clothoids. Specifically, the autonomy will then create several possible vehicle trajectories by generating clothoids and learn the desired human intention such as lane change by mapping the human input to the appropriate clothoid. After determining the desired human intent, the autonomy will then safely navigate the target clothoid by appropriately modifying the vehicle control input based on the driver alertness.

COMPRESSION AND BUCKLING ANALYSIS OF CORRUGATED BOARDS IN PACKAGING USING FINITE ELEMENT ANALYSIS

Presenter(s): Ameen Muhammad *
Mechanical Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1702
Mentor(s): Amin Joodaky

Corrugated board design optimization has been a major area of study for many researchers all across the globe. In 2020, the corrugated box market reached a value of approximately $189.8 Billion. Material use efficiency, environmental factors, costs of materials, and sustainability are of utmost importance in the packaging industry. Most of the characterization of structures is typically done in a laboratory setting which tends to be expensive and time-intensive. The entities that are affected by this tend to be E-commerce such as Amazon, Shopify and Ebay. Here, we investigate whether corrugated boards can be simulated for a compression and buckling analysis as an alternative method to more exhaustive experiments. We hypothesize that these simulations will be able to depict where and how the boards can fail before spending unnecessary time and money on lab experiments. To test this we used ABAQUS, a type of Finite Element Analysis software that allows for the troubleshooting of both standard and advanced engineering problems.

ADDRESSING ENGINE SHAKE WITH CRANKSHAFT-MOUNTED PENDULUM VIBRATION ABSORBERS

Presenter(s): Aaditya Ranjit *, Bayleigh Purdy *
Mechanical Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1703
Mentor(s): Ryan Monroe *

Due to increasingly stringent fuel economy and emissions regulations, vehicle manufacturers are introducing new technologies to meet these demands across their fleets through engine downsizing and hybridization. In particular, the in-line 4-cylinder engine continues to be a popular choice due to its small footprint and easy packaging for hybrid powertrains. An inherent characteristic in this engine is a vertical shaking force that happens twice per engine rotation, leading to adverse vibrational effects and wear on the engine. These forces have been historically addressed using balance shafts, which consist of two counter-rotating eccentric masses that are geared to the engine rotation in a 2:1 ratio to cancel the shake force. This project will explore the feasibility of using centrifugal pendulum vibration absorbers (CPVAs) as a more space- and cost-efficient alternative to address engine shake. CPVAs can be mounted to the engine crankshaft and tuned to address the shake force. In theory, these devices can replace existing counter-weights on the crankshaft resulting in no net weight or inertia addition to the engine, and can also provide a potential packaging advantage over balance shafts. These devices are currently deployed in many production vehicles to address torsional vibration but have shown promise for engine shake as outlined in multiple research papers. In this study, an inline 4-cylinder model with crankshaft mounted pendulums is developed in a commercial software tool (GT Suite) and simulations are performed to investigate the vibration performance of the CPVA system.

CFD MODELING OF THE CFR ENGINE FLOW DURING STEADY-STATE FLOW BENCH TESTING

Presenter(s): Elizibeth McVay *, Natalie Marlowe *
Mechanical Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1704
Mentor(s): Dan DelVescovo *, Laila Guessous *

The Cooperative Fuels Research (CFR) engine is the global standard for measuring fuel octane number (ON). To reduce carbon emissions, engine manufacturers have implemented innovative technologies including turbocharging, variable valve systems, direct injection, and advanced combustion strategies that have pushed engine operating conditions beyond the range covered by the CFR engine test methodology. For this reason, and to avoid costly experiments, engine and fuels manufacturers and researchers rely on robust computational models to aid the design and development of further improvements to engine efficiency, performance, and emissions. One way to reduce carbon emissions from engines is to increase engine efficiency through optimizing the swirl present in the system. Swirl is the bulk charge motion that rotates concentrically about the axis of the cylinder. In spark ignition (SI) engines, swirl contributes to increased flame propagation speed, thereby increasing engine efficiency. In this work, the accuracy of a 3-D computational fluid dynamics (CFD) model of the CFR engine cylinder head is compared to experimental steady-state flow bench measurements of volumetric flow and swirl at various intake and exhaust valve lift positions. Two different intake valves were evaluated, including the stock shrouded valve used to generate swirl in the F1/F2 CFR engine, and a second unshrouded valve used in the F4 aviation CFR engine. The operating conditions that were present in that experimentation were imposed on the CFD cylinder head model using ANSYS Fluent software; the numerical results of this analysis were then compared to those obtained through the steady-state experimental testing.

SIMULATING POWERTRAIN PERFORMANCE AND OPTIMIZATION UNDER REAL-WORLD DRIVING CONDITIONS

Presenter(s): Ethan Holt *, Grace Pagel *
Mechanical Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1705
Mentor(s): Dan DelVescovo *

Implementation of more stringent vehicle fuel economy and emissions regulations are expected worldwide to mitigate the rise in global CO2 emissions. The amount of CO2 a vehicle emits is directly linked to the amount of fuel the vehicle consumes, thus improving vehicle fuel economy could significantly lower transportation sector CO2 emissions. In the US, vehicle fuel economy and emissions are evaluated on a chassis dynamometer under controlled laboratory conditions over appointed driving cycles. The appointed driving cycles are regulated by the Environmental Protection Agency (EPA), and include the FTP-75, HWFET, and US06 cycles. Nonetheless, there is a disconnect between the EPA test-cycle fuel economy assessment and real-world driving situations which include variables such as driver behavior, road grade, and traffic conditions. Using GT-Suite software packages, including the newly released GT-RealDrive, vehicle fuel economy and emissions are assessed under real-world scenarios and compared to results derived from the EPA drive cycle standards. In addition, an optimization of the vehicle's powertrain was performed for real-world driving conditions and behaviors. Simulating vehicle performance under real-world driving conditions will provide insight into optimal powertrain configurations, thus improving vehicle fuel economy and lowering vehicle emissions.

INVESTIGATE THE EFFECT OF A RANGE OF SUBSTITUTED PHENOL ADDITIVE ON LAMINAR FLAME SPEED AT DIFFERENT CONDITIONS USING A CONSTANT VOLUME COMBUSTION CHAMBER

Presenter(s): Ha Dang
Mechanical Engineering, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1706
Mentor(s): Elisa Toulson

With the growth in demand of energy around the world, it is a challenge to introduce new energy types without knowledge of long-term environmental and technical consequences. The focus of this project is on using bio-additives to improve the combustion of conventional fuels for use in high efficiency, low emission engine applications. In this project the effects of the addition of substituted phenol additives (~2% by volume) to conventional petroleum-based fuels on laminar flame speed will be measured over a range of conditions (T, P, ?, EGR dilution). The substituted phenol additives have a six-membered aromatic ring, bonded directly to a hydroxyl group (-OH). These phenol additives are known to enhance octane number to prevent autoignition. Improved understanding of the laminar flame speed characteristics of these types of additive-fuel blends is important in identifying flame characteristics of premixed fuels and validation of chemical kinetic combustion mechanisms. The recently designed and built MSU Constant Volume Combustion Chamber (CVCC) will be used for the experiments. The CVCC was built to have optical access with a Z-type Schlieren image capture system using a high-speed camera. Additionally, the vessel allows for control of temperature, pressure, equivalence ratio, and exhaust gas recirculation with minimum uncertainty. The goal of the research is to gain an improved understanding of the effects of substituted phenol additives on the laminar flame speed over a range of temperature, pressure and mixture conditions.

GAS PHASE SYNTHESIS OF GAN AND INN NANOPARTICLES USING A NONTHERMAL PLASMA

Presenter(s): Chloe Ho
Mechanical Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1711
Mentor(s): Rebecca Anthony

Synthesis of gallium nitride (GaN) and indium nitride (InN) nanoparticles for light emission and catalysis purposes has shown growing attraction. Particles of these materials at the nano level exhibit size-dependent properties such as band gap tunability, increased surface area for reactions, and more versatile deposition methods. Due to the high melting points of GaN and InN, the traditional liquid-phase methods utilized for nanoparticles of other materials impede synthesis. In this work, we synthesized these semiconductor nanoparticles using a continuous-flow nonthermal plasma reactor. Our gas phase precursors were trimethylgallium (TMGa) or trimethylindium (TMIn) along with ammonia (NH3) as a nitrogen source, and we supplied argon as the background gas. An RF power supply and matching network were used to deliver energy to the gases through triple ring electrodes encircling a pyrex reaction tube. We collected nanoparticles at the reactor exit on stainless steel mesh filters or by inertially impacting them onto substrates such as microscope slides. We used Fourier-transform infrared spectroscopy (FTIR), transmission electron microscopy (TEM), and X-ray Diffraction (XRD) to characterize the nanoparticles' physical properties. With FTIR, we observed surface groups containing indium, gallium, nitrogen, carbon, and oxygen. We identified the presence and average sizes of nanoparticles with TEM, showing nanoparticles with diameters <10nm. XRD analysis confirmed the synthesis of these compounds. These results are promising, demonstrating successful synthesis of nitride nanoparticles using a flow-through gas-phase technique. Our future work includes alloying GaN and InN for even more tunability of properties, and performing optical and photocatalytic measurements to confirm functionality.

STUDY OF ALLVAC 718PLUS SUPERALLOY MICROSTRUCTURE

Presenter(s): Amir Gómez-Pérez *
Mechanical Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1712
Mentor(s): Carl Boehlert, Geeta Kumari

Superalloy, also known as high-performance alloy, is the backbone of the aerospace industry, specifically in the gas turbine engine application. Superalloy's excellent creep and corrosion resistance, at high temperatures in the range of 1000-2200°F, are the reason why they are preferred on gas turbines. Various types of Ni-based superalloys for turbine applications exist, but one of the most predominant is the INCONEL718. However, INCONEL718 is limited by its service temperature limit of 1200°F and the absence of a strengthening phase that helps it maintain its creep life and strength, which can provoke turbine failures. In 2005, the superalloy Allvac718Plus was developed by the group of W. D. Cao. This superalloy showed an enhanced service temperature of 1300°F and γ′ (Ni_3Al) as a significant strengthening phase. The size and distribution of γ′ precipitates in the alloy helps Allvac718Plus withstand high temperature and stressed by hindering the motion of dislocation defect. The present study aims to develop a bi-modal distribution of the γ′ precipitates by conducting various heat-treatment to asses the effect of bimodal distribution in improving the mechanical properties. Scanning electron microscope images (SEM) were collected and analyzed using ImageJ to study the average particle size at different aging times. Determining the size of the γ′ precipitates could support future studies on how the bimodal distribution directly affects the mechanical properties of the alloy. The particle distribution study at different aging times will also enlighten us about the behavior/kinetics of alloy during service.

ESTIMATION OF EX VIVO MURINE URINARY BLADDER'S MECHANICAL BEHAVIOR

Presenter(s): Sara Purdue
Mechanical Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1713
Mentor(s): Sara Roccabianca

This project focuses on studying the mechanical properties of mouse bladders and the changes that occur due to drug treatment. To measure intravesical pressure, bladder volume, wall deformation, mechanical stress, and mechanical stretch, the pentaplanar reflected image macroscopy (PRIM) method, a system developed by Dr. Tycocki's lab, was used. The bladder was mounted in the system that has mirrors surrounding the sample, which shows multiple sides of the sample from an aerial perspective. Each bladder was filled at a rate of 30 μl/min until the maximum pressure, 25mmHg, was reached. A video that shows multiple angles of the bladder due to the mirrors was taken throughout the ex vivo filling process. For each video, specific frames were taken at different pressure values to be analyzed. This work focused on image analysis to isolate the bladder in every picture. The code being used creates a 3-D model of the bladder by isolating each view of the sample from the background by differentiating between the color of each pixel; the 3-D model allows for an accurate calculation of volume. Each view of the bladder was traced, and the rest of the image was made black so the code can more accurately model the bladder. Additionally, the wall thickness was measured to be used in stretch-strain calculations. By creating stretch-strain graphs with the data, the mechanical properties of both healthy and treated bladders can be evaluated to further understand the way that disease affects bladder function.

BIO-INSPIRED ROBOTIC GLOVE WITH CABLE-DRIVEN ASSISTED MOVEMENT FOR STROKE REHABILITATION

Presenter(s): Brady Russell
Mechanical Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1714
Mentor(s): Xiaobo Tan

Assisted movement has been documented to help in stroke rehabilitation where hand movements must be relearned. To see if novel movements can be learned in the same way, a similar process of assisted and restrictive actuation will be used. This will be tested with a cable-driven glove that provides assisted and restrictive actuation to the index, middle, ring, and pinky fingers. This will attempt to give actuation to as many joints as possible without stopping the hand from being mobile. Materials for this are important for mechanical reasons—they must be strong (particularly to repeated friction) while allowing freedom of movement. An assistive glove is constructed of elastic material with pulleys made of abrasion-resistant fabric, to help with comfort and flexibility. The lines are made with a Kevlar cord, since it has good abrasion-resistant qualities as well as high strength while remaining thin. Linear actuators are used for actuation as they allow for modular configuration with a compact footprint. The information gained in this project could let us understand at a greater depth how muscle memory is learned and gained and be of use to hand rehabilitation.

RAPID PROTOTYPING OF MICROFLUIDIC DEVICES USING MICROMACHINING

Presenter(s): Ashley Bolt
Mechanical Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1715
Mentor(s): Brian Johnson, Jacob Reynolds

The use of digital manufacturing, including both additive (3D printing) and subtractive (CNC milling), has increased in both industry and academia. Digital manufacturing allows for rapid prototyping of devices while providing the ability to create the features on the micro level. Our lab has developed an approach that uses CNC micromachining to construct microfluidic devices directly into microplates that are used to study models including orofacial development, thyroid metabolism, and lipid metabolism. These microfluidic devices are important as they combine a user-friendly platform with throughput compatibility. Certain devices are designed with tight tolerance requirements where work holding and milling parameters must be optimized to achieve the required tolerances. To manufacture devices with tight tolerances, we evaluated sources of variation including deck flatness, microplate flatness, and evaluation of various work holding strategies. We have found solutions that contribute to reducing the high deviations of tolerance while increasing reproducibility of the measurements. The current solution for work holding is using side blocks to hold down the device. A deck solution was to design, then mill that newly created deck cutout that matches the height profile of the bases for the 96-wells and 48-wells. Our results demonstrate that machines can create the reproducibility needed for the devices being used. We anticipate more precise tolerances after the torque applied to the work holding is addressed. The reproducibility of this machine will make for more accurate production for future devices.

DESIGN OF A PLANAR UNIAXIAL RING STRETCHER FOR BLADDER EXTRACELLULAR MATRIX TESTING

Presenter(s): Abdelrahman Zebdi
Mechanical Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1716
Mentor(s): Sara Roccabianca

Bladder inflammation is a process associated with many different bladder pathologies and poses a significant reduction in quality of life for many. Treatment of these various pathologies often require some bladder tissue replacement, frequently using bioengineered tissue. Current bioengineered bladder tissue face difficulties with biocompatibility, inflammation, vascularization, and creation of sufficient contractile properties to allow for voiding. Determining the changes in properties of the bladder extracellular matrix (ECM) in response to inflammation may help characterize the mechanical behavior of tissue in response to pathologies, paving the way for better bioengineered tissue replacements. Beginning with existing tissue stretcher designs, an iterative design process will be used to synthesize and prototype a custom tissue stretcher that improves on the current ECM testing process. The design aspects of chief importance are as follows: removing the necessity for suture string to be threaded through the tissue by using a rigid support method; this reduces possible error in force readings introduced by the innate elasticity of the suture thread. Ensuring the tissue is planar for top-down viewing and photography. Submerging the sample in a bath of Krebs solution to mimic in vivo tissue conditions. Achieving these objectives will assist researchers in acquiring accurate ECM mechanical property data, paving the way for a better understanding of bladder tissue mechanics and future improvements in tissue engineering. Developments in this field will assist in treatment of many bladder pathologies that present a significant reduction in quality of life and pose a meaningful financial burden to many.

THE EFFECTS OF OSTEOARTHRITIS ON THUMB MOTIONS AND FORCES

Presenter(s): Emily Kelly
Mechanical Engineering, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1717
Mentor(s): Adam Chrzan, Nicole Arnold, Tamara Bush

The thumb carpometacarpal (CMC) joint, located at the base of the thumb, allows for the ability to pinch objects during tasks such as holding a key or opening jars. CMC joint function can be hindered by osteoarthritis (OA), which is a degenerative disease that decreases the joint's range of motion, strength, and overall hand function. The goal of this study was to establish a range of thumb forces and range of motion for healthy individuals. With these data future comparisons can be made between healthy people and people with OA pre- and post- surgical treatment. Two groups were recruited for this study: younger (<40 years) healthy participants and older (>40 years) healthy participants. A three-dimensional motion capture system and reflective markers located on the segments of the thumb were used to track the movements and determine the thumb's range of motion while performing numerous tasks. Load cells were also used to quantify the maximum forces exerted by the thumb during these tasks. It is expected that the older healthy participants will have less strength and range of motion when compared to the younger healthy participants. Future work will involve recruiting and testing older individuals with OA using the same protocols described in this study. By better understanding the motions and forces of the thumb, the data will support improved treatments and surgical interventions.

MICROBIOLOGY, IMMUNOLOGY & INFECTIOUS DISEASE

THE EFFECT OF SILVER INFUSED CLOTHING ON BACTERIAL VIABILITY

Presenter(s): Madalyn Fields *
Microbiology, Immunology & Infectious Disease, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1801
Mentor(s): Lance Shultz *

Metal based-antimicrobials (MBA) have shown to be effective in reducing cell viability through the release of toxic metal ions. Silver ions are used commercially to inhibit bacteria in a variety of consumer products. Clothing companies attempt to utilize silver's known antimicrobial properties by embedding silver particles directly into their fabrics. This technological advancement has been advertised as creating garments that are "bacteria-resistant" and "odor-free". The purpose of this research is to analyze how effective silver-infused clothing is in disrupting bacterial growth. Using a variety of methods, six different antimicrobial shirts and one cotton shirt were analyzed to assess the validity of the companies claims. The assays measured visual growth which supported the inhibition of bacteria from one fabric. The other fabrics provided little or no evidence to support antimicrobial activity. Growth curves were created to display the mode of action of the silver-infused fabric against Bacillus megaterium. The results reflect that the silver fabric can delay bacterial growth in a dose-dependent fashion. In high doses, the silver fabric displayed bactericidal activity.

REPRODUCIBILITY OF ANTIBIOTIC PRODUCTION FROM STUDENT ISOLATES

Presenter(s): Tirth Patel *
Microbiology, Immunology & Infectious Disease, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1802
Mentor(s): Paul Price *

In 1928, the antibiotic era started with the discovery of the drug Penicillin. However, antibiotic-resistant bacteria soon emerged, and we now have multi-drug resistant (MDR) pathogens that cannot be killed by most of our current antibiotics. Our research aims to determine the reproducibility of antibiotic production for bacteria identified by Tiny Earth students. We selected 40 student isolates to test against ESKAPE pathogens. The purity of the isolates was verified followed by spread-patch plate testing using ESKAPE pathogens, including Mycobacterium smegmatis, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli MG1655, and drug-resistant E.coli 15X. The zones of inhibition for any of the ESKAPE pathogens were used to confirm antibiotic production. 90% (36/40) bacterial strains continued to inhibit at least one ESKAPE pathogen. We are now planning on determining their ability to produce antibiotics when grown either individually or in co-culture using various formulations of liquid media.

ANALYSIS OF IMMUNE BIOMARKERS IN CANCER PATIENTS WITH SOLID TUMORS VERSUS HEALTHY SUBJECTS

Presenter(s): Dev Acharya
Microbiology, Immunology & Infectious Disease, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1803
Mentor(s): Gordan Srkalovic

Cytokines and other immune regulatory molecules are critical players in the immune response against cancer. There is growing interest in testing the potential utility of systemic immune

biomarkers to track cancer progression and to use them as predictors of effective responses to cancer therapy. The central hypothesis guiding this project is that specific immune biomarkers will serve as predictors of effective vs. ineffective immunotherapy in patients with malignant diseases. The objective of this study was to establish baseline of immune markers in patients already started treatment with immunotherapy (n=10) (T), patients starting, but not yet treated (S) with immunotherapy (n=10) and subjects without diagnosed malignant disease (W) (n=10). Blood was collected and plasma was isolated and used in the biomarker (100 markers) analysis using a protein microarray method (RayBiotech). The biomarkers in the three groups were analyzed by Principal Component Analysis, heat map with clustering, and differential expression based on p value, and Significance Analysis of Microarrays (SAM). Although 15 biomarkers were significantly different between S vs. W groups, based on SAM, only seven were found differentially expressed. Similarly, although 10 biomarkers were significantly different between T vs. W groups, based on SAM, only one biomarker was found differentially expressed. Furthermore, SAM revealed that responders (n=4) vs. stable (n=5) subgroup of patients within the T group exhibited 22 differentially expressed biomarkers. Future larger studies will be needed to evaluate whether immune markers will be able to predict effective vs. ineffective responses to immunotherapy and whether they may have therapeutic potential.

CHARACTERIZING PHAGE DEFENSE PATHWAY OF PATHOGENICITY ISLAND VSP-1 FROM 7TH PANDEMIC CHOLERA

Presenter(s): Ram Sanathkumar
Microbiology, Immunology & Infectious Disease, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1804
Mentor(s): Christopher Waters, Kaylee Wilburn, Soo Yoon

Nucleotide-derived second messengers play crucial roles in many bacterial processes from environmental adaptation4 to immune responses2,3. The second messenger cyclic GMP-AMP (cGAMP) was recently shown to be synthesized by the enzyme DncV that is encoded in the bacterial pathogen Vibrio cholerae, the causative agent of the current cholera pandemic. We showed that cGAMP activates CapV, a membrane degrading enzyme5, encoded adjacently to dncV, to cause abortive death upon phage infection3. We also recently identified a gene upstream of capV and dncV we named dcdV and showed it also defends bacteria against phage infection. Both DncV/CapV and DcdV are encoded on the VSP-1 genomic island in V. cholerae, and homologous systems similar to DncV/CapV and DcdV have been found in other bacteria3. To better understand the role of the VSP-1 island in phage defense, I quantified its impact on the ability of 10 distinct phages to infect the heterologous bacteria Escherichia coli. My results shows that Demerecviridae phage T5 exhibits reduced infection of E. coli engineered to encode VSP-1 compared to wild type E. coli. Future experiments will determine if this reduction of phage infection is due to dncV/capV and dcdV, and/or other unidentified genes on VSP-1. By understanding VSP-1 phage defense systems, we can ascertain how they play a role in the pathogenicity of V. choleraeand a multitude of other bacteria. This knowledge will aid efforts to use phage to treat antibiotic resistance bacterial infections.

IMPACT OF INFANT GUT MICROBIOTA ON TEMPERAMENT IN LATER INFANCY

Presenter(s): Dana Nzerem
Microbiology, Immunology & Infectious Disease, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1805
Mentor(s): Sarah Comstock

The microbiota has been associated with the temperament of infants. This association is hypothesized to be due to the bidirectional interactions between the brain and the gut

microbiota. Using the following databases, Web of Science and PubMed, 25 articles, with publication dates from 1986 to 2021, were used to create this literature review. The following search terms were used to identify relevant articles: gut, brain, gut-brain axis, behavior, temperament, microbiota, and microbiome. The articles used involved human or animal subjects to test hypotheses; all animals in the articles referenced were mice. In sum, the articles reviewed through this search process presented evidence to suggest that due to the gut-brain connection, microbes play an essential role in neurodevelopment and behavior control. Studies also showed a homotypic continuity, or a temperament that persists through stages of childhood, from infancy to childhood which suggests that temperament in infants can be predictive of developmental characteristics later in life. In conclusion, this review of the literature provides evidence for a relationship between the microbiome and the temperament of infants, which could be important in mediating later mental illness.

CHARACTERIZING THE ROLE OF AN UNIDENTIFIED VIBRIO CHOLERAE OPEN READING FRAME IN 3′-3′-CGAMP SIGNALING

Presenter(s): Elise Trost
Microbiology, Immunology & Infectious Disease, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1806
Mentor(s): Christopher Waters, Soo Yoon

Cholera, a gastrointestinal diarrheal disease, is an ongoing issue in underdeveloped countries. The El Tor biotype of Vibrio cholerae is the cause of the current pandemic. El Tor is unique from the classical biotype in the inclusion of VSP-1 & VSP-2 genomic islands. The VSP-1 island encodes a four-gene operon called the cyclic-oligonucleotide-based antiphage signaling system (CBASS). In this system, phage infection prompts dinucleotide cyclase in Vibrio (DncV) to make 3′-3′-cyclic GMP-AMP (cGAMP), which activates a phospholipase, CapV, to degrade the cell membrane and kill the infected cell. The remaining two genes encode for ancillary proteins that assist in phage defense via an undescribed mechanism. We have identified an uncharacterized open reading frame (ORF) upstream of CBASS, and given its proximity to the signaling system, we hypothesize that it may modulate CBASS by affecting cGAMP synthesis. Sulfamethoxazole is an antibiotic that induces CBASS-mediated death by activating cGAMP synthesis from DncV. In viability assays with sulfamethoxazole, deletion of ORF in V. cholerae resulted in quicker death compared to the wild type strain. This result prompted us to quantify intracellular cGAMP in these conditions, and thus far, our evidence suggests that deletion of ORF leads to increased cGAMP synthesis. My future experiments will further define how ORF influences cGAMP signaling, increasing our understanding of this novel phage defense mechanism and signaling pathway found in many bacteria, including numerous human pathogens.

DEVELOPING A RAPID PLASMID DNA EXTRACTION METHOD

Presenter(s): Sonia Rafique
Microbiology, Immunology & Infectious Disease, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 1807
Mentor(s): Azam Sher, Linda Mansfield, Lixin Zhang

Plasmid DNA are small extrachromosomal circular DNA strands, mainly found in bacteria, that can be transferred amongst each other during a process known as conjugation. This exchange of genetic material via plasmid transfer has allowed bacteria to acquire and share antibiotic resistance genes (ARGs), posing severe threats to both humans and animals. The isolation and characterization of plasmid ARGs in bacterial populations has always been challenging. We found that commercial plasmid extraction kits were not successful in extracting larger sized plasmids, and additional literature revealed that these kits were ineffective for complex samples such as soil or cecal samples. In our study, we hope

to develop a rapid and cost-effective method for DNA plasmid extraction. This method will facilitate the isolation of plasmids from simple bacterial cultures to complex microbial samples such as sewage, soil, and feces. We plan to use this method to screen human isolates for the presence of conjugative plasmids carrying the Extended-Spectrum Beta-Lactamase (ESBL) enzyme, which is responsible for resistance to many types of antibiotics including penicillin and cephalosporins. We are currently testing both commercial plasmid DNA extraction kits and in-house methods on overnight bacterial cultures to isolate plasmids of known sizes with various resistance genes. The preliminary results show that tested methods have different abilities to extract plasmids from pure cultures of bacteria. The findings from this study will enable us to advance the screening process for multi-drug-resistant bacteria carrying ARGs on conjugative plasmids.

GENE EXPRESSION REANALYSIS IN SYSTEMIC LUPUS ERYTHEMATOSUS (SLE)

Presenter(s): Naomi Douglas *
Microbiology, Immunology & Infectious Disease, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1811
Mentor(s): George Mias

Systemic lupus erythematosus (SLE) is a chronic auto-immune disease that commonly affects the skin, joints, and internal organs. Common symptoms of SLE include extreme fatigue, headaches, and low fevers, swelling in the hands, feet, or around the eyes, and hair loss. According to the Lupus Foundation of America, 90% of adults that suffer from SLE are women, and women aged 15-44 that have a racial/ethnic background of African American, Asian American, Hispanic/Latino, Native American, or Pacific Islander, are more susceptible to develop SLE. In this investigation, to investigate the hypothesis that there is age-specific variation in SLE gene expression, we curate, annotate, and reanalyze RNA-sequencing data from Gene Expression Omnibus (GEO) from multiple previously published studies. Sequencing data are re-mapped to the transcriptome using the Galaxy platform to obtain gene expression, and linear models are used to study the effects of different factors (including age, sex, and ancestry). Pathway and gene ontology (GO) analyses are used to identify the involvement of differentially expressed genes in different molecular pathways. The results of gene specific expression changes can help explain differences in SLE patients versus healthy individuals, identify biological pathways involved in SLE, and identify age and sex associated effects in SLE gene expression. The identified genes can provide molecular targets for improving SLE diagnostics and the basis for further exploration of SLE molecular mechanisms.

PLASMID-MEDIATED TRANSFER OF ANTIBIOTIC RESISTANCE GENES (ARGS) TO COMMENSAL AND MULTI-DRUG RESISTANT BACTERIA

Presenter(s): Mia Van Allen
Microbiology, Immunology & Infectious Disease, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1812
Mentor(s): Azam Sher, Julia Bell, Linda Mansfield, Xingxing Li

Antibiotic resistant (AR) pathogens have become a major health problem: the CDC announced we are now existing in a post antibiotic era. Plasmids are carriers of antibiotic resistance genes, and they spread between bacteria in the microbiome via a horizontal gene transfer mechanism called conjugation. During each conjugation event, plasmids enter a host cell and express their antibiotic resistance genes, resulting in newly acquired antibiotic resistance for that cell. This process of unrestrained AR plasmid spread cultivates an evolving reservoir of antibiotic resistant pathogens and commensal bacteria in the human gut microbiome. This study aimed to replicate and observe the rate and patterns of transconjugant frequency of fluoro-tagged plasmids in combinations of commensal,

pathogenic, and lab strain bacteria in vitro. Conjugation protocols that allowed for quantitating transconjugation events using both introduction and absence of antibiotic pressure for selection were created and employed. The transconjugant colonies were confirmed using colony PCR with primers selecting for antibiotic resistance genes. Growth curve assays were used to estimate transconjugation rate during an induced antibiotic pressure event. Fluorescent microscopy was used to observe the transconjugants directly. Using the transconjugant frequencies obtained, predictions of plasmid spread could be made that model those in the human gut microbiome. Additionally, the individual combinations of donor and recipient bacteria could give insight into strain-specific features that affect transconjugant frequency and plasmid spread effect. Understanding plasmid spread between gut microbiota is crucial to gain insight on how potential treatments can be developed to combat the spread of antibiotic resistance genes.

MISMATCH REPAIR FACTORS FACILITATE DOUBLE STRAND BREAK FORMATION AT IMMUNOGLOBULIN SWITCH REGIONS

Presenter(s): Em Segraves
Microbiology, Immunology & Infectious Disease, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1813
Mentor(s): Kefei Yu

Immunoglobulin class switch recombination (CSR) is the process by which B cells switch from producing IgM antibodies to IgG, IgE, or IgA, allowing for better clearance of infection. In antigen-stimulated B cells, activation-induced cytidine deaminase (AID) converts cytosine bases in DNA to uracil, generating uracil-guanine mismatches that can trigger the base excision repair (BER) and/or mismatch repair (MMR) pathways. In the BER pathway, uracil DNA glycosylase (UNG) removes the uracil base, leaving behind an apurinic site, which can be cleaved by apurinic/apyrimidinic endonuclease (APE) to generate a single strand break (nick). It is believed that multiple nicks in the switch region can lead to double strand breaks (DSBs), which is a key intermediate in CSR. However, the mechanism by which nicks are converted to DSBs is poorly understood. By using CRISPR technology that can generate nicks at precise DNA locations, the Martin lab has shown that nicks separated far away (up to 250 bp) can induce a "CSR-like" chromosomal deletion event. Using the same system, we tested the hypothesis that the MMR pathway plays a pivotal role in converting distal nicks to DSBs. By using a mouse B cell line called CH12F3, we compared chromosomal deletion efficiency mediated by CRISPR-induced nicks in genetically engineered cells that are proficient or deficient in MMR. We found that MSH2, an essential MMR factor, greatly increases the efficiency of the "CSR-like" reaction, suggesting that strand excision during MMR facilitates nick to DSB conversion at immunoglobulin switch regions.

UNDERSTANDING THE ROLE OF THE PI3K/AKT PATHWAY IN THE MACROPHAGE RESPONSE TO GROUP B STREPTOCOCCUS

Presenter(s): Yadira De Leon-Lopez *
Microbiology, Immunology & Infectious Disease, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1814
Mentor(s): Rebecca Flaherty *

Group B Streptococcus (GBS) can be part of a healthy individual's microbial flora. However, problems may arise when a GBS-colonized mother becomes pregnant. GBS may be transferred from a colonized mother to her newborn or developing fetus, which may result in complications such as meningitis, pneumonia, sepsis, or even death. Macrophages play an especially important role in the fetal and newborn response to GBS due to the limited capacity of the adaptive immune system early in life. The goal of this project was to understand how GBS manipulates macrophage cell signaling to survive and cause disease. To

this end, we investigated whether the PI3K/Akt pathway was involved in several key aspects of the macrophage response to GBS. We first explored whether certain GBS strains, such as sequence type (ST)-17, rely on this pathway for the more rapid macrophage uptake they are known to induce compared to other GBS strains. Our colony counting-based studies suggested this pathway is important for macrophage uptake of GBS. We also compared the ability of different GBS strains to induce actin rearrangements in macrophages using fluorescence microscopy. These studies revealed that more virulent strains of GBS induced more actin stress fibers in macrophages than less virulent strains. We also explored whether the PI3K-Akt pathway impacted the ability of GBS to survive within macrophages after phagocytosis. As well as, the survival rate of macrophages themselves following GBS infection. Overall, this research may provide new insights for the development of diagnostic and therapeutic tools to combat GBS.

MODELING BIOMARKERS TO PREDICT SEVERITY OF ILLNESS IN COVID-19 PATIENTS

Presenter(s): Shay Ladd *
Microbiology, Immunology & Infectious Disease, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1815
Mentor(s): Christina Chan

COVID-19 cases range in severity from asymptomatic to fatal, with symptoms affecting the whole body and lasting long after the initial infection. Risk factors for severe illness have been identified, but do not necessarily predict the outcome of infection. Being able to identify which patients are likely to deteriorate would allow for more effective and efficient care. Using proteomic data from OLINK and RNA-seq data from lung tissue of COVID-19 patients, 15 biomarkers were computationally mapped as having expression patterns that contributed to changes in disease severity and their role in COVID-19 was investigated. Based on these markers, a predictive model will be developed to determine which patients are most likely to progress to death. In addition to the model, several potential areas of interest for further research are presented. Of the identified biomarkers, TBC1D5, DSG2, AGR3, PIK3IP1, LTBP2, and DARS1 had not been investigated in relation to COVID-19 at the time of research. Four of the 15 biomarkers have opposite trends in their protein and RNA-seq expressions, suggesting a possible role of miRNAs: another research area of interest. While there has been much research performed in the past year and half regarding the COVID-19 pandemic, much is still not understood about disease progression. Predicting which patients are likely to deteriorate based on biomarkers will help in providing more timely monitoring and treatment of patients. Continued research into why these markers can lead to death will aid in understanding how the virus works and in developing improved and targeted treatments.

PLANT-ASSOCIATED MICROBIOTA AND CRYOPRESERVATION IN A GNOTOBIOTIC PLANT GROWTH SYSTEM

Presenter(s): Tim Johnson
Microbiology, Immunology & Infectious Disease, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1816
Mentor(s): Sheng Yang He *

The use of gnotobiotic plant growth systems allow scientists to grow plants under controlled conditions with defined microorganisms and represents a powerful tool for biologists to study the function of plant-associated microbiota. For example, using a newly developed gnotobiotic plant growth system called GnotoPots and a complex microbial community extracted from soil, the He lab recently demonstrated that exposure to microbiota is required for wildtype immune function in Arabidopsis. Inoculation of plants with a synthetic community composed of 49 bacterial isolates was also sufficient to restore wildtype immune function; however, the preparation of fresh synthetic community is time consuming and

represents a significant bottleneck in experimental preparation. To address this the He lab has considered using a cryopreserved synthetic community to allow for batch scale production and storage. This also has the potential to reduce variability and sources of error since the procedure does not need to be repeated for every experiment. While individual isolates can be resuscitated after long-term storage at -80°C, it is unknown whether a complex frozen community will retain its structure and function compared to fresh cultures after plant growth. Moreover, a detailed characterization of the bacterial communities associated with Arabidopsis grown in GnotoPots has not yet been performed. Here, 16S rRNA sequencing was performed to characterize the composition of plant-associated microbial communities in GnotoPots. Additionally, several key results will be presented to show the impact of various cryoprotective agents and methods of resuscitation on the establishment of plant microbiota from frozen synthetic communities.

SELF-ASSEMBLY OF COMPLEX POLYMICROBIAL INFECTIONS

Presenter(s): Amber Hickey
Microbiology, Immunology & Infectious Disease, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 1817
Mentor(s): Lydia-Ann Ghuneim, Robert Quinn

Cystic Fibrosis is an autosomal recessive disorder caused by mutations in the CFTR gene, which facilitates the transport of chloride ions across cellular membranes. This mutation results in the thickening of mucosal secretions which in turn cause a variety of health problems. Leading to the decrease in lung function and increased incidence of chronic polymicrobial infection. This project aims to understand the assembly and progression of the CF lung microbiome when inoculated into a mucus-plugged lung bronchiole microcosm. We will be monitoring two microbiome communities obtained from the sputum of cystic fibrosis patients along with a single isolate community (P. aeruginosa) and pure sterile media (as a control) over the course of 48 hours, in order to observe community dynamics. The results will be analyzed using multi-omics techniques which include: 16S rRNA sequencing, qPCR, and metabolomics to identify community members and metabolites in the subsamples. We expect to see an increase in P. aeruginosa abundance in the beginning of the experiment due to oxygen respiration, and then at later time points an increase in anaerobes by the end of the 48-hours. These results will allow for a better understanding of how these microorganisms assemble and interact when grown together, which can lead to future advances in understanding the complexity of these chronic infections as a whole.

NEUROSCIENCE

COMPARING DIFFERENT TECHNIQUES OF MRI TO CREATE A STANDARD MEASUREMENT

Presenter(s): Joshua Lewis *
Neuroscience, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1901
Mentor(s): Andrew Bender

The Hippocampus is an important region within the brain which is associated with learning and memory. The Hippocampus is composed of distinct sub levels which differentiate from one another. Magnetic Resonance Imaging (MRI) can be used to detect these sub levels of the hippocampus. However, these methods of MRI contain variability. Multiple methods of MRI have been made to detect these subfields but the sensitivity of these methods produce variability. However, the variability of these methods have not been throughly studied. We

sought to compare two methods as outlined in the Day to Day Study (Filevich, Elias et al 2017). Day2Day study acquired both T1-weighted and T2-weighted data points and compared two methods (Freesurfer and ASHS) to evaluate how consistent and variable these methods are over time. Results are expected to demonstrate that high resolution data is more variable which is more sensitive to error. Smaller regions are less reliable and produce more variability than larger regions. This is due to there being less measurement room for errors within smaller regions. These results are expected to demonstrate that it would be best to utilize high resolution testing.

SEX DIFFERENCES IN MEDIAN EMINENCE MAST CELLS DURING HYPOTHALAMIC-PITUITARY-ADRENAL AXIS STRESS RESPONSE

Presenter(s): Geraldine Ortiz *
Neuroscience, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1902
Mentor(s): Adam Moeser

It is known that females exhibit stronger hypothalamic-pituitary-adrenal (HPA) axis activation and more blunted negative feedback in response to stress, compared with males. Females typically suffer more from chronic stress illnesses such as depression and post-traumatic stress disorder (PTSD), but the mechanisms remain poorly understood. The median eminence (ME) is situated between the hypothalamus and the pituitary gland and is a functional link between stress hormone release from the brain and transmission to the body during HPA axis activation. Mast cells (MCs) are immune cells rapidly activated by stress, exhibit sexual dimorphism, and are abundant in the ME, however, it is still unknown their role during the stimulation of the HPA axis. Therefore, our overall objective is to determine the role of MCs in regulating the ME pathway and if MCs are drivers of sex differences in the HPA axis stress response. The objective of this study is to characterize the localization of MCs in the ME during HPA activation. We are working with the MCPT5-Cre tdTomato transgenic mouse model, whose mast cells express a fluorescent protein allowing us to localize MCs in the ME. To induce HPA activation, adult female and male mice adults will be administered 10 mg/kg of lipopolysaccharide (intraperitoneal injection) for 6 hours, followed by tissue perfusion and fixation of brains for analysis of MCs location and number in the ME. This research project will lead us to a broader understanding of the sex differences in the median eminence MCs during HPA axis activation.

THE TRANSCRIPTION FACTORS SIX3 AND VAX1 ARE REQUIRED FOR SUPRACHIASMATIC NUCLEUS CIRCADIAN OUTPUT AND FERTILITY IN FEMALE MICE

Presenter(s): Fabiola Ramos *
Neuroscience, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1903
Mentor(s): Hanne Hoffmann, Melissa Jaiman Cruz

In modern society is very common nightshifts and rotating shift-work. This investigation is focused to find the negative implications of shift-work on fertility, reproduction cycle including menstrual and ovulatory cycling and pregnancy. Changes in light cycle such as light at night are hypothesized to cause mismatches in cellular circadian rhythms (daily), exposure to constant mismatch light signal can disturb the synchrony of rhythms in the body leading to impairments of physiological functions such as reproduction. The SCN is a small bilateral brain structure localized in the ventral part of the hypothalamus. The SCN is responsible of translating daylight information to hormonal and nervous signals. Disruption of circadian rhythms trough light exposure or genetically can lead to despair hormonal and endocrine disorders. We principally discuss the contribution to the circadian right and its implications on the female reproductive axis, hormone release and fertility.

REVISITING THE INHIBITION OF AMYLOID-BETA AGGREGATION WITH SMALL MOLECULES

Presenter(s): James Torres *
Neuroscience, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1904
Mentor(s): Jessica Fortin

Alzheimer's disease (AD) is associated with amyloid plaque (Aβ peptides) and tangle (hyperphosphorylated tau) formation which accumulate in the brain, contributing to neurodegeneration. To date, there are no good mitigation strategies that stop or slow AD progression. All new scientific advance in the field may improve not only the amyloid targeting drugs, but also other ways also to innovating in AD. Therapeutic approaches applicable at different stages of AD amyloid formation are direly needed. The long-term goal of this research is to establish an effective treatment strategy for AD. Our overall objective is to develop and validate a new proprietary class of anti-amyloidogenic molecules to impede the formation of Aβ toxic oligomers. The specific aims of our research are 1) to provide a relevant library of small molecules, 2) to identify the key chemical moieties driving their effect in interfering with oligomer formation (structure-activity relationship). The potency of at least three different series of small molecules to reduce the formation of amyloid fibrils and toxic oligomers was assessed in vitro using biophysical methods such as Thioflavin T (ThT) fluorescence and photo-induced cross-linking of unmodified protein (PICUP) assays. Based on the screening of certain newly synthesized molecules, we will be able to discover which compounds works as amyloid inhibitors of both $A\beta_{1\text{-}40}$ and $A\beta_{1\text{-}42}$. This project may lead to a better understanding of AD by providing a model compound that may confirm or deny the role of amyloidosis in disease progression.

STUDY DESIGN: AN INVESTIGATION OF THE INFLUENCE OF GUT MICROBIOTA COMPOSITION ON CHILDREN'S NEURODEVELOPMENT

Presenter(s): Madeleine Russell
Neuroscience, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1905
Mentor(s): Sarah Comstock

Emerging research has a placed a focus on the gut-brain axis. The early life gut microbiome has been linked to optimal neurodevelopmental outcomes. Beneficial microbes in the intestines produce signaling molecules, such as dopamine and serotonin, that interact with the central nervous system. This communication between the gut and brain has been tied to both metabolic and psychiatric disorders. While previous studies placed an emphasis on infant and toddler microbial composition with regards to cognitive health, few studies have investigated the role of the gut microbial composition in early and middle childhood. Our objective is to assess potential relationships between the gut microbiota and neurodevelopment for children ages 4-5 and 10-11 for a subset of participants in our already running longitudinal pregnancy and birth cohort. Participants will submit a stool sample at the time when they also complete their overall neurodevelopmental assessment as well as the child behavior checklist (CBCL), a validated, parent-reported assessment of behavioral and emotional problems. DNA will be extracted from fecal samples. The V4 region of the 16S rRNA gene will be sequenced to determine gastrointestinal microbial community membership. We hypothesize CBCL scores as well as internalizing and externalizing behaviors will be associated with distinct taxa of the gut microbiota. Knowing the dietary intake and gut microbiota community composition in early and middle childhood (at the time of neurodevelopmental assessments) will be imperative for complete interpretation of the impact of the early infancy microbiota on later cognitive or obesity outcomes.

ROLE OF NEUROTENSIN RECEPTOR-1 EXPRESSION IN DOPAMINE NEURONS FOR FEEDING, LOCOMOTOR AND ANXIETY BEHAVIORS

Presenter(s): Sydney K. Arriaga *
Neuroscience, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1906
Mentor(s): Gina Leinninger, Jariel Ramirez-Virella *

The dopamine (DA) system is essential for motivated feeding and locomotion, but disruption of this system is implicated in the development of obesity and low body weight, namely anorexia nervosa. All DA neurons transiently express the neurotensin receptor-1 (NtsR1) during development, suggesting it may contribute to the establishment and/or function of the DA system. Intriguingly, female mice lacking NtsR1 exhibit lower body weight that controls and present altered feeding behaviors, raising the possibility that lacking NtsR1 may increase vulnerability to developing sex-specific feeding disorders like anorexia. Thus, we hypothesize that lacking NtsR1 expression in DA neurons impairs the function of the DA system and DA-dependent feeding, locomotor activity, and anxiety behaviors. To test this, we crossed DATCre/+ and NtsR1flox/flox mice to generate mice with intact NtsR1 (Controls - DAT+/+; NtsR1flox/ flox) or mice in which NtsR1 was selectively deleted from DA neurons (DATCre/+; NtsR1flox/flox mice). Comparing control and DATCre/+;NtsR1flox/flox mice of both sexes will reveal if lacking NtsR1 disrupts normal feeding and physical activity, DA-dependent behaviors and if it potentiates low body weight. We predict that baseline feeding, locomotion, and anxiety behaviors will be similar in control and DATCre/+;NtsR1flox/flox mice, but that DA- dependent behaviors like motivated feeding and amphetamine-induced locomotor activity will be significantly different across genotypes and sexes. Our findings will address the gap of knowledge regarding the role of NtsR1 via DA neurons, and whether lacking NtsR1 may be a genetic factor that contributes to anorexia nervosa.

CAN MOUSE MODELS BE TRUSTED? UNCOVERING DIFFERENCES IN HUMAN AND MOUSE SEROTONIN RECEPTOR EXPRESSION

Presenter(s): Ali Cramer
Neuroscience, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 1907
Mentor(s): Mark Reimers

Rodent models are used to test the efficacies of most candidate drugs intended for human use. In particular, the widely prescribed SSRI family of drugs were first validated on rodent models of depression. However, there has always been controversy about whether it is appropriate to model human psychiatric illness in rodents. The SSRI drugs act on the serotonin reuptake transporter, directly influencing the effects of serotonin on many neurons. So far there has been no comprehensive attempt to catalog the varied effects of serotonin on different neuron types or brain regions or to compare these effects between human and rodent brain. In this study we used single cell RNA sequence data and regional expression from the Allen Brain Institute to compare the expression levels of serotonin receptor genes in the brains of mice and humans across cell types and brain regions. We find much more contrast in 5-HT receptor (HTR) expression between humans and mice than previously reported in literature. Perhaps the most striking difference is the inhibitory receptor HTR1E: this gene is absent from the mouse genome but abundant across the human brain. Through our examination of regional expression of HTRs we have also found several mouse HTR genes which are widely regarded as homologs of human HTR genes yet have markedly different expression profiles in both inhibitory and excitatory neurons. In conclusion, we demonstrate a surprising discrepancy between human and mouse serotonin systems, calling into question the widespread use of rodent models for testing SSRIs for human use.

REGULATION OF INFLAMMATION BY SENSORY NEURONS

Presenter(s): Jesus Rosario-Claudio *
Neuroscience, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1911
Mentor(s): Geoffroy Laumet

Inflammation is a beneficial process designed to contain and eradicate threats to the host organism. However, dysregulated inflammation, including in the nervous system, is a central pathological process in diverse disease states. It is critical to understand the mechanisms that regulate inflammation. One of the master regulators of inflammation is the anti-inflammatory molecule interleukin (IL)-10. Traditionally it is thought that IL-10 signals to its receptor (IL-10R1) on immune cells to regulate inflammation. Lately, it has been demonstrated that sensory neurons also expressed IL-10R1, suggesting that IL-10 may regulate inflammation by signaling to sensory neurons. Recent preclinical works have shown that some sensory neurons actively regulate joint, skin, lung, and gastrointestinal inflammatory conditions. Therefore, we will determine if IL-10 receptors on sensory neurons can regulate inflammation. Inflammation is induced by intraperitoneal injection of lipopolysaccharide (LPS) and assessed by changes in body weight, locomotor activity, and cytokine expression of tumor necrosis factor (TNF), IL-1β, and IL-10 by RT-qPCR in wild type and sensory neuron IL-10R1 knock out (KO) mice. We hypothesize that the lack of the IL-10R1 in sensory neurons will result in enhanced inflammation. A greater understanding of the role of sensory neurons in regarding inflammation could potentially lead to new approaches to treat inflammatory diseases.

A-SYNUCLEIN GENE KO RESULTS IN DECREASED NEUROGENIC CONTRACTIONS IN THE PROXIMAL COLON

Presenter(s): Cristina hernandez *
Neuroscience, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1912
Mentor(s): James Galligan

The enteric nervous system, located in the gastrointestinal tract, plays an important role in the early pathogenesis of Parkinson's disease (PD) and its non-motor symptoms. a-Synuclein (-Syn), encoded by the gene SNCA, is a nerve terminal protein and a pathological biomarker in PD. Our previous data show that SNCA knockout (KO) mice, that do not express a-Syn, have reduced proximal colon longitudinal smooth muscle contractions compared to wild type (WT) C57Bl/6 mice. The aim of this project is to elucidate whether the reduction in colonic contractions in SNCA KO mice is due to alterations in synaptic and neuromuscular transmission or changes in muscle tone. We will use SNCA KO and WT C57Bl/6 mice to measure drug-induced longitudinal smooth muscle contractions in the duodenum, ileum and proximal and distal colon. We will use isometric tension and isolated organ baths under the influence of bethanechol and nicotine. Bethanechol is a muscarinic receptor agonist at found in smooth muscle while nicotine is an agonist at nicotinic acetylcholine receptors in enteric ganglia. Therefore, we can determine whether contractions in SNCA KO mice have increased neurogenic or myogenic responses. As a-Syn is expressed in neurons, we anticipate that there will be an increased reduction in contractions compared with nicotine vs. bethanechol in SNCA KO mice. This work supports our previous findings showing that loss of a-Syn alters gastrointestinal motility.

BRAIN ACTIVITY DURING SPONTANEOUS BEHAVIORS

Presenter(s): Miguel Martinez *
Neuroscience, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1913
Mentor(s): Mark Reimers

The broad program is to understand the relationship between brain dynamics and spontaneous auto-generated behavior during experiments. Our specific aim here is to characterize the relationship between brain activity in the two experimental animals. Brain activity could be a cause or a correlate of specific actions, and we attempt to decide which is most likely. We first characterize fluctuations in neurons' activity over the whole brain of the larval zebrafish in relation to vigorous swimming and to eye motion during virtual reality swimming. Then we characterize the rapid dynamics of neural activity in several brain areas of an adult mouse in relation to skilled grasping and to exploratory information-gathering movements. For the first study we re-analyzed data from [Chen et al 2018]. We compared activity in various brain regions during specific kinds of movement with those during stillness. For the second study we obtained neural recordings from [Steinmetz, 2019] we applied DeepLabCut [REF] to video data recorded alongside the neural data to obtain locations of paws and whiskers. Then we regressed a variety of measures of population activity and LFP on the effectiveness of skilled motor movements and on whisking.

DYSREGULATION OF CHOLESTEROL METABOLISM AND ITS IMPLICATIONS IN NEUROLOGICAL DISEASES

Presenter(s): Lisa Zou
Neuroscience, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1914
Mentor(s): Ilce Medina Meza

Human brains contain up to 25% of the cholesterol in the body, where cholesterol makes up 2% of the brain. Cholesterol plays a significant role in the brain's health and function. Factors that affect cholesterol metabolism include oxidative stress, weakened antioxidant defenses, and gene expression. The crucial role of lipids and cholesterol in brain tissue physiology and cell signaling is demonstrated by numerous neurological disorders, including bipolar disorders and schizophrenia, and neurodegenerative diseases such as Alzheimer's, Parkinson's, Niemann-Pick and Huntington diseases, that involve deregulated lipid metabolism. The brain contains a high amount of lipids, especially cholesterol, and is vulnerable to oxidative stress and lipid peroxidation, characterizing traumas of vast clinical importance. The aim of this study was to evaluate cholesterol alterations in human brains at different clinical stages and its association with brain aging. Cholesterol was quantified by gas chromatography-mass spectrometry (GC-MS). Brain tissues were separated into four major sections: frontal cortex, occipital cortex, hippocampus, and cerebellum. In the control group, cholesterol was 19.06 ug per mg compared to the illness group with 6.17 ug per mg. Using an independent samples T test, the decreased levels of cholesterol in illness versus control brains were found to be statistically significant ($p < 0.001$). The cholesterol homeostasis shift due to brain aging is a potential biomarker indicating the development of neurological diseases. Further research in lipid homeostasis can benefit neurological diseases early detection. The next step would be to evaluate the oxidized lipids such as cholesterol oxidation products (COPs) in human brains.

EXAMINING ACTIVATION OF OXYTOCIN NEURONS IN ADOLESCENT C57BL/6 MICE FOLLOWING INVESTIGATION OF SOCIAL AND FOOD STIMULI

Presenter(s): Navya Kalia
Neuroscience, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1915
Mentor(s): Alexa Veenema, Christina Reppucci

Social interaction-seeking and food-seeking are both motivated behaviors that we hypothesize are regulated by overlapping neuronal populations. Here we examined oxytocin (OT) neurons in the supraoptic (SO) and paraventricular (PVH) nuclei of the hypothalamus, because these neuronal populations have shown to regulate social- and food-related behaviors. To test our hypothesis, we exposed male and female adolescent C57BL/6 mice to either a social stimulus (unfamiliar age- and sex- matched mouse), a food stimulus (standard lab chow), or an empty corral. Before testing, all mice were socially isolated and food-deprived to increase their motivation to investigate the stimuli. Mice spent more time investigating the food stimulus than the social stimulus, and tended to spend more time investigating the social stimulus than the empty corral. Following the test, the mice were sacrificed and their brains were collected to measure neuronal activation (using Fos induction as a marker) in response to stimulus investigation. There were no significant differences in total or OT-specific Fos induction between stimulus groups, which suggests that the PVH and SO are equally activated by a variety of stimuli. However, significant positive correlations between investigation of the empty corral and total Fos induction in the PVH, and within PVH-OT neurons, suggests the PVH may regulate object investigation. Also, a significant negative correlation between total PVH Fos induction and food investigation is consistent with the anorexigenic role of the PVH. Thus, future research should examine whether there is another neuronal population in the PVH that may regulate social and food investigation.

ROLE OF NEUROTENSIN RECEPTOR-2 EXPRESSING CELLS IN THE VENTRAL TEGMENTAL AREA ON BODY WEIGHT

Presenter(s): Koralee Santiago *
Neuroscience, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 1916
Mentor(s): Gina Leinninger, Rabail Khan

Excess food intake and reduced physical activity drive the obesity pandemic. The neuropeptide neurotensin (Nts) suppresses food intake and promotes locomotor activity via the ventral tegmental area (VTA) of the brain, and may have potential to support weight loss. Nts signals via the G-protein coupled receptors neurotensin receptor-1 (NtsR1) or -2 (NtsR2) but it remains unclear if either isoform is preferential for weight loss. Our lab showed that NtsR1 is expressed by VTA neurons that, when activated, promote weight loss. In contrast, NtsR2 is predominantly expressed by astrocytes, so NtsR2-expressing cells may exert distinct contributions to body weight and behavior. We hypothesize that activating VTA NtsR2-expressing cells modulate feeding and locomotor activity to support weight loss, but not via invoking stress or anxiety behaviors. To test this, we injected NtsR2Cre mice in the VTA with AAVs to induce Cre-dependent expression of mCherry (controls) or excitatory Designer Receptors Exclusively Activated by Designer Drugs (DREADDq). DREADDs can only be activated by clozapine-N-oxide (CNO), which will activate VTANtsR2 cells "on command". In conclusion, we hypothesize that the activation of VTA NtsR2-expressing cells will promote weight-losing behaviors but have no effect on drinking or anxiety/stress-like behaviors.

ACTIVATION OF LEC-NAC NEURONS MEDIATE COCAINE SEEKING BEHAVIORS

Presenter(s): Daniela Bermudez *, Hayley Kuhn
Neuroscience, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 1921
Mentor(s): Andrew Eagle

Drug craving and seeking are critical components of drug addiction. Neurons in the lateral entorhinal cortex (LEC) are activated by cocaine craving and cocaine cues. The LEC also sends neuronal projections to the nucleus accumbens (NAc), a region associated with reward and motivation, and a major area implicated in drug addiction. However, little is known about this pathway of LEC-NAc neurons, specifically whether it mediates drug seeking behavior and drug reward. We found that the LEC-NAc pathway is also activated by acute cocaine administration in mice. We now seek to determine whether the LEC-NAc pathway is necessary for the rewarding effects of cocaine. We used innovative viral DREADD (Designer Receptors Exclusively Activated by Designer Drugs) technology to target the expression of inhibitory G-protein-coupled DREADD receptors onto LEC-NAc neurons in mice. This allowed us to use DREADD-specific ligands to inhibit this pathway and determine how this alters the rewarding effects of cocaine. Mice subsequently were trained on a cocaine conditioned place preference (CPP) task, which is a common behavioral model to test cocaine reward. The findings will indicate whether inhibition of the LEC-NAc neurons impairs cocaine reward. The results of this study will give us a causal assessment on whether this key pathway that is activated by drugs is also necessary for drug seeking behaviors.

EXCITATION OF OXYTOCIN NEURONS IN THE PARAVENTRICULAR NUCLEUS OF THE HYPOTHALAMUS MODULATES SOCIAL PLAY IN JUVENILE RATS

Presenter(s): Anna Luxhoj
Neuroscience, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 1922
Mentor(s): Alexa Veenema, Samantha Bowden

One social behavior that is commonly displayed by juveniles of many mammalian species is that of social play. This highly rewarding behavior is critical for the development of typical social skills in adults, and deficits in social play are commonly seen in children diagnosed with autism spectrum disorder (ASD). Although the number of ASD diagnoses are rising, there are no leading therapeutic treatments to help diminish the social deficits that are commonly associated with the disorder. Oxytocin (OXT) has shown to have an important role in regulating social behaviors and is currently being researched for the alleviation of social deficits in ASD. However, the underlying neural mechanisms of OXT signaling in juvenile social play still remain poorly understood. To address this, we used a chemogenetic approach to specifically target OXT cell populations within the paraventricular nucleus (PVN) and supraoptic nucleus (SON) of the hypothalamus in juvenile female rats(males not tested yet). We show that excitation of PVNOXT neurons increases the duration of social play in juvenile females, while excitation of SONOXT neurons selectively increases social investigation. These preliminary studies demonstrate the involvement of PVNOXT system in social play and SONOXT system in social behavior in female juvenile rats, and provides further evidence for the use of OXT as a potential therapeutic option for children with ASD.

OPTIMIZING RECORDING QUALITY AND LONGEVITY OF IMPLANTED INTRACORTICAL MICROELECTRODES WITH NANO-ARCHITECTURAL SURFACE MODIFICATIONS

Presenter(s): Austin Cornish *
Neuroscience, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 1923
Mentor(s): Evon Ereifej *

Intracortical microelectrodes (IME) are biomedical devices implanted into the cortex of the brain with the purpose of recording the electrical impulses of neurons. By doing so, IMEs can help treat and understand conditions of the nervous system; for example, IMEs can provide input to brain machine interface technology to control prosthetics. Unfortunately, IMEs are hindered by the inability to sustain high-quality recordings over extended intervals partly due to the foreign body inflammatory response of nervous tissue. Previous studies indicated a trend of reduced inflammation when one of the IME surfaces more closely mimicked the architecture of the surrounding natural tissue environment. The goal of this study is to evaluate the impact of etching nano-architectures (NA) on both surfaces of silicon, single shank IMEs to improve the quality and longevity of electrophysiological recordings. Focused ion beam lithography was used to etch parallel grooves 200nm wide and 100nm deep, spaced 300nm apart along both sides of the IMEs. IMEs without any surface modifications were used as controls. Rats were implanted with either the etched (n=2) or the control (n=2) IMEs and electrophysiological recordings were obtained twice per week for 8 weeks. It was found that there were significantly more single unit neurons recorded per channel from the electrodes etched with NA features during the chronic time points compared to the smooth control electrodes. To explore this finding further and increase the understanding of the effects of NA on the inflammatory response, histological and gene expression analysis is currently being performed.

INVESTIGATING THE ROLE OF NEUROMEDIN S IN THE VENTRAL TEGMENTAL AREA IN MORPHINE BEHAVIORS

Presenter(s): Milagros Alday *
Neuroscience, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 1924
Mentor(s): Cristina Rivera-Quiles, Michelle Mazei-Robison

The ventral tegmental area (VTA) of the brain is responsible for behavioral reward, making it important for understanding drug addiction. In the VTA is a heterogeneous population of dopamine neurons whose specific roles have yet to be described. We are particularly interested in Neuromedin S (NMS) expressing neurons because we have found that NMS expression is increased in mice following chronic morphine. Thus, we hypothesize that VTA NMS neurons play a role in morphine reward and addiction. To explore this, we stereotaxically injected viral vectors into the VTA of mice that allowed us to either activate or inhibit VTA NMS neurons. Excitingly, we have observed behavioral differences when NMS-activated mice were given morphine injections compared to a control group whose VTA NMS neurons were not activated. Specifically, we are measuring the change in ambulation each day following morphine injection. Our preliminary data suggest that VTA NMS-activated mice are more susceptible to the locomotor stimulatory effects of morphine. Following the behavioral assays, we will perform immunohistochemistry to confirm VTA NMS activation using c-fos as a marker for active neurons. We will also do co-staining to determine the number of dopamine-NMS cells that are being activated. Furthermore, we will stain for the NMS receptor, NMUR2, to determine if the nucleus accumbens, a brain region involved in the reward pathway, contains the necessary receptor to respond to an NMS signal from the VTA.

Collectively, these data will provide cellular and behavioral-level understanding of the role of NMS VTA neurons in morphine behaviors.

USING 3D MARKERLESS POSE ESTIMATION PROGRAMS TO DETERMINE FEAR REACTIVITY IN HUMAN INFANTS.

Presenter(s): Samantha Finkbeiner, William Quackenbush
Neuroscience, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 1925
Mentor(s): Rebecca Knickmeyer

Infancy is a key period in the development of fear, an essential emotion involving recognizing and responding to threatening stimuli. Researchers studying infant fear rely on parental reports and direct assessment of child behavior either in the home or structured laboratory settings. The objective of our study is to develop automated approaches for direct assessment of infant behavior. Specifically, we are testing if a markerless pose estimation program can effectively track infants' reactions during a paradigm adapted from the Laboratory Temperament Assessment Battery (Lab-TAB) Mask episode. DeepLabCut and OpenPose are 3D markerless pose estimation programs based on transfer learning with deep neural networks. DeepLabCut was designed for a single animal, while OpenPose was trained to work on multiple human subjects. Both allow users to track key features on the body as they move through space. Our goal is to determine which program will give the most accurate motion tracking for our project. Videos were collected by a research team at the University of North Carolina at Chapel Hill. Poisson regression was used to determine whether body part movement during mask presentation predicts an expert rater's assessment of whether specific fear behaviors are present. Preliminary results suggest movement of the eyes and nose predict both the presence of bodily fear and startle responses with McFadden's R-Squared between 0.2 and 0.4. Ultimately, we hope to develop user-friendly methods of assessing highly complex infant behaviors, which could be deployed to a wide range of research labs.

THE INFLUENCE OF PROBIOTIC TREATMENT ON MATERNAL BRAIN SEROTONIN LEVELS AND POSTPARTUM SOCIOEMOTIONAL BEHAVIORS

Presenter(s): Aneeqa Hasan
Neuroscience, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 1926
Mentor(s): Joseph Lonstein, Taryn Meinhardt

High levels of maternal care and response after birth is pertinent to the survival and normal development of offspring. Investigating the maternal brain using a rodent model allows for a greater understanding of neurobehavioral changes influenced by postpartum depression in human mothers and how it affects their infants. Motherhood causes dramatic neurobiological and behavioral changes, including altering brain size, neurochemistry and the affective state. Using a probiotic treatment, this study aims to determine how perinatal depression can affect levels of serotonin in the maternal brain and how Lactobacillus rhamnosus HN001 used in rodent models can regulate effects of pregnancy stress, caregiving behaviors and gut microbiome. This was conducted by using groups of female laboratory rats exposed to pregnancy stress to induce postpartum depression (PPD) behaviors and also treated with the probiotic treatment to reduce PPD behaviors. After giving birth, depressive-like and maternal caregiving behaviors are assessed, such as grooming and nursing. Brain samples are then collected to process serotonin levels in four brain areas implicated in PPD and fecal samples are collected after sacrifice to examine gut microbiome. The expected outcomes include strong correlations between the effects of HN001 on the maternal brain and measures of brain serotonin at non-stressed levels to prevent effects of pregnancy stress, increased

maternal caregiving after birth and produce healthy maternal gut microbiota. Potential applications related to findings include developing psychobiotic treatments to improve maternal mental health and understanding how gut microbiome may affect neurochemistry within the maternal brain and associated postpartum socioemotional behaviors.

C-FOS EXPRESSION PATTERNS ASSOCIATED WITH INCENTIVE LEARNING

Presenter(s): Jacklyn Staffeld *
Neuroscience, Section 3
Time: 2:30 - 3:45 PM
Presentation Number: 1927
Mentor(s): Jonathan Morrow *

Pavlovian studies have identified an important difference in learning behaviors related to addiction. Some individuals, referred to as sign trackers (STs), become attracted to reward-paired cues such that the cues become reward in themselves. Goal trackers (GTs) learn reward-cue associations, but treat the cues as mere predictors without incentive properties. This makes STs more prone to addiction-like behaviors. In order to measure neuronal activity associated with this incentive learning process, we used a protein immunohistochemistry with intronic fluorescence in situ hybridization (PICIFISH) technique, which distinguished neurons showing c-Fos protein expression activated by food reward from c-Fos intronic mRNA expression activated by a lever-cue in STs versus GTs. This would allow us to identify a pattern of neuronal activity that correlates with incentive properties, as opposed to mere predictive properties, acquired by reward-cues. We expect to find that GTs incentive-related neuronal activity for food rewards but not the lever-cue. will show in contrast, STs will show incentive-related activity for both the lever-cue and the food reward. Because this method allows quantification of multiple brain areas simultaneously, these experiments will result in a "map" of neural activity related to incentive salience attribution, which may later be used to enhance our understanding of human behaviors associated with addiction.

MAST CELL-SEROTONIN INTERACTIONS AS A POTENTIAL MECHANISM UNDERLYING ANTI-ANXIETY EFFECTS OF MAST CELLS

Presenter(s): Robby Teis
Neuroscience, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 1931
Mentor(s): Adam Moeser, Alfred Robison, Natalia Duque-Wilckens

Mast cells (MCs) are known for their involvement in peripheral disease such as allergy, but they are also present in the brain where they can modulate behavior. We recently found that the MC-deficient Wsh/Wsh mice show a phenotype consistent with increased anxiety/anhedonia: they show decreased time spent in the open vs. the closed arms in the elevated plus maze test and reduced sucrose preference. These results suggest that MCs exert anti-anxiety and anti-depressive effects under basal or mild stress conditions. One of the mechanisms by which MCs could reduce anxiety is by modulating the brain serotonergic neural network, as MCs can release molecules that directly affect neural function including cytokines, histamine, and serotonin. Indeed, pharmacological activation or conditional knock-out of MCs affect brain serotonin content, although it is not clear whether this contribution is a direct result of MC serotonin release or MC modulation of neural serotonergic circuits. To start answering this question, here we used a combination of immunohistochemistry and real-time qPCR to thoroughly characterize the dorsal raphe serotonergic system, the largest serotonergic input to brain areas involved in mood regulation, in wild type and Wsh/Wsh mice. Preliminary data suggest that, compared to wild type, Wsh/Wsh mice show less serotonin+ cells, but no differences in serotonin transporter, Tph1, or Tph2 mRNA in dorsal raphe, suggesting that MCs could affect brain serotonin content by modulating serotonin release from neurons.

ROLE OF OXYTOCIN RECEPTORS IN THE SEX-SPECIFIC REGULATION OF SOCIAL BEHAVIOR IN JUVENILE AND ADULT RATS

Presenter(s): Daniela Anderson *
Neuroscience, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 1932
Mentor(s): Abigal Barrett, Alexa Veenema

The oxytocin receptor (OTR) system is a crucial component for the regulation of a broad range of social behaviors in males and females across a variety of species′. Sex differences in OTR binding density in brain regions implicated in the regulation of social behavior can be observed in both juvenile and adult rats. The ventromedial hypothalamus (VMH) is a brain region that is involved in the regulation of social behaviors such as mating and social recognition, in both sexes. In the VMH, adult males have higher OTR binding density than adult females, while adult rats in general exhibit higher OTR binding density than juvenile rats. We sought to determine whether cells that express OTR are recruited in a sex-specific manner following exposure to a social stimulus, specifically in the VMH. To begin, adult and juvenile rats of both sexes were exposed to either a three week old sex-matched rat (social stimulus) for ten minutes or were left alone in their home cage (no social stimulus). Following this, brain sections were processed using fluorescent in situ hybridization which allowed us to examine OTR expression as well as cFos activation (an immediate early gene used as a marker for neuronal activation) within the VMH. The acquired data will provide insight and further our knowledge and understanding of the role of the OTR system in the sex-specific regulation of social behaviors.

INVESTIGATING THE EFFECTS OF CHILDHOOD TRAUMA AND OPIOID USE ON THE REWARD FUNCTION OF THE ANTERIOR MIDCINGULATE CORTEX

Presenter(s): Marissa Cortright
Neuroscience, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 1933
Mentor(s): Travis Baker *

Previous research has shown abnormalities in reward functioning in individuals with opioid use disorder (OUD) and in individuals with a history of childhood trauma. While current OUD treatments tend to focus on cessation of opioid use, individuals with reward and decision making dysfunction are more likely to drop out of treatment programs as well as relapse. Due to this, newer treatments should begin to incorporate neurocognitive deficits and trauma profiles for people struggling with OUD. The anterior midcingulate cortex (MCC) plays an important role in reward valuation when initiating goal-directed behavior, and has also been implicated in trauma and addiction. An event-related brain potential, the reward positivity, can be used as a biomarker of the reward function of the MCC. While previous research has shown a blunted reward positivity in substance use disorder, little is known whether trauma compounds this disorder. Here we present preliminary results of the effects of trauma on the reward positivity in both controls and opioid users. The reward positivity was measured using electroencephalography (EEG) as participants (n = 45) navigated a virtual T-maze to find rewards. We plan to conduct several statistical tests to identify the inter-relationships between trauma, opioid use, and the reward function of the MCC. It is our hope that our results will provide a better understanding of the relationship between trauma and reward functioning in drug addiction and illustrate how future interventions might be individually tailored for specific trauma and neurocognitive profiles.

ROLE OF THE VENTRAL PALLIDUM IN THE REGULATION OF SOCIAL PLAY BEHAVIOR IN JUVENILE RATS

Presenter(s): Elie Huez
Neuroscience, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 1934
Mentor(s): Alexa Veenema, Jessica Lee

Social play is a rewarding behavior that is displayed by juveniles of many mammalian species. Engagement in social play behavior is important for the development of social competencies throughout life. Children diagnosed with neurodevelopmental disorders such as autism spectrum disorder (ASD) show deficits in social play, which may contribute to their life-long impairments. Therefore, it is essential to understand how the brain modulates the expression of typical and impaired social play behavior. In the present study, we aimed to determine the role of the ventral pallidum (VP) in modulating social play behavior in juvenile male and female rats. The VP regulates adult social behaviors such as maternal behavior and pair-bonding, but its role in regulating juvenile social behaviors, such as social play, is unknown. We first determined whether activation of the VP is required for the expression of social play behavior by temporarily inactivating the VP via local infusions of the GABAA receptor agonist muscimol. We found that pharmacological inactivation of the VP decreased social play behaviors in males and females compared to their vehicle-treated counterparts. Next, we determined whether exposure to social play altered neuronal activation of the VP. We observed that exposure to social play increased the number of fos+ cells in the VP of males only. Together, these findings provide the first evidence that activation of the VP is required for the typical expression of social play in both sexes but that exposure to social play recruits VP cells in a sex-specific manner.

SPATIOTEMPORAL EXPRESSION OF LEGUMAIN AND MYELIN-ASSOCIATED PROTEINS AROUND IMPLANTED ELECTRODE ARRAYS

Presenter(s): Nicholas Heelan
Neuroscience, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 1935
Mentor(s): Cort Thompson, Erin Purcell

Implanted neural interfaces enable numerous clinical and research applications but are often hindered by long-term signal instability. The foreign body response (FBR) of the brain to implanted device is suspected to contribute to signal instability. The FBR has been traditionally characterized by inflammation, glial scaring, and neuronal cell death. New RNA-sequencing data from our lab suggests that mechanisms of the FBR are more complex than previously anticipated and that broad spatiotemporal changes in gene expression drive the biological response to implanted devices. We identified genes associated with inflammation (Lgmn) and myelin structure (Plp1, Mbp) which are differentially expressed (DE) following electrode implantation. Lgmn is implicated in inflammation and neurodegeneration and in the context of neurodegenerative disease, Lgmn is known to disrupt myelin via digestion of asparagine bonds in Mbp. Additionally, the cell type specificity, localization, and mRNA-to-protein correlations of these genes have yet to be validated at the device interface. To evaluate the effect of elevated Lgmn on cortical tissues and to determine the spatiotemporal protein expression of Lgmn, Plp1, and Mbp at the device interface we have used immunohistochemistry and quantitative fluorescence intensity analysis to systematically evaluate the protein expression of these genes as well as relevant synaptic markers at key time-points (24 hours, 1 week, and 6 weeks). We believe that the results of this study will expand our understanding of the FBR by evaluating the impact that implantable device have

on nearby myelin structure and potentially identifying Lgmn as a therapeutic target for neural implant longevity.

PROTECTIVE ROLE OF MAST CELLS IN INFLAMMATION-INDUCED PAIN

Presenter(s): Karli Monahan
Neuroscience, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 1936
Mentor(s): Geoffroy Laumet

Chronic pain costs about $635 billion each year in the United States. Inflammation is a significant predictor for developing chronic pain, and targeting inflammation mechanisms offers opportunities for alternative therapeutic intervention. Mast cells are a type of immune cell that regulate inflammation in the skin. To overcome limitations of pharmacological inhibitions, transgenic mouse models are used, where all mast cells are virtually deleted. However, the impact of inflammation on pain in mast-cell-deficient mice remains unknown. We hypothesized that the lack of mast cells will impact the pain response to skin inflammation. To test this, two groups of mice were used: wildtype (WT) with mast cells, and sash (SAH) without mast cells. Both groups received a 5-microliter injection in a hind paw of saline (SAL, control) or complete Freund's adjuvant (CFA) to induce an immune response. Tissue samples were collected, pain sensitivity was monitored, edema was measured, and gene expression of IL1b, IL4, IL6, IL10, TNF, FERC1A, and TGFb was assessed. SAH mice had significantly more pain sensitivity that took longer to subside compared to WT mice. The edema response to CFA was also bigger and longer in SAH mice. qPCR analyses showed that anti-inflammatory cytokines are upregulated in response to CFA but was similar in WT and SAH mice. The lack of mast cells drastically prolongs pain and delays resolution of edema. Therefore, targeting mast cells may provide new strategies to prevent chronic pain, but further studies are necessary to decipher their role.

GREATER MINDFULNESS IS ASSOCIATED WITH LOWER INTERNALIZING, EXTERNALIZING, AND ATTENTION PROBLEMS IN ELEMENTARY SCHOOL CHILDREN

Presenter(s): Pelli Mechnikov
Neuroscience, Section 4
Time: 2:30 - 3:45 PM
Presentation Number: 1937
Mentor(s): Hilary Marusak *

Mindfulness-based interventions are increasingly implemented in school settings. However, empirical research on mindfulness-based interventions lag behind their widespread implementation. Here, we tested whether greater mindfulness is associated with lower internalizing, externalizing, and attention problems in elementary school children. This study included a total of 310 students (grades 2-4; 47% female, 68% Black American, 15% White, 17% Other) recruited from two public suburban schools with the same district and one nearby private school. Mindfulness was measured using the Child and Adolescent Mindfulness Measure. Internalizing (e.g., anxiety, depression), externalizing (e.g., conduct, oppositional defiance), and attention (e.g., ADHD) problems were measured by the Pediatric Symptom Checklist. Overall, greater mindfulness was associated with lower internalizing, externalizing, and attention problem behaviors ($rs<-0.34$, $p's<0.001$). These results remained significant when controlling for gender, grade, and district. Overall boys reported more externalizing problems than girls ($t(308)=2.6$, $p=0.01$), and the association between mindfulness and externalizing symptoms was moderated by gender ($b=-0.1$, $t=3.4$, $p<0.001$) such that boys showed greater reductions in externalizing symptoms with higher mindfulness as compared to girls. There were no other interactive effects with gender, race/ethnicity, district, or grade. These results demonstrate the potential benefits of mindfulness for reducing internalizing, externalizing, and attention problem behaviors among diverse students from

public and private schools at the elementary school level. Boys, in particular, may benefit from mindfulness-based school interventions to reduce externalizing problems. School-based programs that cultivate mindfulness may be beneficial for improving student health and outcomes (e.g., academic performance).

PHARMACOLOGY & TOXICOLOGY

EVALUATING THE EFFECT OF THE SYNTHETIC FOOD ADDITIVE TERT BUTYLHYDROQUINONE ON MURINE B CELL ACTIVATION

Presenter(s): Elizabeth Mateo Pagán *
Pharmacology & Toxicology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2001
Mentor(s): Allison Boss, Cheryl Rockwell, Luca Kaiser

B cell is a type of white blood cell that makes antibodies. B cells are part of the immune system and develop from stem cells in the bone marrow. How tBHQ at different amounts effects B cells. B cells will be activated - look at response - antibody production + markers of activation. In my research project, I will be working with B cells taken from the mouse livers. For this, I will be using the Zombie Aqua which will help me to identify how many cells were alive and how many died after adding the Zombie Aqua. Zombie Aqua is an amine-reactive fluorescent dye that is non-permanente to liver cells but permanent to cells with compromised membranes. This, it can be used to asses live vs. dead status. Work has also been done with the tBHQ. tBHQ is an antioxidant that is used to preserve fatty acids in common foods, we can find it in cooking oils, cookies, frozen fish, cereals.

THE REXINOID V-125 MODULATES IMMUNE CELL PHENOTYPE IN IN VITRO ASSAYS AND IN MMTV-NEU MAMMARY TUMORS

Presenter(s): Matthew Granzotto *
Pharmacology & Toxicology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2002
Mentor(s): Lyndsey Reich

Retinoid X receptors (RXRs) are a class of nuclear receptors that regulate transcription of genes associated with inflammation, proliferation, and apoptosis. Thus rexinoids, pharmacological agonists of these receptors, have significant potential for use to treat cancer. The rexinoid bexarotene is FDA approved for cutaneous T-cell lymphoma and has been tested in clinical trials for metastatic breast cancer. While bexarotene failed to achieve approval for this indication, some patients responded to treatment despite late-stage, aggressive disease. We have made chemical modifications to bexarotene in order to improve its potency and to reduce toxicity. The new lead rexinoid, V-125, is effective for prevention and treatment in the MMTV-Neu mouse model of HER2+ breast cancer. The mechanism of rexinoid-induced tumor regression remains unclear, but rexinoids modulate the immune microenvironment rather than cancer cells. We hypothesize that V-125 skews macrophages from a tumor-promoting to tumor-suppressive phenotype. To test, bone marrow-derived macrophages were skewed toward a tumor-promoting phenotype, treated with V-125, and analyzed by qPCR for changes in expression of genes associated with macrophage phenotype and function, such as iNOS and Arg1. We also will complete immunohistochemical staining on tumor sections from MMTV-neu mice treated with V-125 (100 mg/kg diet for 10 days). Biomarkers will include CD206, a mannose receptor indicative of a tumor-promoting macrophage phenotype; programmed death-ligand 1 (PD-L1), an immune checkpoint protein;

and cleaved caspase-3 (CC3), a marker of apoptosis. Results from these studies will further elucidate the immunomodulatory effects of V-125, a promising treatment for breast cancer.

NRF2 ACTIVATION ALTERS POLARIZATION STATUS OF BONE MARROW-DERIVED MACROPHAGES

Presenter(s): Norma Murillo *
Pharmacology & Toxicology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2003
Mentor(s): Karen Liby

Lung cancer is the leading cause of cancer-associated deaths worldwide, and there is a need for new treatment strategies. The Nrf2 pathway in healthy cells is cytoprotective and contributes to the prevention of malignant transformation. However, cancer cells can utilize the cytoprotective effects of Nrf2 to increase the resistance to chemotherapy and promote cancer cell survival, resulting in poor prognosis. The effects of Nrf2 activation in the tumor microenvironment, particularly immune cells, are underexplored. Macrophages can stimulate the development of tumor progression depending on the environmental conditions. To determine the effects of Nrf2 activation in macrophages from Nrf2 wild-type (WT) and knockout (KO) mice, bone marrow-derived macrophages (BMDMs) were stimulated with LPS and IL-4 and treated with a synthetic activator of Nrf2. LPS stimulation drives BMDMs towards a tumor-suppressive, "M1" phenotype, while IL-4 stimulation drives BMDMs towards a tumor-promoting, "M2" phenotype. Nrf2 activation using the triterpenoid CDDO-Me increased M1 markers and decreased M2 markers in BMDMs treated with conditioned media from lung cancer cells. Another Nrf2 activator, tert-Butylhydroquinone (tBHQ) is a food preservative widely used in western countries and is often ingested at levels higher than FDA recommends. Using tBHQ and other known Nrf2 activators in BMDMs will elucidate the effects of Nrf2 activation in macrophages. This project will help determine if Nrf2 activation in immune cells within the tumor microenvironment will be an effective strategy for the treatment of lung cancer.

EXAMINING THE EFFECTS OF WHEAT VARIETIES ON HEALTHSPAN AND LIFESPAN USING C. ELEGANS

Presenter(s): Champa Danappanavar
Pharmacology & Toxicology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2004
Mentor(s): Jamie Alan

Wheat is an essential food source for billions of people around the world, yet there is limited knowledge on the overall health risks/benefits that wheat strains produce upon consumption. The nutraceutical properties of this abundant and readily available food source can be improved resulting in increased health benefits to those unable to access fresh fruits and vegetables. We will use *C. elegans* as a model organism for this research because it is genetically close to humans, easy to observe in vivo as its body is transparent, and has a lifespan of about three weeks. Our previous data showed that three types of wheat strains produce varying amounts of the free radical hydrogen peroxide (H202). We used these three strains to supplement *C. elegans* to measure the effects of these strains on the lifespan and healthspan (measured by thrashing). Surprisingly, we observed that while there were striking differences in lifespan and healthspan measurements in the strains, these changes did not correlate with the overall H202 levels measured in the worms. Therefore, we hypothesize that these changes may be due to global changes in reactive oxygen species (ROS) rather than a change in one particular reactive oxygen molecule. The experimental design includes using worms expressing a glutathione sensor (Grx1-roGFP2) to measure the overall levels of ROS in the worm. We will supplement these worms with extract from the three wheat strains used

previously. We will then measure the change in fluorescence in Grx1-roGFP2 transgenic worms to measure the overall amount of harmful free radicals. Results from this study will determine the mechanism by which various strains of wheat alter lifespan and healthspan in *C. elegans*.

SOLUBLE EPOXIDE HYDROLASE AND FATTY ACID EPOXIDES AFFECT PARKINSON DISEASE PATHOGENESIS

Presenter(s): Roland E Calderon *
Pharmacology & Toxicology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2005
Mentor(s): Derek Vonarx, Jamie Alan, Kin Sing Lee

Parkinson's disease (PD) is the second most common neurodegenerative disease in the world. Many studies have shown that specific gene mutations and environmental toxins that could play a role in the onset of Parkinson's disease. The creation of Lewy bodies, which promote the degeneration of dopaminergic neurons and contribute to dementia and slow movements, is one of the hallmarks of PD. Lewy bodies are α-synuclein (αSyn) aggregates that build up in the brain. Due to lack of effective treatment, there is an unmet medical need to improve our understanding the pathogenesis of PD. Recent research demonstrated that inhibition of soluble epoxide hydrolase (sEH) which metabolizes endogenous fatty acid epoxides, are beneficial to PD in murine models. Therefore, we hypothesize that sEH and its substrates, fatty acid epoxides play an important role in PD pathogenesis. The overall objective of this project is to investigate how sEH and fatty acid epoxides affect Parkinson's disease pathogenesis. We will use transgenic *C. elegans* that expresses αSyn as a Parkinson's disease model. We will examine their movement (thrashing) at day 9 adult with or without treatment with a sEH-inhibitor, AUDA. We will then use RNA-seq to identify potential beneficial signaling pathways that are triggered by AUDA. The endogenous levels of sEH and fatty acid epoxides are affected by environmental toxicants, like pesticides or antibacterial chemical called triclocarban in personal care product; therefore, our studies will help us to better understand how exposure to environmental toxicants affects the progression of Parkinson's disease.

THE IMPACT OF ADIPOSE TISSUE ON MULTIPLE MYELOMA GROWTH

Presenter(s): Loren Dariana Lopez Rivera *
Pharmacology & Toxicology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2006
Mentor(s): Jamie Bernard

Multiple Myeloma (MM) is an incurable white blood cell cancer that begins when plasma cells, the immunoglobulin producing cells of the bone marrow, develop and grow out of control. Epidemiology demonstrates that obesity is a risk factor for both the incidence and progression of MM. Obesity is associated with an increase in adipose tissue in which the body mass index (BMI) is over the 30 kg/m2. How adipose tissue impacts MM progression has not been fully elucidated. Previous work from our laboratory demonstrated that factors secreted from adipocytes, lipid storing cells of the adipose tissue, stimulate the malignant transformation of epithelial cells. We therefore want to determine if factors secreted from adipose tissue contribute to MM progression. We will test this hypothesis by analyzing the growth of two human MM cells lines, MM.1S and U266B, in the presence or absence of factors secreted from adipose tissue. Understanding how obesity effects MM progression may lead to novel therapeutic interventions or behavioral strategies to slow disease.

OVEREXPRESSION OF ALPHA-SYNUCLEIN RESULTS IN DECREASED COLONIC MOTILITY

Presenter(s): Evan Ziehl
Pharmacology & Toxicology, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2007
Mentor(s): James Galligan

α-synuclein (α-Syn) accumulation and aggregation in the central nervous system in Parkinons's disease (PD) causes cell death of dopaminergic neurons and results in motor deficits. Many patients with Parkinson's disease also have several gastrointestinal (GI) symptoms, the most common of which is constipation. As α-Syn is also found abundantly in cholinergic neurons within the nervous system of the gut, the enteric nervous system (ENS), we hypothesize that overexpression of α-Syn will disrupt cholinergic neurotransmission and result in colonic dysmotility. We will use mThy1-hSNCA and wild-type (WT) littermate mice to measure transmural electrical stimulation on longitudinal smooth muscle contractions in the duodenum, ileum, and proximal and distal colon in the isometric tension isolated organ baths. We anticipate that mThy1-hSNCA mice will have decreased proximal and distal colon longitudinal muscle contractions compared to WT mice. As contractions in the colon are mediated by cholinergic neurotransmission, we predict that an overexpression of α-syn will alter cholinergic neurotransmission. This work supports our previous findings showing that α-Syn plays an important role in modulating enteric neurotransmission.

GNAO1 HAPLOINSUFFICIENT MICE DISPLAY CEREBELLAR DEFECTS WHICH MAY EXPLAIN MOVEMENT DISORDERS

Presenter(s): Alex Roy
Pharmacology & Toxicology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2011
Mentor(s): Erika Lisabeth, Michael Williams, Richard Neubig

Mutations in the gene *GNAO1* are associated with ultra-rare (ca. 200 patients) neurologic abnormalities including movement disorders, epilepsy, and developmental delay. Patients with these mutations often display symptoms at birth or in early childhood. *GNAO1* codes for the alpha subunit ($G\alpha_o$) of the G-protein G_o, which is the most abundant membrane protein in the central nervous system. G_o is activated by a wide array of inhibitory G protein-coupled receptors. Also, $G\alpha_o$ and its corresponding βγ dimer have multiple downstream effects including regulation of cAMP, Ca^{2+} channels, and neurite outgrowth. Our lab developed a *Gnao1*$^{+/-}$ mouse line to mimic symptoms seen in patients with loss of function mutations in *GNAO1*. These mutant mice have reduced inhibitory signaling in the cerebellum, a brain region important for motor learning and movement coordination. We hypothesized that the signaling deficits in *Gnao1*$^{+/-}$ mice are due to fewer cerebellar inhibitory interneurons or reduced functional synapses of these interneurons onto Purkinje cells. Immunofluorescence staining suggests that there are normal numbers of inhibitory interneurons in mutants but reductions in the number of inhibitory synapses. Ongoing studies include additional immunofluorescence experiments to solidify preliminary data and Golgi-Cox staining to measure interneuron arborization. Ultimately, understanding the source of aberrant signaling in the cerebellum of *Gnao1*$^{+/-}$ mice will provide insights into mechanisms of GNAO1 disorders. Work supported by MSU ASPET SURF.

PREDICTING ENDOCRINE DISRUPTING CHEMICALS VIA A HUMAN DERIVED AND METABOLICALLY COMPETENT UTEROTROPHIC ASSAY

Presenter(s): Milady Feijoo *
Pharmacology & Toxicology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2012
Mentor(s): Brian Johnson, Keri Gardner

Human populations are constantly exposed to low levels of endocrine disrupting compounds, including chemicals that disrupt the estrogen receptor signaling pathway. Because low level exposures are unavoidable, determination of which chemical exposures have the potential to disrupt human health is critical to balance risks and benefits. The uterotrophic assay is an in vivo rodent bioassay that is used to estimate a chemicals estrogenic activity. The purpose of this research is to develop a "humanized" in vitro version of the uterotrophic assay. Several in vitro assays are in use to determine estrogenic potential of chemicals, but these models lack the metabolic functions of the liver that often alter chemicals absorbed in the gut. It is known that the liver helps to metabolize fats, drugs, chemicals, and toxins via phase I and II metabolism. Using human liver cells cocultured with uterine cells, we are developing a metabolically competent in vitro uterotrophic assay for drug metabolism and toxicity studies. In a first step toward this goal, we are developing cellular readouts of ER activity in the human uterine Ishikawa cell line including increase proliferation and alkaline phosphatase activity and decrease apoptosis. The work aims to yield more predictive, human specific and metabolically competent in vitro assay to determine the potential of a chemical or its metabolites to disrupt estrogen signaling.

DETERMINING THE EFFECTS OF CLOPIDOGREL ON CEREBRAL BLOOD FLOW IN HYPERTENSIVE MALE MICE

Presenter(s): Maria Rollinger
Pharmacology & Toxicology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2013
Mentor(s): Adam Lauver, Anne Dorrance, Dawn Kuszynski, Laura Chambers

Hypertension is a chronic condition that worsens the cerebral vasculature's ability to constrict and control cerebral blood flow, which is associated with dementia. Hypertension increases the risk of heart disease and stroke in arterial thrombosis patients. Clopidogrel (Plavix) is a common antiplatelet therapeutic prescribed after a cardiovascular incident. Whilst efficacious, clopidogrel is associated with cerebral microbleeds and intracerebral hemorrhage, and its effects on the cerebral vasculature are poorly understood. We hypothesized that hypertension and clopidogrel together contribute to worsening cerebral vascular blood regulation resulting in a decrease in cerebral blood flow, cognitive decline, and an impairment of vasoconstriction. Sixteen 17-week-old C57BL/6 male mice were infused with Ang II (800 ng/mL/min) for four weeks; eight of these mice were orally administered 10mg/kg clopidogrel and the other eight were orally administered vehicle every day for three weeks. An additional sixteen C57BL/6 male mice were kept normotensive with eight of them being treated orally with clopidogrel and the other eight were treated with vehicle. To verify the mice were hypertensive or normotensive, we measured blood pressure twice a week for three weeks. Cognitive function was assessed via novel object tests at. Cerebral blood flow was determined via laser doppler flowmetry. Vascular function was measured in the posterior cerebral artery via pressure myography after euthanasia at 22 weeks of age. All together, these data aid in establishing risk factors leading to adverse bleeding in arterial thrombosis patients treated with clopidogrel.

MACROPHAGE RECEPTOR WITH COLLAGENOUS STRUCTURE (MARCO) PROMOTES LIVER REPAIR FOLLOWING ACETAMINOPHEN OVERDOSE

Presenter(s): Anna-Katherine Fournier
Pharmacology & Toxicology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2014
Mentor(s): James Luyendyk, Lauren Hardy

Macrophages promote repair following overdose of the over-the-counter drug acetaminophen (APAP). Macrophages play a critical role in clearance of necrotic debris from the APAP-injured liver. We tested the hypothesis that macrophage receptor with collagenous structure (MARCO), a scavenger receptor expressed on the cell surface of macrophages, promotes liver repair after APAP overdose. Plasma and liver were collected from wild-type and MARCO knockout (MARCO-/-) mice 24, 48, and 72 hours after challenge with APAP (300 mg/kg) or vehicle (saline). Compared to vehicle-treated mice, MARCO mRNA and protein expression, determined by qRT-PCR and immunolabeling, were upregulated in APAP-challenged wild-type mice at each time point. Hepatic necrosis was increased in MARCO-/- mice compared to wild-type mice 24 hours after APAP challenge, indicated by analysis of hematoxylin and eosin (H&E)-stained liver sections. Persistent liver injury was evident in APAP-challenged MARCO-/- mice at 48 hours, indicated by elevated serum alanine aminotransferase (ALT) levels. To define the precise changes in macrophage phenotype driven by MARCO, we isolated F480+ cells (i.e., macrophages) from livers of wild-type and MARCO-/- mice 48 h after APAP challenge and measured expression of pro-repair genes. Interestingly, expression of one pro-repair gene, Mmp12, was increased, whereas another, Gpnmb, was reduced in the macrophages from the MARCO-/- mice compared to wild-type macrophages. The results indicate MARCO expression increases in the APAP-injured liver and that MARCO deficiency produces sustained hepatic injury after APAP challenge. The results suggest a critical role of MARCO in repair of the APAP-injured liver.

HYPERTENSION IS ASSOCIATED WITH SUSTAINED HPA ACTIVATION AND INSULIN RESISTANCE

Presenter(s): Ireyon Buchanna *
Pharmacology & Toxicology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2015
Mentor(s): Anne Dorrance

Insulin resistance is the most significant risk factor for dementia development, aside from advanced age. Furthermore, hypertension plays a role in the development of cognitive decline due to decreased cerebral perfusion; we hypothesized that hypertension causes insulin resistance. 6-month-old spontaneously hypertensive/stroke-prone rats (SHRSP) (7 male, 8 female) were compared to age-matched normotensive Sprague Dawley rats (6 male, 8 female). Blood pressure was measured using a tail-cuff blood pressure system (CODA-6 Kent Scientific). Steroids were extracted from fecal pellets, and corticosterone was measured using an ELISA (Arbor Assays). Fasting glucose (Freestyle lite portable glucose meter) and insulin (ELISA assay, Mercodia) were measured and used to calculate insulin resistance index using the homeostatic model of insulin resistance. Glucose clearance will be measured using the intraperitoneal glucose tolerance test (IP-GTT). Both male and female SHRSP had higher mean arterial pressure than their normotensive controls ($p < 0.0001$). Male and female SHRSP had higher fecal corticosterone levels than their controls (males, $p < 0.0001$; females, $p = 0.0017$). However, male SHRSP produced significantly more corticosterone than females ($p < 0.0001$). There was no difference in fasting blood glucose between the male hypertensive and normotensive rats. However, female SHRSP had higher fasting blood glucose than controls ($p = 0.0045$). In SHRSP rats, hypertension is associated with glucocorticoid excess and insulin resistance, two factors that often contribute to vascular damage and intensify the

development of dementia. Future experiments will be conducted to determine if hypertension causes glucocorticoid excess and insulin resistance.

THE EFFECT OF PERSISTENT ACTIVATION OF ARYL HYDROCARBON RECEPTOR BY 2,3,7,8 TETRACLORODIBENZO-PARA-DIOXIN ON EXPRESSION OF GENES INVOLVED IN REGULATING DEVELOPMENT OF HUMAN B CELLS

Presenter(s): Luis Colon
Pharmacology & Toxicology, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2016
Mentor(s): Isha Khan, Norbert Kaminski

The immune system is essential for defense of the human body. B cells are part of the adaptive immune system. Hematopoietic Stem and Progenitor cells can differentiate into B lymphocytes. During this process, the development is blocked by persistent activation of the Aryl Hydrocarbon Receptor (AHR) by 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD). This persistent activation of AHR by TCDD treatment suppresses expression of genes leading to a developmental block. This research examines the effect of continuous activation of AHR by TCDD on critical B cell lineage genes. The experiment will be conducted using an in vitro B cell line model (SUDHL-6 cell line). SUDHL-6 cells will be treated with TCDD, and gene expression will be quantified. The hypothesis is that the persistent activation of AHR by TCDD treatment will lead to downregulation of critical genes that are essential for B cell development. Gene expression will be analyzed by measuring mRNA with qPCR.

DETERMINATION OF FOLATE AND COBALAMIN CONCENTRATIONS IN CANINE AND FELINE SERUM BY LIQUID CHROMATOGRAPHY TANDEM QUADRUPOLE MASS SPECTROMETRY WITH REFERENCE INTERVAL VALIDATION

Presenter(s): Makenna Pitchford *
Pharmacology & Toxicology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2021
Mentor(s): John Buchweitz, Justin Zyskowski

Reference intervals (RI) in veterinary laboratory diagnostics are critical for the interpretation of patient test results. Many minute factors impact the overall health and wellness of animals, and the foundation of an accurate diagnosis involves determining precise RI for each laboratory and patient population to account for population-based variance and protocol differences. This research aims to develop and validate a new method of RI calculation and diagnostic testing at the MSU Veterinary Diagnostic Laboratory (VDL) for two analytes involved in digestive health: cobalamin (vitamin B12) and folate (vitamin B9). Concentrations of these analytes are necessary to identify a need for vitamin supplementation or further testing of the alimentary tract and accessory organs. Values outside of the established RI can indicate exocrine pancreatic insufficiency, bacterial overgrowth in the small intestine, and other intestinal diseases. However, the existing method of cobalamin analysis is not accurate enough to measure above 1000 ng/L, and the current feline RI encompasses values from 290 - 1,500 ng/L. The clinical significance of values at the high end or above this range is not known. Samples from feline and canine patients were collected at the MSU College of Veterinary Medicine and split in half for analysis. One part of each sample was sent to the MSU VDL, and the rest was shipped to the Texas A&M Gastrointestinal Laboratory for testing. Results from Texas A&M will be used to validate an improved protocol using LC-MS/MS analysis.

SEX DIFFERENCES IN RESPONSE TO ANGIOTENSIN II IN POSTERIOR CEREBRAL ARTERIES

Presenter(s): Martina Yen
Pharmacology & Toxicology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2022
Mentor(s): Anne Dorrance, Laura Chambers

Cerebral small vessel disease (CSVD) increases the risk of vascular cognitive impairment and dementia (VCID), the second most common type of dementia after Alzheimer's disease. Hypertension is a major risk factor for CVSD as it disrupts the regulation of blood flow to the brain due to impairment of cerebrovascular structure and function. Angiotensin-II (AngII) is known to activate, and eventually desensitize, AT1 receptors on endothelial cells resulting in constriction. Previous studies in our lab found that female mice with AngII induced hypertension had globally reduced cerebral blood flow whereas AngII-hypertensive male mice had decreased blood flow in the parietal region only. We hypothesize that female mice have a decreased tachyphylactic response to AngII compared to male mice. In this study, 16-18-week old C57BL/6 female and male mice were implanted with AngII containing osmotic minipumps (800ng/kg/day). Female mice are resistant to the effects of AngII, therefore a higher dose (1200ng/kg/day) was administered to a group of female mice to increase their blood pressure. Sham mice served as control. Behavioral tests were performed three weeks following minipump implantation. Novel object recognition test was performed to assess non-spatial memory and the novel arm Y-maze was performed to assess spatial memory. Following euthanasia, posterior cerebral arteries were isolated and mounted on a pressure myograph to determine sex differences in the contractile response to AngII, as well as to assess PCA structure. Understanding the sex differences is important for developing specific therapeutic targets to reduce the consequences of hypertension.

DIETARY OMEGA-3 FATTY ACID ATTENUATES SILICA-TRIGGERED AUTOIMMUNE DISEASE IN 16-WEEK-OLD LUPUS-PRONE MICE

Presenter(s): Tasha Scarlett *
Pharmacology & Toxicology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2023
Mentor(s): Jack Harkema, James Wagner, Lauren Heine

Systemic Lupus Erythematosus (Lupus) is an autoimmune disease affecting five million people worldwide. Though a genetic disease, occupational exposures to crystalline silica dust (cSiO2) are associated with lupus flares. We have found that dietary supplementation with an omega-3 fatty acid (docosahexaenoic acid, DHA) prevents cSiO2-triggered autoimmunity and pathology in lungs (ectopic lymphoid structures, ELS) and kidneys (glomerulonephritis) of 8-week-old lupus-prone mice. The present study was designed to test the hypothesis that older mice have even greater pathology after repeated pulmonary exposures to cSiO2, and with less dietary DHA protection. 16-week-old, female, NZBWF1 mice were intranasally instilled once a week for 4 weeks with: 1) saline-vehicle and fed a control diet (VEH/CON); 2) 1 mg cSiO2 and fed a control diet (cSiO2/CON); and 3) 1 mg cSiO2 and fed a DHA supplemented diet. Animals were sacrificed 1 or 5 week(s) after the last instillation. Lung and kidney tissues were processed for light microscopic examination and morphometric analysis. VEH/CON mice had no pulmonary or renal histopathology. cSiO2/CON mice at 5 weeks post-instillation had marked pulmonary ELS and glomerulonephritis, that were more severe than after 1-week. cSiO2/DHA mice had conspicuously less lung ELS and glomerulonephritis than cSiO2/CON mice. 16-week-old mice developed pathologies that were comparable in character and severity to what we have previously observed in similarly exposed younger mice. Likewise, dietary DHA effectively ameliorated cSiO2-triggered lupus

in these older mice. This suggests that age might not be a factor in DHA prevention of occupationally triggered lupus flares.

THE EFFECT OF PEROXYNITRITE ON FIBRINOGEN BINDING TO INTEGRIN EXPRESSED BY THP 1 MONOCYTIC CELLS

Presenter(s): Jackson Tucker
Pharmacology & Toxicology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2024
Mentor(s): James Luyendyk

Fibrinogen is the primary component of blood clots and engages with white blood cells to modify the inflammatory response. Fibrinogen engages with white blood cells via their integrin receptor. During the blood clotting process, the protease thrombin cleaves fibrinogen to form a fibrin polymer or blood clot. This structural change allows fibrin(ogen) to engage with the receptor. During tissue injury, fibrinogen can be modified by an oxidative compound called peroxynitrite (PN) at the site of damage. Prior studies have shown that peroxynitrite inhibits the capacity of fibrinogen to effectively polymerize, but the impact of this oxidative modification on fibrinogen-integrin engagement is unknown. In this study, I tested the hypothesis that PN modification of fibrinogen decreases white blood cell adhesion. To test this hypothesis, tissue culture plates were coated with 10 μg/ml fibrinogen, peroxynitrite-modified fibrinogen, or vehicle (phosphate-buffered saline, PBS), and the adhesion of THP-1 monocytic cells quantified using a fluorescent DNA-detecting dye (Cyquant) after 25 minutes of incubation. As expected, very few cells adhered to wells with PBS. Significantly more cells adhered cells to wells with unmodified fibrinogen. Compared to unmodified fibrinogen, the vehicle saw fewer cells adhere and PN-modified fibrinogen saw a similar amount adhere. In conclusion, the results indicate that peroxynitrite modification of fibrinogen has no significant effect on THP1 cell adhesion. My next step would be to identify the impact of fibrinogen modification on the binding of specific integrins.

UNDERSTANDING HOW THE FOOD PRESERVATIVE TBHQ CAN BE ASSOCIATED WITH TH2-MEDITATED FOOD ALLERGIES IN JUVENILE MICE MODEL.

Presenter(s): Madison Janey *
Pharmacology & Toxicology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2025
Mentor(s): Cheryl Rockwell

In the past few decades, the U.S has seen a rapid increase in food allergy cases, but the cause remains unknown. Recently, Dr. Rockwell has conducted research finding a potential reason for the basis of allergies. There is a possible link between food preservatives such as tert-butlyhydroquinone (tBHQ) and T Cells within the immune system that could be responsible for the development of allergies. While previous studies to examine the role of tBHQ on food allergies have already been conducted on adult mice, our current experiment focuses on juvenile mice because allergies typically arrive in infants. We hypothesize that by developing and characterizing this model of food allergies in juvenile mice, we can then determine the effect of tBHQ and its immune response to food allergens at an early age. The BALB/c mice were fed with 0.0014% tBHQ or control diet (without tBHQ) and were used to produce pups. The pups were sensitized to ovalbumin (OVA) from day 12. Sensitization was conducted by a tape-stripping method to expose skin to the OVA (10mg/mouse) in a 3-day interval six times. The OVA-sensitized pups were challenged by oral gavage with OVA (10mg/mouse). Rectal temperature will be measured. Symptoms will be scored on a scale from 0 to 5 based on severity. Tests are then run for mast cell degranulation in the gut and measurements for

detecting OVA-specific antibodies IgE and IgG1 from the plasma. We expect that the clinical symptoms of the tBHQ group will display a more severe allergic response.

CHEMERIN: WHAT CAN WE LEARN

Presenter(s): Ebube Okpechukwu
Pharmacology & Toxicology, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2026
Mentor(s): Stephanie Watts

Chemerin is a protein found in plasma, the levels at which correlate to obesity and high blood pressure in humans. It is also an adipokine, being made in adipose tissue. Obese humans (BMI > 30 kg/m2) have a greater risk for diseases of non-vascular smooth muscle, including asthma, inflammation, and bladder dysfunctions. Our hypothesis is that chemerin-9 will contract non-vascular isolated smooth muscle (bladder body, stomach fundus, trachea and small intestine), thus contributing to diseases of non-vascular smooth muscle. I performed isometric contractility using the agonist chemerin-9 on organs which serve the above-described dysfunctions from male Sprague Dawley Rat. Organs were placed in a tissue bath system designed to simulate the organs biological environment. Once we validated the tissue was living with a challenge of KCL (80 mM), chemerin-9, an agonist for the Chemerin1 receptor, was added in a cumulative fashion and isometric contraction measured. The following maximum concentration of chemerin-9 (3 x 10 -6 M) normalized to KCl (80 mM) were observed: stomach fundus a three percent cumulative contraction on average, bladder did not cause a contraction with baseline remaining between fifteen and twenty, intestine there was no contraction observed remaining at zero baseline, and trachea no contractions were seen while having a baseline range of two to four. Explanations could include a lack of chemerin-1 receptor in tissues, or that chemerin causes relaxation instead of contraction.

PHYSICAL & MATHEMATICAL SCIENCES

ASSESSING SEISMIC TOMOGRAPHY MODELS OF ALASKA

Presenter(s): Aracely Garcia *
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2101
Mentor(s): Songqiao Wei

Alaska is positioned on a convergent plate boundary, where the Pacific Plate is being subducted underneath the North American Plate, with a convergence rate of 7.8 to 5.5 cm/yr from the Near Islands region to the Gulf of Alaska along the Aleutian-Alaska Trench. The plate movement has resulted in Alaska's mountains, volcanos, and frequently occurring earthquakes at high magnitudes. Seismic tomography images of the upper mantle's seismic structure of Alaska are used to better understand the geological processes in subduction zones, including earthquakes, volcanoes, and crustal deformation in Alaska. By comparing multiple seismic velocity models in this region, we will be able to better understand the earth structure under Alaska to better assess earthquake and volcano hazards.

EMPLOYING NANOPARTICLES FOR THE SYNTHESIS OF LANTHANIDE PNICTOGEN MOLECULES

Presenter(s): Alenis Santiago *
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2102
Mentor(s): Selvan Demir

The incorporation of Group 15 elements into lanthanide-based compounds has predominantly revolved around nitrogen and phosphorous activation which has given rise to unique molecular complexes and multinuclear clusters. The activation of atmospheric nitrogen between metal centers has potential applications in industrial-scale ammonia production as an alternative to the energetically expensive Haber-Bosch process. In addition, the activation of elemental phosphorous may function as an economically and environmentally safer alternative to harsh phosphorous precursors, such as PCl3, which are necessary for the development of phosphate fertilizers. Similarly, the activation of heavier pnictogens such as antimony and bismuth with lanthanides hold promise in the areas of electronics and molecular magnetism, however, this chemistry is hitherto largely unknown. This may be attributed to the generally challenging synthesis and characterization of lanthanide-based compounds. The contracted 4f-orbitals innate to lanthanides mitigate the formation of covalent bonds and typically result in ionic bonding interactions. Importantly, the poor radial extension of the 4f-orbitals may be compensated by the large ionic radius and diffuse p-orbitals of Sb and Bi. Here, the formation and reactivity of new organometallic lanthanide-pnictogen compounds will provide insight into the bonding and electronic structure of the 4f-orbitals. A viable synthetic route to molecular lanthanide-pnictogen compounds will be pursued through the implementation of highly reactive and reducing Sb and Bi nanoparticles.

PRODUCTION OF HYDRAZINE AS A VERSATILE GREEN FUEL BY PHOTOLYSIS OF PLATINUM AMMINE COMPLEXES

Presenter(s): Jessie Lee *
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2103
Mentor(s): Milton Smith, Reza Ghazfar

To address the intermittence of renewable energy sources, hydrogen gas (H2) can be utilized for their storage and transport, which has zero carbon emissions. Storing H2 as ammonia (NH3) is attractive because NH3 liquefies easily, has a high energy density, and already has existing storage and transport infrastructure. However, on-demand conversion of NH3 to H2 and nitrogen gas (N2) is difficult, and aqueous NH3 corrodes electrodes and metallic infrastructure. Using hydrazine (N2H4) instead is a potential solution to these two issues. Converting NH3 to N2H4 specifically is endothermic and thus stores more energy than other N2H4 synthetic processes. Kunkely et al. have written on the only reported metal-mediated version of this conversion, proposing that upon photoexcitation of the coordination complex [PtIV(NH3)4(NH2)Cl]2+, reductive elimination produces N2H4, [PtII(NH3)3Cl]+, and protons. We first synthesized the starting complex, then verified the study by irradiating it and experimenting with detecting N2H4 formation, especially because N2H4 can decompose. N2H4 yields were optimized by assessing the effects of temperature, concentration, pH, and irradiation wavelength. We produced bipyridine analogs of the [PtIV(NH3)4(NH2)Cl]2+ complex to explore how changing electronic effects can increase reaction efficiency and decrease the energy of light required for photoexcitation. Complexes and products were assessed with nuclear magnetic resonance (NMR) and spectrophotometric methods, and the results of these studies will be presented. Optimizing this photocatalysis, isolating N2H4, and incorporating the reaction into a catalytic cycle by regenerating [PtIV(NH3)4(NH2)Cl]2+ from

[PtII(NH3)3Cl] will contribute toward an efficient and scalable hydrazine synthesis for renewable hydrogen storage.

INTERACTIVE AND USER-FRIENDLY METHODS FOR DOCUMENTING CODE

Presenter(s): Isaac Smith
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2104
Mentor(s): Andrew Fullard, Wolfgang Kerzendorf

As computational modeling is an ever-growing part of modern science, scientific modeling codes have the potential to be a great educational tool for the next generation of scientists. In order to unlock this potential, codes must be well-documented. We describe several strategies that can be used to create interactive and user-friendly documentation. These can help a code be used as an educational tool, including having detailed input/output information, tutorials, and code walkthroughs. We discuss good organizational strategies to demonstrate how to make documentation easy to navigate. Finally, we show how these strategies are being incorporated into the Temperature And Radiative Diffusion In Supernovae (TARDIS) Core Package documentation.

SEARCHING FOR DARK MATTER IN DWARF GALAXIES THROUGH NEUTRINO PRODUCTION

Presenter(s): Brandon Pries
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2105
Mentor(s): Mehr U Nisa

Dark matter—a yet-to-be-directly-detected form of non-baryonic matter—is hypothesized to be five times more abundant in the universe than baryonic matter. One of the leading candidate particles for dark matter are Weakly-Interacting Massive Particles (WIMPs), which could potentially annihilate into baryonic matter in astrophysical environments. Among a variety of annihilation outcomes is the production of neutrino/antineutrino pairs, which can be detected by neutrino telescopes like the IceCube Neutrino Observatory at the South Pole. IceCube consists of a cubic kilometer of Antarctic ice instrumented with optical detectors used to detect Cherenkov radiation from neutrino interactions within the ice. Previous IceCube analyses have searched through seven years of IceCube data for signatures of WIMP annihilation from nearby galactic sources. This study seeks to constrain the dark matter annihilation cross-section from dwarf galaxies for dark matter masses up to hundreds of GeV.

STUDY ON TEMPERATURE DEPENDENT SHELL MODEL CALCULATIONS FOR ELECTRON CAPTURE RATES

Presenter(s): Jason-Michael Gabler, Jeremy Rebenstock, Jordan Lesniak
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2106
Mentor(s): Remco Zegers

Core-Collapse Supernovae end the life of massive stars. In order to understand the late evolution of such stars, it is important to describe the nuclear reactions that occur in the core leading up to the astronomical spectacle. Electron captures (ECs) on nuclei play a particular important role in the late evolution. Since EC on many nuclei play a role and temperature-dependent effects are important that are impossible to reproduce in a laboratory, one cannot rely on experimental data only. Instead, theoretical calculations that are guided and benchmarked by experiment are needed. In this work, we present results for EC rates based

on shell-model calculations of Gamow-Teller strengths for nuclei near neutron number N=50 (86Kr, 79Cu, 80Zn). Nuclei in this region have been shown to be particularly important in the late-stage evolution. In particular, the impact of the high temperatures on the electron-capture rates is studied by explicitly including the thermal population of initial states with total angular momentum from 0 to 8, and positive and negative parity. Although such calculations are difficult to complete for a very large number of nuclei, it is helpful for comparison with other theoretical approaches, such as the Quasiparticle Random Phase Approximation. In addition, the shell-model calculations provide a good opportunity to understand the interplay between the reduced population of initial states at higher excitation energy, which reduces the EC rate, and the reduced EC Q-value for initial states at higher excitation energy.

EFFECT OF IRON AND REDOX STATE ON THE POST-PEROVSKITE TRANSITION

Presenter(s): Mikayla Kauinana *
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2107
Mentor(s): Susannah Dorfman

The post-perovskite transition in the most abundant material in the Earth, bridgmanite, has inspired experimental and theoretical studies to understand implications for the D″ seismic discontinuity and the effects of chemical heterogeneity on properties of the lowermost mantle. The pressure conditions at depths of observed seismic discontinuities and an increase in seismic anisotropy are similar to the pressure conditions where the post-perovskite transition in MgSiO3 has been observed in the lab, about 120 GPa. The temperatures and pressures associated with the post-perovskite transition vary as a function of composition, and this is potentially important for mapping thermal and compositional heterogeneity based on variations of the depth of the D″ seismic discontinuity. However, the details of effects of compositions on the transition remain unclear due to differences in experimental methods, challenges in controlling compositions, and discrepancies between studies. The aim of this project is to summarize the results of studies over the past 17 years since the post-perovskite transition was discovered on the effects of iron and oxidation state on this transition. We will present progress towards a literature review including our recent experimental data on oxidized, iron-rich compositions. The resulting review will provide an integrated view of the state of the science on interpreting depth variations in the D″ layer as variations in temperature and composition.

FITTING VELOCITIES TO GPS TIME SERIES ACROSS THE PACIFIC PLATE

Presenter(s): Vanessa Mendoza *
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2108
Mentor(s): Jeffrey Freymueller

Monitoring and studying the motion and behavior of tectonic plates and just the overall processes of Earth are beneficial in preparing its inhabitants of any dangers and any changes. Using precise GPS data to measure tectonic and other motions of sites across the Pacific plate gives people the ability to study tectonic effects, volcanic deformation, seasonal loading, and many other solid earth processes operating on a variety of timescales. All of these different things help see what Earth is doing, at what rate and brings a bigger understanding to how this planet works and operates. Assessing the subsidence rates of a number of Pacific islands and the overall motion of the Pacific plate along with sites relative to the plate would bring a bigger understanding as to what the Pacific plate is doing and its motion. This would be done by estimating site motion models, mainly velocity, from a multi-year time series of positions. Problems that arise from looking at multi-year series are any

earthquakes or any activity that has interrupted the site which causes an offset in the data which was then accounted for and fixed so that there is clean data. So far, the velocities are being assessed to see the overall motion of the Pacific plate, any sites relative to it and any subsidence that occurs in any of the Pacific islands.

LEVEL DENSITY OF STATES IN 118SB

Presenter(s): Charles Hultquist
Physical & Mathematical Sciences, Section 1
Time: 2:30 - 3:45 PM
Presentation Number: 2109
Mentor(s): Remco Zegers

A good understanding of nuclear level densities is important for estimating the rate of several types of reactions that are important in astrophysical phenomena. However, the extraction of level densities from experimental data is not straightforward, especially at higher excitation energies, where the density is high and the level spacing is smaller than the experimental resolution. In this work, the level density of states in 118Sb are extracted with a fluctuation analysis by using results from a high-resolution (30 keV FWHM) 118Sn(3He,t) experiment at E(3He)=420 MeV, performed at the Research Center for Nuclear Physics (RCNP) in Osaka, Japan. The level densities are determined by studying the autocorrelation function obtained from the experimental spectra. The backgrounds in the spectra were determined and subtracted by using a discrete wavelet transformation analysis of the spectra with a normalized biorthogonal wavelet. The analysis is performed for spectra at different scattering angles to investigate the effects of contributions from states of different multipolarity, which are preferentially populated at different scattering angles. Parameters in fluctuation analysis and discrete wavelet transform are varied to understand the error present in the analysis.

ONE-POT CYANATION OF PYRIDINES VIA AN IRIDIUM-CATALYZED C-H BORYLATIONS

Presenter(s): Cliff Yang *
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2111
Mentor(s): Robert Maleczka (), Thomas Oleskey

The invention of new synthetic methodologies that reduce the use of halogenated reagents and the number of steps in chemical reactions is an essential part of the field of green organic chemistry. Past work by Hartwig has shown that one-pot cyanation of arenes is feasible through a borylated intermediate generated by iridium catalyzed C-H borylation. The regiochemistry of the borylation reactions in these reactions is directed by sterics, opposed to electronic directors, allowing for the facile synthesis of products not easily accessible through other methods. Once the boronic ester is added, the conversion of the boronic ester to the nitrile can be achieved. This direction coupled with the ease of functionalization of boronic esters allows for a straightforward path to 3-cyanated pyridines. In this work, a straightforward route to 3-cyanopyridines will be shown via the one-pot cyanation, which will be expanded to pyridine substrates with various functional group substituents. An iridium catalysts will be used to selectively borylate the three position of pyridine rings after which the introduced boronic ester will be converted into a nitrile. NMR and GC-MS spectroscopy will be used to identify the products isolated by column chromatography. Once optimized for pyridines, this one-pot synthesis will allow the direct conversion of a C-H bond on a pyridine to a nitrile. The of the synthesis will be reported along with isolated products and yields.

COMPARATIVE ELECTROCHEMICAL CHARACTERIZATION AND CORROSION RESISTANCE OF HOT MELT AND ADDITIVELY MANUFACTURED ALUMINUM ALLOYS: 6061 AND 7075

Presenter(s): Gynesis Vance *
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2112
Mentor(s): Greg Swain

The emerging field of 3D printing (or additive manufacturing) is an environmentally friendly and cost-effective method for producing metal alloys. Additive manufacturing (AM) can produce complex geometries and reduce material waste in comparison to traditional hot melt alloy production. However, it is important to note any changes in the physical, mechanical and or electrochemical behavior of the AM material compared to the wrought or die cast alloy counterpart. Understanding a material's behavior for practical use, through its mechanical functionality, electrochemical behavior, or resistance to corrosion all serve as useful modes to compare the processes. The focus of this research is on the electrochemical behavior of aluminum alloys AA7075 and AA6061 to understand their corrosion. This study compares the electrochemical properties of traditional wrought aluminum alloys with those prepared by fused filament fabrication. The wrought and AM alloys were electrochemically tested in a solution of 0.5 M Na2SO4 + 0.01M NaCl using open circuit potential - time curves (OCPT), linear polarization resistance (LPR) measurements, and potentiodynamic polarization curves. These tests provide useful insight on the corrosion resistance of the two alloy types through various electrochemical parameters including the corrosion potential (Ecorr), the polarization resistance (Rp) or resistance to general corrosion. Potentiodynamic polarization curves provide information on the rates of anodic and cathodic reactions as a function of potential. The resulting data from these measurements can be used to learn about the electrochemical behavior of AM and wrought AA6061 and AA7075 alloys.

ELECTROCATALYTIC LIGNIN DEPOLYMERIZATION

Presenter(s): Isaac Spackman *
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2113
Mentor(s): James Jackson, Zhen Fang

Sustainable chemistry demands a shift from petroleum feedstocks in the production of small molecules and a transition to more renewable energy sources. Lignin, a large macromolecule found in trees and a byproduct of the paper and pulp industry, presents a possible solution. As the largest source of natural aromatics and second most abundant biopolymer, lignin has great potential as a renewable carbon feedstock for industrial chemicals and biofuels, yet several obstacles restrict the path to lignin valorization. Perhaps foremost among these is lignin depolymerization, in which lignin is converted from a large polymer network into phenolic monomers, dimers and oligomers; many strategies target the β-O-4 bonding structure, which accounts for 50-60% of lignin polymer crosslinks. Electrochemistry provides a green approach to depolymerization, with a comparatively small environmental impact relative to traditional chemical techniques. However, electrochemical methods are limited by substrate diffusion to the electrode surface, a particular problem when dealing with large polymers such as lignin. Employing a redox mediator to act as a small diffusible intermediate offers a tractable solution to this constraint. Further, existing electrochemical strategies have focused primarily on oxidative reactions at the anode, with limited reports of cathodic depolymerization schemes. In response to this gap in the literature, we report herein a study of the electrocatalytic activity of an reductive redox mediator in the depolymerization of a β-O-4 lignin analog in a divided cell.

BINDING ACTIVITY OF PER- AND POLYFLUOROALKYL SUBSTANCES TO A HUMAN THYROID-PRODUCED PROTEIN

Presenter(s): Catherine Saunders *
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2114
Mentor(s): Angela Wilson

Per- and polyfluoroalkyl substances (PFASs), also referred to as "forever" or "zombie" chemicals, are man-made organic molecules consisting of carbon-fluorine bonds so strong that they do not break down in the environment. They are toxic to humans and aquatic life and are suspected carcinogens. Their persistence in the environment and contamination of water supplies is a current societal problem. Due to their unique properties, such as repelling water, PFASs were once used in products including non-stick pans, firefighting foam, clothes, and furniture. However, in recent years, a number of PFASs have been linked to human health issues and - as forever chemicals - they persist in the human body and the surrounding environment. PFASs have been linked to thyroid problems; therefore, this study used molecular dynamics (MD) to investigate the binding of different PFAS molecules to human thyroglobulin - a protein produced by the thyroid gland. Through the use of MD, the most likely binding sites, ligand conformations, and binding energies are determined for each thyroglobulin-PFAS complex tested. The purpose of this study is to better learn how certain PFAS molecules interact with the thyroglobulin protein and explore a possible mechanism through which they may create thyroid issues. Ultimately, this MD analysis can be used in the future to further investigate how PFASs react in the body.

SEARCHING FOR LOW ENERGY PROTONS FOLLOWING THE BETA DECAY OF 32AR

Presenter(s): Logan Schaedig
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2115
Mentor(s): Christopher Wrede

The decay of 32Ar is one of the most thoroughly documented beta-delayed proton emitters, and we have acquired data on this decay to expand beyond our existing knowledge using the Gaseous Detector with Germanium Tagging (GADGET) at the National Superconducting Cyclotron Laboratory. The unprecedented sensitivity to low energy protons provided by GADGET's Proton Detector enables us to improve precision constraints on nuclear structure models and fundamental symmetries of physics. The data set also allows us to set the first upper limits on the intensities of unobserved low energy protons. The current status of the data analysis will be presented.

BETA DELAYED GAMMA DECAY OF 32AR

Presenter(s): Evan Argo
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2116
Mentor(s): Christopher Wrede

Positron decay of 32Ar can be used to precisely study nuclear structure and search for physics beyond the Standard Model. Data from positron decay of 32Ar was collected at the National Superconducting Cyclotron Laboratory (NSCL) using the Gaseous Detector with Germanium Tagging (GADGET) system. This study's goal is to analyze the gamma rays emitted from 32Ar following positron decay. The high-resolution of the germanium detectors within GADGET allows us to gain a better understanding of the decay scheme of 32Ar in addition to searching for any coincidences between low energy proton and gamma decays.

BE AND LI ION PRODUCTION VIA LASER ABLATION FOR EXPERIMENTS TO INVESTIGATE THE NATURE OF THE NEUTRINO

Presenter(s): Dakota Keblbeck *
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2117
Mentor(s): Matthew Redshaw *

The investigation of neutrinos is an important part of understanding physics beyond the Standard Model. One experimental approach, beta decay studies, provides information on the particle nature of the neutrino, its absolute mass, and on the existence of sterile neutrinos. These types of experiments often require precise Q values of the beta decays, to aid in analyzing and interpreting results. One example is the BeEST experiment, which uses the electron capture decay of 7Be, to search for signatures of keV scale sterile neutrinos. Penning trap mass spectrometry (PTMS) is the most precise method for determining the Q value, by measuring the mass ratio of the parent and daughter atoms. A key part of PTMS experiments is the successful implementation of an efficient and reliable ion source. At Central Michigan University, we are investigating our laser ablation ion source as a means of producing 9Be and Li ions, for future CHIP-TRAP experiments that aim to measure the 7Be Q value more precisely. More specifically, we are investigating 9Be+ ion production using a solution of beryllium dissolved in HCl and dried out on a backing target material. This will act as a proxy for the suggested method of producing 7Be+ ions from the available 7Be from the National Isotope Development Center.

MEASURING STRESS STATE IN A RUBY FILM

Presenter(s): Bella Arroyo *
Physical & Mathematical Sciences, Section 2
Time: 2:30 - 3:45 PM
Presentation Number: 2118
Mentor(s): Susannah Dorfman

Ruby gemstone is a tool that is useful to high pressure geoscience, materials science, and physics because of its strong stress-dependent fluorescence. This fluorescence allows us to measure stress conditions during experiments to replicate Earth's interior conditions and understand how these conditions affect the materials in the layers of the Earth. To understand deformation in the Earth, we need to create and measure not only pressure but also shear. This research will explore the usage of the ruby thin technology to calibrate nonhydrostatic stress using laboratory benchtop spectroscopy. The combination of quasi-hydrostatic pressure generated in a diamond anvil cell and nonhydrostatic stress generated by thin film technology was tested to control a wide range of stress conditions. We analyzed the spectroscopy dataset to produce a spreadsheet and figures on the stress state in the ruby film. Results may be used to control and measure elastic and plastic stress and strain related to tectonic and mantle dynamics. The significance of understanding high pressure and the calibration needed, is to replicate the right calibration of stress and pressure without the use of heavy machinery or synchrotron facilities.

PLANT SCIENCE

PREDICTIVE MODELING OF DROUGHT RESPONSES IN SORGHUM

Presenter(s): Maxwell Harman *
Plant Science, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2201
Mentor(s): Jeremy Pardo, Robert VanBuren

Drought is the single largest abiotic factor limiting crop yield and quality globally. Despite substantial advances in understanding the genetic basis of drought tolerance, the inability to identify and predict drought-tolerant phenotypes early in development significantly inhibits breeding efforts, increasing time, labor, and land needed to develop improved cultivars. To address this, this project aims to outline molecular signatures at the seedling stage by identifying genes and regulatory networks associated with drought responses in the important cereal crop, sorghum. We collected physiology and RNAseq-based expression data in triplicate from leaves across a diverse twenty-five accession panel under drought and well-watered conditions. Using differential gene expression analysis, we compared each drought transcriptome pair-wise against its well-watered condition as well as against each of the other accessions and found statistically significant associations between gene expression and drought condition. These associations were used to create predictive models attempting to identify crop physiological response to drought given only transcription data. Identifying drought tolerance predictors can provide more precise strategies and earlier prediction and selection in traditional crop breeding programs and identify promising sites for direct genetic modification. Using these strategies, the development of next-generation drought-tolerant crop varieties could be some of agriculture's greatest tools in the effort to feed a growing world with a changing climate.

UNDERSTANDING TERPENOID PERMEABILITY THROUGH BIOLOGICAL MEMBRANES VIA MOLECULAR SIMULATION

Presenter(s): Mykayla Miller *
Plant Science, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2202
Mentor(s): Josh Vermaas

Terpenoids are small molecules produced by plants for defense, signaling, energy production, and other functions. Industrially, naturally occuring terpenoids are used fragrance production, pharmaceutics and as a natural insecticide. Despite their ubiquity in plant systems, it remains unknown how plants control terpenoid localization. For other small molecules, plant cells maintain transport proteins that control compound compartmentalization. However, for general terpenoids, these transport proteins have not been identified, and so it has been hypothesized that terpenoids may cross biological membranes passively. Through molecular simulation, we are studying membrane transport for three selected terpenoids from among the many made by members of the Lamiaceae family. To evaluate the effect of membrane composition on permeability, we simulate the terpenoids in two membrane models from sorghum and yeast. After system construction using CHARMM-GUI, each membrane model was solvated with water with the terpenoid compounds added to the aqueous phase. The built membranes were simulated using the molecular dynamics engine NAMD. 1 We observe from the resulting trajectories that the terpenoids permeate freely through these membranes without a transporter. Moreover, the permeability is observed to be greater for plant-like membrane systems when compared against our animal-like membrane model from yeast. These findings suggest that plant systems have harnessed the perfect molecules for signaling purposes, in that they are readily transportable with minimal energy input.

MODELING THE STRUCTURE AND FUNCTION OF ABC1 KINASE AND FBN IN ARABIDOPSIS PLASTOGLOBULI

Presenter(s): Joel Landa *
Plant Science, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2203
Mentor(s): Peter Lundquist

Plastoglobuli (PGs) are lipid droplets that appear on chloroplast thylakoid membranes. PGs have been shown to increase in size and number when a plant is challenged with abiotic or biotic stress and during certain developmental stages. Despite continuity with the thylakoid, they harbor a unique proteome including abundant ABC1 atypical kinase and the Fibrillin (FBN) protein families. The ABC1 kinases likely play a central role in regulation of PG protein function although kinase activity has not been conclusively shown. The FBN family of structural proteins is likely responsible for when and where PGs are formed and for their dynamic morphology. Phosphorylation sites in PG-localized proteins from Arabidopsis thaliana were analyzed using Multiple Sequence Alignments. Patterns in these sites that could link proteins to regulation by the ABC1 atypical kinase family have been identified. Using homology modeling tools, predictions of 3D structure for the FBN proteins and PG proteome Phosphorylation sites have been generated. These predictions will be used to identify structural patterns linked to functions unique in the PG. These models will then be used in molecular docking simulations to hypothesize lipid binding mechanisms of experimentally-demonstrated lipid binding events in FBNs. These analyses will shed light on the mechanisms of regulation of the PG proteome by the ABC1 kinases and the formation of the PG by FBNs. PGs appear to play an important role in plant stress response. Understanding the mechanisms behind this response has applications in agriculture that will be vital in the context of combatting a warming climate.

IDENTIFICATION OF CONSERVED ABIOTIC STRESS RESPONSES IN POACEAE

Presenter(s): Catherine Zhao *, Michael Voyt *
Plant Science, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2204
Mentor(s): Chad Niederhuth

Increasing agricultural demand has led to expansion beyond the native growing regions of many crops. This, in addition to climate change, presents environmental stresses in the form of temperature extremes, drought, and salinity. Stressors such as these challenge growth and development, and lead to reduced harvests. Resistance mechanisms have evolved in different crops species and the Poaceae family is particularly resilient. Grains, members of Poaceae, are also among the most agriculturally important crops worldwide, and thus our study will focus on members of this family. Inter- and intraspecies genomic and epigenomic comparisons will be used to study resistant traits and elucidate their molecular basis. RNA-seq data will be used to determine differentially expressed genes. Furthermore, Assays for Transposase-Accessible Chromatin (ATAC)-seq data will also be incorporated to infer regulatory sites for genes of interest. Furthermore, the identification of orthologous genes across species will aid in identifying conserved core stress response elements and contributes to our understanding of the evolution of important agricultural traits. The information generated from this study will create a resource for breeders, enabling better breeding and genetic engineering of highly resistant crops to increase the reliability of global food sources.

EFFECT OF CLIMATE CHANGE ON THE CIRCADIAN CLOCK OF SOLANUM SPP. PLANTS

Presenter(s): Maria Santiago *
Plant Science, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2205
Mentor(s): Ann Feke, Eva Farre

Most organisms depend on their environment to coordinate their physical and chemical processes. Circadian rhythms give many organisms the evolutionary advantage of being able to anticipate changes in environment such as light and temperature in order to generate physiological and biochemical responses in advance. These are daily rhythms and are driven by endogenous processes in the organism. Photoperiodism is a set of processes that allow plants to carry out regulation of their biological functions using the number of hours they are exposed to light. An abrupt change in temperatures and weather patterns due to climate change would cause a decrease in the ability of the circadian clock to anticipate and respond appropriately to environmental stimuli. In plants, the circadian clock is part of processes such as control of metabolism, growth, development and stomatal aperture. We will evaluate the growth rate in wild species of Solanum section Petota. Several wild species of the Solanum were obtained from different geographical localities and were periodically photographed by time-lapse for one week. For automatic image processing, we will use the Python package scikit-image in order to segment the plants from the background and identify features of interest, such as the total plant area and the leaf length. We will relate the growth rate with the circadian clock according to the geographical origin of the species evaluated. The knowledge and relationship between the circadian cycle and growth in crop plants represent an advance in the knowledge for the hybridization of plants in order to improve their crop yield.

TEACHING COMPUTERS TO LOOK AT LEAVES

Presenter(s): Cassandra Hernandez *, Emely Mendez *, Hannah Kimbrough *
Plant Science, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2206
Mentor(s): Daniel Chitwood, Margaret Fleming, Marjorie Weber

Grapevine leaves include the blade and veins. The blade of a leaf is the flat, broad part of the leaf where photosynthesis occurs, and the veins form the vascular network. Both are important structures that can be used to measure the shape of a leaf and they are easy to see with the human eye. However, measuring leaf shape manually can take a lot of time. Computers could help identify the veins, blades, and other structures of grapevine leaves, as well as functional structures like domatia (white, hairy filaments on the underside of the leaf where insects live) to statistically measure large numbers of grapevine leaves for genetic and ecological studies. Image analysis was performed on a large number of leaves to manually mark domatia, but at the same time the data marked the location of veins, since domatia are located at the axels of the veins. All the data will be collected and used to train a computer program to classify pixels as blade, vein, or domatia. Such a machine learning model can help others in the future with leaves from different species and identifying additional structures. For the final results, we hope to see if a computer can take random, unmarked leaves and assign probability values to classify structures as vein, blade, or domatia.

LEAF MORPHOMETRIC ANALYSIS TO DISTINGUISH IMPATIENS CAPENSIS FROM IMPATIENS PALLIDA

Presenter(s): Stephanie Lugo *
Plant Science, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2207
Mentor(s): Rachel Toczydlowski

The genus Impatiens is formed by a group of flowering plants well known for their bright colored blooms. Impatiens capensis (orange jewelweed) and Impatiens pallida (yellow jewelweed) are seasonal plants that can both be found in the Eastern part of the United States. They share many morphological characteristics and can only be distinguished by the color of their flowers. These similarities make it difficult to differentiate between the two species when their flowers are not in bloom. A previous study in the state of Wisconsin showed differences in leaf shape, size, and color between the two Impatiens species. We expanded on this by collecting leaves via mail from citizens in different states with the goal of proving if the differences can be observed through out the entire range of the species.

TEACHING COMPUTERS TO DETECT DOMATIA

Presenter(s): Hannah Kimbrough *
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2211
Mentor(s): Daniel Chitwood, Margaret Fleming, Marjorie Weber, Sourabh Palande

Domatia are barely visible (1mm or less in diameter) chambers that are located in vein axils on leaves in many woody plant species. Although domatia are very diverse across plant species, Vitis (grapevine) domatia are typically observed as dense hairy projections that function to house mites that can prevent infestations of pathogenic fungi and herbivorous predators. In order to understand the genetic basis underlying the development of domatia, and their size, shape, and location across Vitis species, we marked the size and location of domatia in grapevine leaves using the image processing program Image J. Using Python, we will develop computer vision algorithms to probabilistically detect domatia on leaves. These data will be used in future studies to determine when and where during leaf development domatia arise so that tissue samples to perform gene expression analysis to determine what gene(s) contribute to domatia expression can be more precisely collected. Understanding when and where domatia arise during grapevine leaf development, and subsequent gene expression studies, will contribute to developing new breeding strategies to improve grapevine survivability to disease and climate change by recruiting beneficial mites.

COMPARATIVE GENOMICS OF STRESS RESPONSES IN GRASSES

Presenter(s): Catherine Zhao *, Michael Voyt *
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2212
Mentor(s): Chad Niederhuth, Robert VanBuren

Environmental extremes, such as cold, heat, flooding, and drought, place enormous stress on plants that can result in considerable losses in crop yield and quality. To respond to stress at the transcriptional and physiological levels, plants deploy dozens of coordinated mechanisms to survive adverse conditions. Identifying the molecular and evolutionary responses of plants to these stressors is key to understanding the mechanisms of plant adaptation and ultimately to engineer climate resilience. This project will use transcriptomic, comparative genomic, and epigenomic approaches to identify genetic elements underlying stress responses of agriculturally important grasses in the Poaceae family. RNAseq and transposase-accessible

chromatin with high-throughput sequencing (ATAC-seq) data will be analyzed using differential expression analysis (DESeq) and compared to identify changes in gene expression and open chromatin associated with abiotic stress responses. Gene ontology and other annotation data will be used to functionally characterize genes of interest. Finally, these stress responsive genes and regulatory elements will be compared across species and different stresses in order to identify conserved and unique responses. The genes and regulatory regions identified in this study could be used to improve stress tolerance in crops, which is especially important as abiotic stressors are increasing in severity and variability due to climate change.

AN INVESTIGATION AND VALIDATION OF ORIGINS OF CONSERVED NON-CODING SEQUENCE VARIATION IN GLOBAL ARABIDOPSIS THALIANA POPULATIONS

Presenter(s): Robert Flinn *
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2213
Mentor(s): Alan Yocca, Patrick Edger

Conserved non-coding sequences (CNS) have been the subject of many studies recently as they are often home to transcription factor binding sites. These sequences, identified through alignment, have at times been conserved for millions of years, while also showing great variation within accessions of a single species. Here we examine thirty different accessions within the species Arabidopsis thaliana, in order to gain a better understanding on their impact on phenotypic expression and the reason for their conserved nature. Within this study we leverage phylogenetics to identify high confidence shared variance across accessions which are likely tied to phenotype. These phenotypes are examined via GO enrichment to better understand their role in the greater genetic network of A.thaliana and serve as a possible model for their role in other plants.

GENETIC MARKER ASSISTED SELECTION (MAS) OF SORGHUM

Presenter(s): Alexander Spanoudis *
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2214
Mentor(s): Addie Thompson, Robert Shrote

Sorghum is an important cereal widely cultivated throughout the world. Sorghum possesses significant natural genetic variation and a database of annotated seedling transcripts making it an ideal model for genetic study. Using hand harvesting and drone cameras to collect data, we can measure sorghum's natural variation on a large and efficient scale. This project aims to find associations between genetic markers and phenotypic traits through a GWAS (Genome wide association study). My research project is using computational code and bioinformatics to find strong relationships between SNPs (single nucleotide polymorphisms) and the traits Sorghum expresses in an agricultural field. Genes associated with these target SNPs of interest can then be investigated in a biotechnology lab to validate the function these genes preform. The long-term goal of this project is to identify gene loci of interest that influence crop yields, harvest times, and other central behaviors that affect the agriculture business. Once identified, unique genetic markers like SNPs offer many applications for gene selection, such as SNP array genetic testing.

ASSEMBLING A TRANSCRIPTOME TO IDENTIFY TERPENE SYNTHASE AND CYTOCHROME P450 CANDIDATES IN SALVIA AND COLQUHOUNIA

Presenter(s): Silas Motyka *
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2215
Mentor(s): Bjoern Hamberger, Davis Mathieu

Terpene synthases (TPS) synthesize terpenes, which are chemically, and structurally diverse compounds used in general and specialized plant metabolism. Terpenes play a crucial role in attracting pollinators and deterring predators while also having industrial applications as flavors, fragrances, and therapeutics. All terpenes are derived from 5-carbon building blocks, dimethylallyl diphosphate (DMADPP) and isopentyl diphosphate (IDP). DMADPP and IDP form multiple classes of terpenes; including, sesquiterpenes (C15), diterpenes (C20), and triterpenes (C30), which are further modified by cytochrome P450s. Terpenes are precious compounds, creating a need to identify TPSs and P450s in plants. TPSs have been identified in numerous plants, including herbs, citrus fruits, teas, and eucalyptus. This project will investigate Salvia aethiopis, Colquhounia coccinea, and Salvia dominica, which produce terpenes, yet have minimal TPS and P450 annotation. By analyzing RNAseq data from these three species, a transcriptome with terpene synthase and cytochrome P450 candidates will be assembled. Specifically, a pipeline is being designed that pre-processes the RNAseq data by performing quality checks on raw reads with FastQC, trims low quality reads with Trimmomatic and fastp, aligns these reads with SPAdes, and BLASTs these contigs to known TPS and P450 genes from other species. This pipeline will build an annotated inventory of terpene synthase and cytochrome P450 candidates in salvia and colquhounia. The goal is to create a phylogeny of TPSs from these candidates, ultimately isolating and cloning these TPS and P450 genes into a host system to synthesize terpenes.

A DETAILED ANALYSIS OF ISOPRENE RESPONSIVE GENES IN ARABIDOPSIS THALIANA EXPRESSING ISOPRENE SYNTHASE

Presenter(s): Joevensky Seme *
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2216
Mentor(s): Sarathi Wijetilleke, Thomas Sharkey

Isoprene is a volatile hydrocarbon produced by some, but not all plant species. Isoprene synthesis takes place in the chloroplast where dimethylallyl diphosphate produced by the methylerythritol 4-phosphate (MEP) pathway is converted to isoprene by an enzyme called isoprene synthase (ISPS). Isoprene has been shown to protect plants from biotic and abiotic stress. However, the underlying mechanism of action of isoprene remains to be investigated. Previous research has shown isoprene can alter gene expression in plants. The current research was carried out to understand in detail which genes are responsive to isoprene and whether isoprene effects on gene expression vary depending on the growth phase of the plant. The model plant Arabidopsis thaliana engineered to express a Eucalyptus globulus ISPS was used in this study. Leaves were harvested from vegetative, flowering, and senescing stages of the life cycle of two non-isoprene emitting Arabidopsis lines, wild-type Columbia (Col-0) and empty vector (EV-B3), and two isoprene emitting lines, B2, and C4. Leaf RNA was extracted followed by RNA-seq analysis. RNA-seq data collected from isoprene emitting and non-emitting Arabidopsis was analyzed to identify isoprene responsive genes belonging to: growth regulator biosynthesis and signaling pathways, transcription factors, specific stress signaling pathways, and membrane and receptor proteins. By looking at the changes in gene expression, I hope to provide insights on the genes that are affected by isoprene and how isoprene responsive gene expression changes depending on the growth phase of the plant.

Overall, these findings will help us understand different genes that are involved in the isoprene signaling pathway.

DEVELOPMENT OF RAPID MOLECULAR DIAGNOSTICS TO SCREEN FOR HERBICIDE RESISTANCE IN MICHIGAN WEED SPECIES

Presenter(s): Rachel Hadvina
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2217
Mentor(s): Eric Patterson, Erin Hill, Jinyi Chen

The evolution and development of herbicide resistance in weed species has clear impacts on agriculture and is a continuous problem on farms. Traditionally, the natural selection of herbicide resistance by plants is avoided by rotating herbicide methods, using herbicides with different mechanisms and sites of action. Accurate herbicide resistance diagnostics allows for well-informed decisions to develop weed management strategies in fields. However, traditional resistance diagnostic methods can be time and space consuming. Herbicide dose-response assays, used to screen plants for resistance, may take six months or more to complete and require a great deal of space in a greenhouse. An alternative to traditional resistance diagnostic screening is molecular diagnostics, which can reduce the time and space required to screen weeds for herbicide resistance. Two target genes for herbicide resistance in 5 weed species common in Michigan were used to design molecular diagnostics. Single nucleotide polymorphisms in the acetolactate synthase (ALS) gene and copy number variation (CNV) the 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) gene are known to cause resistance in plants. The development of rapid molecular diagnostics to screen for resistance involved the designing of molecular assays to address known mechanisms of resistance in the ALS and EPSPS genes; collection of susceptible and resistant plant tissue; extraction of high-purity, high-throughput DNA from tissue samples; and the performance and streamlining of developed molecular assays via polymerase chain reaction (PCR). Assessment of the molecular assays demonstrated the binding of PCR primers for both EPSPS and ALS gene amplification to the sample DNA.

REGULATORY MOTIF ANALYSIS OF CHT7 TARGET GENES IN THE CELL CYCLE REGULATION OF CHLAMYDOMONAS

Presenter(s): Aikaari Ryce *
Plant Science, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2218
Mentor(s): Christoph Benning, Yang-Tsung Lin

Green algae have long been considered a promising source for biofuel feedstock production. Studying green algae on a molecular level will allow individuals to better understand how algae regulate the accumulation of these high-value compounds. In microalga Chlamydomonas reinhardtii, the metabolic status-dependent accumulation of lipids is correlated with the cell cycle to optimize energy utilization for cell growth and proliferation. For instance, Chlamydomonas cells under nitrogen-deprived conditions enter a long-term resting state called quiescence, where cells stop dividing and accumulate energy storage lipids like triacylglycerol to survive the environment. In 2014, a Chlamydomonas gene encoding the COMPROMISED HYDROLYSIS OF TRIACYLGLYCEROLS 7 (CHT7) protein was reported to mediate the transition between a normal cell division cycle and the nitrogen deprivation-induced quiescence. To investigate the role of CHT7 in the transcriptional regulation of the cell cycle, the Benning lab recently performed an RNA-sequencing analysis to compare the transcriptomes of synchronized wild-type (control 1), CHT7-HA::cht7 (control 2; complementation line), and cht7 mutant cells at different stages of the cell cycle. The result showed that most genes in cht7 exhibited transcription profiles similar to the control strains.

However, genes for specific cell division activities such as DNA replication and mitotic entry were abnormally activated in the cht7 mutant at the non-cell dividing stages. This finding suggested that CHT7 negatively regulates a subset of the cell division genes to control the cell cycle. Here, to better understand how the CHT7 protein recognizes its targets, we examined the transcriptomic data gathered from RNA-Seq, selected and grouped

SOCIAL SCIENCES

RELIGION AS A MORAL MOTIVATOR

Presenter(s): Clifford Choates *
Social Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2301
Mentor(s): Ana Bracic

After the fall of the USSR in 1991, large areas of eastern Europe were left in a state of turmoil and confusion. The transitioning Governments and their people were left in a political power vacuum, and were almost used as tools to spread soviet communism once again. This conflict led to what is commonly known as The Yugoslav wars. From the years of 1991 to 1998, during the last period of said wars, some 3.2 million people fled or were displaced from their homes throughout the former Yugoslavia. According to the U.N. High Commission for Human Rights, 50,000 people fled from Serbia over the three months of the NATO bombing campaign. In 2011, a similar refugee crisis began in Syria as a result of a religious civil war. Over 5 million syrian refugees were forced to seek asylum across the world, and in neighboring countries across eastern europe. Using survey data collected by Dr. Ana Bracic, I intend to analyze the level empathy that natives of eastern europe poses for these primarily muslim syrian refugees seeking aslyum in their countries. Seeing how the area is primarily Orthodox Christian, and a majority of the Syrian refugees practice Islam, I also intend to examine if religiosity is a determining factor in the feelings of Eastern Europeans.

MYTH VS SCIENCE VAMPIRISM

Presenter(s): JuliAnna Ebeling *
Social Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2302
Mentor(s): Megan Moore *

The myth of the vampire is one of the most enduring in popular culture today. The undead have gone through many changes over time since the origins of the eastern European myth. This research combines skeletal analysis, general taphonomy, and cultural responses to support the conclusion that all aspects of the original myth can be explained with modern science as simply anemia and decomposition. In addition, the cultural response to the folklore is explored as a way to understand the grip this belief had over the region.

AN EXPLORATION OF THE PREDICTORS OF GROUP BLAME

Presenter(s): Jonathan Doriscar *
Social Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2303
Mentor(s): Mark Brandt

Oftentimes in society, present-day groups are attributed blame for the actions of their predecessors. For example, white people have often attributed blame for their predecessor's

slavery of black people. Research suggests, that these blame attributions often shape and steer the political climate. Additionally, research suggests that in present perpetrator groups these blame attributions are significant predictors of prosocial behavior. Therefore, understanding these blame attributions is of great importance, as they are highly influential in shaping behavior. Having said that previous research has failed to assess which factors predict these blame judgments. The present study looked to expand our understanding of these blame judgments, by investigating the context in which they occur. In particular, the present study assessed the relationship between entitativity, perceived connectedness, perceived fulfillment of obligations, and perpetrator status. Additionally, we explored the effect of other factors such as time and extent of harm. We utilized a conjoint study design to assess these factors.

THE EFFECT OF PARENTING BELIEFS ON CHILD MALTREATMENT AND SELF- BLAME FOR MALTREATMENT ON THE MOTHER- CHILD RELATIONSHIP

Presenter(s): Haley Kohl *
Social Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2304
Mentor(s): Dean Lauterbach *

There is considerable interest in understanding the factors that may influence the quality of parent-child relationships among maltreated and at-risk youth. The current study tested a model examining the longitudinal relationships among parenting beliefs (assessed when child was 4), child self-report of physical/psychological maltreatment and self-blame (assessed after child completed elementary school), and mother-child relationship quality (assessed when child was 12). The sample is composed of 1,354 children who were maltreated or at elevated risk for maltreatment (48.9% male, 36.7% African American) drawn from the Longitudinal Studies on Child Abuse and Neglect dataset. Structural equation modeling was conducted to test relationships among constructs. Overall, results of the SEM yielded adequate fit (RMSEA=.036, close fit test NS, SRMR=.046, CFI=0.89). The 3 elements of parenting beliefs (appropriate expectations, empathy, and value placed on physical punishment) were strongly interrelated (βs .72-.83, ps <.0005) but were unrelated to self-reported severity of physical maltreatment, psychological maltreatment, or relationship quality. Physical and psychological maltreatment were strongly interrelated (β=.48, p<.0005). Importantly, more severe psychological maltreatment was significantly predictive of poorer mother-child relationship quality (β=-.35, p < .0005) and greater self-blame for the maltreatment (β=.13, p=.003). The relationship between severity of physical maltreatment and worse mother-child relationship quality approached significance (β=-.12, p = .09). These results support victim reports that psychological maltreatment can effect familial relationship quality and internalized beliefs about one's self. Results from similar analyses will also be presented examining the effects of parenting beliefs, physical/psychological maltreatment and self-blame on other characteristics of parent-child relationships.

ASSESSING THE EXPERIENCES OF BLACK WORKERS WITH EMOTIONAL LABOR

Presenter(s): Aylasia Steen
Social Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2305
Mentor(s): Angela Hall

Inumerable black employees face overt discrimination in the workforce, creating adversity to progress. This is when problematic behaviors like emotional labor arise within black people in the workforce. Emotional labor is the process of suppressing your actual emotions in order to satisfy the emotional obligations of the job, this involves interactions with customers,

management and other staff. Black people consistently have to combat negative stereotypes of being unapproachable, hostile and abrupt from society. Therefore in the workforce they must exhibit additional positive emotion to have an inclusive relationship with colleagues and succeed within the workforce. Black workers consistently have to display more emotional labor compared to white workers.This research will investigate the excessive emotional labor black workers have to display in the workforce to be recognized and respected. The drawback with emotional labor within black workers is that it does more harm than good. This speculation has to do with emotional labor causing that person to have depression, low job satisfaction, burnout and decline of performance. Additionally, black workers feel obligated to suppress their emotions to fit in, they frequently have to deal with being the "token black person" to obtain success. The research will consist of analyzing literary review, scholarly articles and journals and conducting surveys to collect data from black workers to understand their experience with emotional labor.

WEAPONS AND MOTIVES IN TRANSGENDER HOMICIDES

Presenter(s): Caitlin Ziesmer
Social Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2306
Mentor(s): Christina DeJong

The number of transgender homicides in the United States has increased significantly over the past several years, including a major spike in 2020 where there was over 40 reported transgender homicides. Prior literature has found that when an offender targets a member of the LGBTQ+ community, it is different from other violent crimes committed against a non-member of the LGBTQ+ community. This literature takes a broadened approach on bias crimes as well as showing limitations to prior research on LGBTQ+ crimes. In this analysis, I will compare the weapons and motives used in transgender homicides versus other homicides over the past several years to see the relationship between these two acts of lethal violence. I will also examine previously published documentation to help discuss the relationship between firearms and lethal violence and why that information helps show us what we know about the offender and their motive.

INTELLIGENT SOCIAL NETWORK INTERVENTIONS TO AUGMENT HUMAN COGNITION FOR BOLSTERED INTER-DISCIPLINARY INTERACTIONS IN PROJECT TEAMS

Presenter(s): Alexander Fos , Evan Seyhun
Social Sciences, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 2307
Mentor(s): Hanzhe Zhang

The NSF-sponsored Intelligent Social Network Interventions to Augment Human Cognition for Bolstered Inter-disciplinary Interactions in Project Teams is composed of MSU faculty in construction management, psychology, economics, education, computer science departments. The goal of the project is to augment human cognition and the functioning of multi-team system via immediate and machine/deep learning enabled social network interventions to help individuals develop the skills needed for future of work and facilitate short and long-term economic and social benefits. Key research questions include (i) how to prepare individuals for the future of work in complex social systems, (ii) how social network interventions bolster multiteam coordination, (iii) how machine learning automates sociogram development and diagnose network problems to augment human cognition for multiteam coordination, and (iv) the economic and social implications of the future of work. This is a data-intensive and labor-intensive project, so the involvement of undergraduate student coders is essential. Under close guidance of faculty, research associates and graduate students, responsibilities of students include: assist in data collection from student project

teams and industry project teams, help with data analysis and data processing, and develop and maintain documents and protocol for coding.

ANTI-INTELLECTUALISM, EDUCATIONAL ATTAINMENT, AND AMERICAN CITIZENS

Presenter(s): Angelina Benli *
Social Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2311
Mentor(s): Matthew Grossmann

Over the last several years, Americans have become increasingly likely to identify with anti-intellectualism (i.e, the generalized mistrust of scientists and other experts). However, Americans are more educated than ever before, spending on average of 13.4 years in school. Utilizing cross-sectional General Social Survey (GSS) data along with public opinion data from the Roper Center for Public Opinion Research, I explore the long term trends of the relationship between educational attainment and anti-intellectual attitudes. Given the established partisan divide in anti-intellectual attitudes in the United States - with most Americans seeing science as relevant to policy, but their willingness to defer to science in policy matters varies considerably across issues—I use political party affiliation to examine the relationship between anti-intellectualism and educational attainment further. Anti-intellectualism stands as a critical challenge in maintaining and increasing public compliance and understanding with expert-guided consensus on a variety of issues. The greater understanding of the relationship between educational attainment, partisanship, and anti-intellectual attitudes in the United States can help inform science communication with the general population.

COVERT STUTTERING

Presenter(s): Vicenta Rodriguez Davis *
Social Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2312
Mentor(s): Bridget Walsh, J Scott Yaruss

Although stuttering is an often misunderstood speech disorder, research has brought more insight into the disorder and has led to the creation of better treatment approaches for people who stutter. There has been far less research into covert stuttering, a type stutter that is not openly displayed by someone. As a result, covert stuttering is often incorrectly interpreted. This study will explore why people feel the need to hide their stutter, common emotions that may occur when hiding, and if strategies are used to conceal their stutter after shifting from less covert stuttering to more overt. Answering these questions could lead to better treatment for covert stuttering and help bring self awareness or acceptance. This is a qualitative study in which five people who stutter will be interviewed about covert stuttering. A survey with pre-established questions will be given for demographic information. The transcribed data will be from semi-structured video interviews that will be reviewing feelings, habits, and experiences while stuttering. After transcription, a quasi-thematic analysis will be used to draw out common points.

THE CORRELATION BETWEEN ATTACHMENT AND ADJUSTMENT DURING THE COVID-19 PANDEMIC

Presenter(s): Adonaia-Ambition Patterson *
Social Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2313
Mentor(s): William Chopik

The COVID-19 has led to an increase in mental health problems in the general population. However, some psychological characteristics might be protective of mental health problems during the COVID-19 pandemic. The current study examines attachment orientation as a predictor of adjustment during the COVID-19 pandemic. Participants were 3,105 undergraduate students (Mage=19.41;70.1% women and 66.6% white/caucasian).Attachment anxiety was associated with greater loneliness and lower life satisfaction. Attachment avoidance is associated with lower life satisfaction but unrelated to loneliness. Overall, the attachment was related to adjustment during the COVID-19 pandemic. This study is important because it allows psychologists to have an idea about how a pandemic can take a toll on one's psyche. The results are discussed in the context of reducing insecurity through making therapy more accessible for students.

HOW PEOPLE VOTE

Presenter(s): Christopher Smothers *
Social Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2314
Mentor(s): Eric Juenke

Heuristics are factors that the average citizen uses in the process of voting. Studies show in lieu of substantial information about candidates in any election, constituents determine a candidates' qualification by their gender, race, ethnicity, education, occupation, and incumbency. The objective for this study is to evaluate qualitative data and counter arguments to test data from prior election results in Georgia legislative elections to see how candidates combatted heuristics during their campaign for election. This presentation seeks to confront the digital divide in low-information signaling evaluating if candidates in battleground legislative elections were able to successfully bridge the gap between access to information and voting inequalities.

CONSEQUENCES OF THE "AMERICAN IDENTITY" ON RACE RELATIONS IN AMERICA

Presenter(s): Kelsey Osborne-Garth *
Social Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2315
Mentor(s): Nazita Lajevardi

American identity undoubtedly shapes citizens' policy preferences and outgroup attitudes. Understanding the role of American identity with respect to race relations is crucial to dismantling years of systemic oppression and prejudice towards Americans who do not fit the Anglo-Saxon narrative. Given the rise of racial tensions in America today, some Americans have grown increasingly uncomfortable associating with an American identity, believing that it has not traditionally included people of color and that those with high levels of American identity hold inherently negative attitudes towards marginalized groups. With American identity under such immense national scrutiny and polarization, it is imperative to understand how American identity matters for shaping individuals' contact with people of color in America. Do Americans with high levels of "American Identity" have closer or weaker social ties with members of the following groups-- immigrants, Asians, Muslims, Latinx, and Black Americans? To observe this relationship, I study 500 responses from an Amazon Turk Survey on their contacts and attitudes towards people of color in America. Using an OLS regression, I expect to find that Americans with greater levels of prejudice are more likely to hold higher levels of "American Identity," and that those with higher levels of American identity have fewer social ties with outgroup minorities. Implications of this phenomenon may lead to higher levels of racial bias and discrimination against ethnic Americans and exclude them from the American Identity because of the limited contact these individuals have with other Americans and exacerbate racial tension today.

THE SOCIOPOLITICAL IMPLICATIONS OF IMMIGRATION AND DIAGNOSIS ON HAITIAN IMMIGRANTS DIAGNOSED WITH HIV/AIDS IN THE DOMINICAN REPUBLIC

Presenter(s): Stephanie Garcia
Social Sciences, Section 2
Time: 1:00 - 2:15 PM
Presentation Number: 2316
Mentor(s): Pilar Horner

Limited research explores the intersectionality between immigration and diagnosis and its implications for diagnosed immigrants. To discover the social and political implications of said intersection on Haitian immigrants diagnosed with HIV/AIDS in the Dominican Republic, a qualitative study conducted, recorded, and transcribed twenty interviews guided by a questionnaire about immigration and diagnosis in Spanish with diagnosed Haitian immigrant-patients at the Boca Chica Health Clinic in the aforementioned country for thematic analysis of transcriptions utilizing Grounded Theory. Although audio inaudibility and/or unintelligibility complicated transcribing, transcripts analyzed nevertheless themed they experience exclusion in the social and political context per stigmatization practices socially and governmental technicalities politically. Socially, stigmatization practices deriving from stigma about immigration and diagnosis impede them from being open about their immigration status and HIV/AIDS diagnosis. Politically, governmental technicalities deriving from governmentalities about immigration and healthcare impede them from feeling comfortable about government requirements to status adjustment and HIV/AIDS treatment. Such sociopolitical ambience and its social and political realities ultimately complicate their lives socially and politically. Further research of them specifically and others generally is advocated to educate of their experience as this too unfortunately is quite limited in its exploration and discovery of the aforesaid.

TRENDS IN EDUCATIONAL ASSORTATIVE MARRIAGE IN SAME-SEX AND DIFFERENT SEX COUPLES FROM 2003 TO 2020

Presenter(s): Tran Nguyen-Phuong *
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2321
Mentor(s): Hanzhe Zhang

Educational homogamy has increased in the past few decades, spurred by increasing levels of educational attainment and increasing numbers of women entering the workforce. Implications for increasing educational assortiveness include income inequality and intergenerational transmission of human capital. We use Current Population Survey Basic Monthly data to document trends in educational assortative marriage in different sex and same-sex couples from 2003 to 2020 in the United States. We are especially interested in observing educational homogamy during periods of subtle policy changes between states regarding same-sex marriage legalization prior to 2015 and the U.S. Supreme Court ruling in Obergefell v. Hodges. Additionally, we test the sensitivity of homogamy trends on different educational attainment grouping criteria. We hypothesize that positive educational assortative mating may be weaker for same-sex couples than different sex couples and that positive educational assortative mating may be stronger in same-sex female couples than same-sex male couples. The results of this study will add to the field's understanding of the marriage market, which will in turn improve the understanding of labor market decisions.

FOOD SYSTEM RESILIENCE AND FOOD ACCESS: OBSERVING SOCIAL NETWORKS IN FLINT, MI

Presenter(s): Najya Zaman
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2322
Mentor(s): Jennifer Hodbod

Although Flint, Michigan has been researched extensively because of the Flint Water Crisis, determinants of public health beyond water quality-such as the nutrition environment-have largely been neglected. Part of the nutrition environment is overall food security, a principal outcome of the food system. Flint's unique setting as a post-industrial city with a majority POC population brings into question the ability of the food system to also provide culturally appropriate foods. Studying Flint from the lens of resilience defined by Folke (2016) and the food system defined as a "social-ecological system" by Ericksen (2008), this project aims to inform Flint stakeholders of the food culture interactions with the food system structure in Flint, Michigan. Using mixed methods data collected during four focus groups in 2019-2020, the goals of this research are: first, identify how different communities within Flint access food; second, identify where culturally appropriate and healthy foods are acquired for different communities; and third, assess how consumer behavior has changed in response to gaps in food system structure, with implications for disparities in food security. Overall, we show that uneven allocations of grocery stores and restaurants that have forced consumers to alter their purchasing behavior. We show how residents within the city shop at a variety of stores within and outside of Flint to fulfill food needs, with certain neighborhoods finding more difficulties in securing food than others. We discuss the resilience implications of these findings.

COVID & EDUCATION: NEEDS THAT DIVIDE

Presenter(s): Aniya Watkins *
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2323
Mentor(s): Sarah Reckhow

This paper explores how often mayors tweeted about education and COVID and what mayors said in regards to education. As the debate on the cost of leaving schools closed continues, the full breadth of issues pertaining to remote learning have yet to be fully explored. Accordingly, this research focuses on two questions: 1) When mayors tweet about education, what kinds of topics and issues are discussed most often? 2) What is the relationship between mayoral identity (partisanship, gender, and race/ethnicity) and the level of Twitter messaging about COVID and education topics? After gathering over 160,000 tweets from 88 mayors of the 100 largest cities in the U.S. from 2019 and 2020, we analyzed their content both quantitatively and qualitatively. Regression analysis and t-tests were used to examine the impact of partisanship, gender, and race on how often a mayor tweeted about COVID or education. We developed a codebook to separate tweets into 8 broad categories, with 37 subcategories, in an effort to understand what the themes might imply about the issues that arose in education during COVID. We find no evidence to support our claims that gender and race impacted how often a mayor tweeted about COVID or education. However, we do find evidence that partisanship is negatively related to how often a mayor tweeted about COVID. We also found that tweets about education commonly contained messaging about resources in the form of materials/supplies and sentiments of appreciation and hope.

MAPPING HEAT RISK BY SOCIAL VULNERABILITY IN CHARLOTTE, NC

Presenter(s): Asher Zhang *
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2324
Mentor(s): Nathan Moore

Extremely high exposure to heat has been known to drastically increase mortality, especially in urban areas. Climate change is projected to increase the intensity and the duration of heatwaves, and overall heat exposure will increase due to strengthening heat islands in urban areas. To develop strategies for mitigation in urban areas, heat vulnerability indexes are becoming commonly used to demonstrate the spatial distribution of heat and at-risk populations. Current gaps in the literature include a lack of studies on specific metropolitan areas, especially cities in the south. Many studies also lack more than one indicator of local climate and fail to map out components of heat vulnerability separately. To remedy these shortcomings in the literature, I seek to visualize which areas of Charlotte have higher exposure to heat and concentrated green space. I will also demonstrate whether more vulnerable populations are clustered around hotter areas and areas with lower green space in Charlotte. To fulfill these objectives, I will first use GIS to map out heat exposure in Charlotte with data from the Landsat 7 satellite. We present correlations between LST data and multivariate indicators of poverty and vulnerability.

THE FUTURE OF THE AMERICAN GARAGE: SUSTAINABILITY AND ADAPTIVE REUSE

Presenter(s): Cynthia Liao *, Tasnima Naoshin *
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2325
Mentor(s): Eva Kassens Noor, George Berghorn, Linda Nubani, Mark Wilson

As an emerging technology, autonomous vehicles will have transformative impacts on our society. This study assumes a post-AV transition scenario where personal vehicles are fully autonomous and on-demand functioning as a mass mobility system, such that individuals do not need to own a car. Currently, the American suburban landscape is dominated by single-family homes with attached garages. Under the assumed scenario, the typical garage in these homes will become obsolete, creating a prime market for adaptive reuse of the space. In this study, we look at accessory dwelling units (ADUs) as a potential conversion option and examine the impacts of ADU planning, construction, and usage. We approach our analysis from the perspective of environmental, social, and economic sustainability. Addressing the environmental aspect, we consider local and national sustainability standards for exterior and interior construction materials, focusing on supply chain and chemical emissions, and evaluate energy consumption and regulations. Addressing the social and economic aspects, we consider the implications of ADU construction on phenomena such as urban sprawl, affordable housing, and business opportunities. To explore location-based impacts, we also conduct a paired-comparison analysis using the attached garage space of two single-family houses, one located in suburban Atlanta, Georgia and the other located in the suburbs of the San Francisco Bay Area, California. These locations were chosen to encompass the various types of suburbs in the US and the socioeconomic pressures present in each region. The results of our analysis can then be generalized to suburban areas with similar characteristics.

MIGRANT FARMWORKING COLLEGE STUDENTS AND THEIR FINANCIAL DECISIONS

Presenter(s): Sylvia Porras *
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2326
Mentor(s): Amanda Flores

Migrant farmworking families share similar experiences throughout their life regardless of their geographical area, where they come from, or where they migrate to. The migrant lifestyle consists of unstable income sources that oftentime shape the cultural background and ideologies in these communities. In addition, research suggests these cultural backgrounds and ideologies are passed down through generations as funds of knowledge and consejos. This study uses qualitative methodologies and testimonio methods to understand how one student's first independent experience with financial practices upon her college arrival was influenced by her family's background and lifestyle. Data analysis consists of an educational journey map and a memo from the one-on-one testimonio to construct a vignette. Findings include that our cultural background, family, and other related experiences, through consejos and FoKs, have an influence towards the student's beliefs, decisions, and actions related to financial ciscumstances. This influence, however, is limited as the students might also make decisions that are affected by individual experiences outside of their family life. This study can be used to inform educators on the unique influence on the financial practices of migrant farmworking students with the goal that they will apply this knowledge when working with such a unique group.

SOCIETY IN ACTION DURING THE FIRST DAYS OF THE PANDEMIC IN MICHIGAN

Presenter(s): Hannah Brock
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2327
Mentor(s): Manuel Chavez

This research was conducted by three research assistants collaborating with Dr. Manuel Chavez. Each researcher interviewed six respondents, which created our sample of 18 people. Participants were surveyed about their news media habits and how they affected their own and their family's behaviors during the COVID-19 shutdown in Michigan.

EXTRAVERSION/INTROVERSION'S EFFECTS ON LIFE SATISFACTION IN TERMS OF LEISURE ACTIVITIES

Presenter(s): Abby Bean *
Social Sciences, Section 3
Time: 1:00 - 2:15 PM
Presentation Number: 2331
Mentor(s): Stephen Colarelli *

This research looks into the idea of personality and how it can affect our life satisfaction, specifically in terms of the leisure activities people participate in. Individuals who tend to lean towards extraversion tend to thrive around others, while introverts thrive alone. This study was done to test this idea and see how people's life satisfaction can be affected based on the type of leisure activities they participate in, either social or solitary. The participants answered a brief questionnaire that recorded if they were more introverted or extraverted, the leisure activities they partake in with or without others, and how satisfied they are with their lives. After calculating all of the data and comparing numbers, it was found that the average introversion/extraversion scale score leaned towards introversion, while the leisure sociability score leaned toward more social activities. The life satisfaction score was moderately high. We could conclude from looking at this data that there was no mediation in this study. The

two conditions were not satisfied, meaning that extraversion/introversion and life satisfaction is not mediated by type of leisure activity.

SMALL BUSINESS GRANTS IN THE GREATER LANSING REGION

Presenter(s): Katie Denzin
Social Sciences, Section 4
Time: 1:00 - 2:15 PM
Presentation Number: 2332
Mentor(s): Elizabeth Mack

The COVID-19 pandemic jeopardized small businesses worldwide through demand shocks and government mandated closures. In Michigan, 32% of Michigan small businesses experienced state ordered shutdowns, a much larger proportion than the national average of 19% (BLS Business Response Survey). Compounding these effects were reductions in demand for goods and services as consumers changed purchasing behavior in response to the pandemic. Between July and September of 2020, Michigan businesses reported a 56.4% decrease in demand for goods and services (Census Pulse Survey). Small businesses, defined as those employing less than 500 employees, are a key source of economic vitality for the state of Michigan's economy. Small businesses accounted for 49% of private employment in 2017 and 89% of Michigan's exporting firms (SBA Michigan Small Business Profile). To combat the adverse effects of the COVID-19 pandemic, the Lansing Economic Area Partnership (LEAP) distributed monies in the form of three cash grants from March 2020 through January 2021 to the Greater Lansing Region. The purpose of this presentation is to assess the effectiveness of these emergency funds using a survey administered to Lansing small business owner grant recipients. Survey results indicate two important outcomes of these grant programs. One, business owners felt grant funds were effective in helping keep their businesses open. Two, grant funds were used for payroll purposes. This fund use likely prevented additional unemployment among people working for small businesses in the state of Michigan.

EXPLAINING TRANSGENDER HOMICIDE IN PUERTO RICO

Presenter(s): Hailey Wood
Social Sciences, Section 4
Time: 1:00 - 2:15 PM
Presentation Number: 2333
Mentor(s): Christina DeJong

During the year 2020, a substantial increase in the number of transgender homicides occurred in Puerto Rico. According to the Human Rights Campaign (HRC), six trans individuals were killed in 2020. Because no transgender homicides were reported in either 2018 or 2019, this increase is especially unusual and alarming. In this study, I compare the Puerto Rican case characteristics to prior literature to determine whether the factors related to LGBTQ+ victimization generally in Latin America are also relevant to transgender homicide in Puerto Rico. Prior research on LGBTQ+ victimization in Latin America has identified several facets of Latin American culture that may contribute to the increase in extreme violence and murder against the transgender community. Some of these factors include machismo, religion, discrimination and prejudice in healthcare, social services, the education system, and other discriminatory policies that exist within Latin America. In this study, I analyze relevant academic articles and conduct a case study analysis of the transgender homicide cases from Puerto Rico in 2020 to determine the reasons as to why these people were murdered.

ON-CAMPUS DINING PREFERENCES FOR GEN Z STUDENTS

Presenter(s): Lauren Kovach *
Social Sciences, Section 4
Time: 1:00 - 2:15 PM
Presentation Number: 2334
Mentor(s): Kerri Orders *

Every college and university needs to feed its students and ensure that its dining services are catering to the students' needs and preferences. Since the onset of the COVID-19 pandemic, the consumer behavior process associated with dining has been transformed and a range of new dining trends has emerged, including curbside pick-up, home delivery, online/app orders, and sustainable packaging. With such accelerated change related to what students eat, how they order, obtain, and pay for food, it is crucial for on-campus dining services to stay abreast of current trends amongsts its students. The focus of this research project is to gain insights about Generation Z's consumer behavior and shifting preferences related to campus dining, specifically at Aquinas College. A range of research methods will be used, including qualitative interviews with students, data collection through student surveys, and a demographic report of Generation Z, using the "Demographics Now" consumer insight tool. The findings gained from this research project will be shared with the dining services team, in order to enhance campus life for new and current Aquinas College students.

HOW DOES PREJUDICE RELATE TO POLITICS OVER TIME

Presenter(s): Jackie Duckett
Social Sciences, Section 4
Time: 1:00 - 2:15 PM
Presentation Number: 2335
Mentor(s): Mark Brandt

Aside from partisanship, prejudice towards minoritized groups is the single most important predictor of vote choice and is an important determinant of policy opinions in the United States (e.g., Federico & Sidanius, 2002; Lajevardi, 2020; Ramirez & Peterson, 2020). We are building on this work by examining two questions. First, what is the relative contribution of prejudice to political attitudes? We answer this question by using the American National Election Study to test if, on average, prejudice towards some groups (e.g., Muslims) contributes more to political beliefs than prejudice towards other groups (e.g., immigrants). Second, does the relative contribution of prejudice to political attitudes change over time? We will answer this question by leveraging the panel data features of the American National Election Study. By comparing the relative contributions in multiple time frames, we will be able to see if there is consistency or change in the relative contributions of prejudice on political attitudes. This will serve as a basis for further work that can then explore what predicts changes in the relative contributions of prejudice on politics.

THE VIRUS AND THE VOTE: PROMOTING YOUTH TURNOUT DURING A GLOBAL PANDEMIC

Presenter(s): Andrea Herrera, Brock Imel, Sara Seid
Social Sciences, Section 4
Time: 1:00 - 2:15 PM
Presentation Number: 2336
Mentor(s): Ana Bracic, Nazita Lajevardi, Sarah Reckhow

Our pre-registered study uses a randomized field experiment to directly test if students from a large midwestern university are more likely to vote in the 2020 election after receiving a treatment with absentee voting information or a treatment encouraging them to "make a plan" to vote. Additionally, we conducted a two-wave survey (pre and post election) with more than 1,000 undergraduate respondents. Our research team is examining whether the

voting treatment has a spillover effects among treated students and their household members by examining open-ended survey responses describing conversations about the 2020 election. Additionally, we are assessing how students with different attitudes and experiences related to politics engage in political conversation with their household members. Overall, our study will provide an opportunity to systematically assess the efficacy and impacts of voter turnout efforts during an unprecedented crisis that enormously disrupted typical GOTV efforts.

PLACING DECISION MAKING IN CONTEXT: THE CASE OF YOUTH VIOLENCE

Presenter(s): Destiny Peterson, Molly Costantino, Shaurel Valbrun
Social Sciences, Section 4
Time: 1:00 - 2:15 PM
Presentation Number: 2337
Mentor(s): Carole Gibbs, Jennifer Cobbina

Criminologists have long documented the association between neighborhood disadvantage and crime. Yet, we know less about how this neighborhood context impacts adolescent youth's decision processes to engage in or avoid violence. To begin examining the links between neighborhood and the decision process and youth violence and safety, we participated in a pilot project in one neighborhood in Lansing, MI, that is high in concentrated disadvantage and violence. The project team completed interviews with neighborhood youth workers during the previous year. We are currently interviewing youth with experiences with violence in the same neighborhood to describe factors that youth consider in making decisions about engaging in violence as well as how they think about those factors.

Research Mentors

Many thanks to the dedicated research mentors who guided and supported the undergraduate research and creative activities presented throughout this program book.

Presenter Index

Student presenters are listed alphabetically by last name.

Addendum

NAME	CHANGE	CATEGORY
Jessica Allen	Withdrew	Diversity & Interdisciplinary Studies
Emmaline Arter	Withdrew	Computer Science & Engineering
Kelly Bohan	Addition	Arts & Humanities
Carmen Cheng	Withdrew	Social Sciences
Adrian Frias	Withdrew	Diversity & Interdisciplinary Studies

PIANO COMPOSITIONS FOR HIGH SCHOOL STUDENTS BY MUSICIANS OF DIVERSE BACKGROUNDS
Presenter(s): Kelly Bohan
Arts & Humanities, Section 1
Time: 1:00 - 2:15 PM
Presentation Number: 208
Mentor(s): Deborah Moriarty

My research project is compiling a list of piano compositions appropriate for high school students by composers of diverse backgrounds that were under-represented in their time or whose works aren't frequently played. While traditional piano repertoire includes a number of masterpieces and beautiful works, it is not necessarily demographically diverse. In addition to including the title and composer of each piece, the list includes a link to a performance, information on where the score is available, and a description of the difficult parts of the piece. Composers include Florence Price, Amy Beach, William Grant Still, Clara Schumann, Teresa Carreño, and others. This list will be a useful reference for piano teachers looking for less frequently played music for their students. It also will encourage students to play works by past composers who did not get recognized in their time for their accomplishments. As the music included in this list is for intermediate and advanced players, it can also be used as a reference for pianists who want to include music by under-represented composers in their programs.


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