MID-MICHIGAN SYMPOSIUM FOR UNDERGRADUATE RESEARCH EXPERIENCES

AUGUST 4–10

2020

MID-SURE

ACKNOWLEDGEMENTS

The goal of the 1st virtual and 10th 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. Over 260 undergraduate students from 30 different institutions will present their outstanding research and creative endeavors at virtual Mid-SURE from August 4 – 10, 2020. These students are mentored by more than 260 faculty, staff, graduate students, and government or industry researchers.

Partnering Programs

Nearly 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 2020:

- BEACON Center for the Study of Evolution in Action
- Biomedical Research for University Students in Health Sciences (BRUSH)
- Cross-Disciplinary Training in Sustainable Chemistry and Chemical Processes (SCCP)
- Engineering Summer Undergraduate Research Experience (EnSURE)
- First-Time Research Experience in Environmental Health Science
- Physics & Astronomy Research Experience for Undergraduates
- Research Experiences for Undergraduates at Kellogg Biological Station
- Summer Research Opportunities Program (SROP)
- Summer Undergraduate Research Institute in Experimental Mathematics (SURIEM)

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: Maddie Cantrell, Jessica Diaz, Amanda Flores, and Christina Igl
- Casie Chunko, Office of the Associate Provost for Undergraduate Education
- 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, and graduate students to evaluate student presentations.

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

About the Cover

The cover art was designed by Jacob Chaban, a 2020 graduate of Graphic Design in the Department of Art, Art History, and Design (College of Arts and Letters) and member of the Design Center of MSU.

TABLE OF CONTENTS

Undergraduate Research
MICHIGAN STATE UNIVERSITY

Abstracts

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

AGRICULTURE, PLANT & ANIMAL SCIENCE

EQUINE BETA DEFENSINS AS INDICATORS OF SEPTIC ARTHRITIS IN HORSES

Brooke Boger
Agriculture, Plant and Animal Science, Section 1
Presentation Number: 1
Mentor(s): Jane Manfredi

Diagnosis of septic arthritis in horses is not straightforward. Increasing time between onset, diagnosis, and treatment can have significant consequences for quality of life. Defensins are used in diagnosis of joint infection in people. The presence of beta defensins (BD) in equine synovial fluid and their utility as a biomarker of sepsis has not been investigated. The objective was to compare protein expression of BD from normal, aseptically inflamed, and septic joints. We hypothesized that BD would be higher in septic joints when compared to other groups. Beta defensin expression was measured from synovial fluid samples from equine joints with: no disease, aseptic inflammation, and septic inflammation using a commercial ELISA and analyzed with a Kruskal-Wallis test (significant at $P<0.05$). Joints with aseptic inflammation had higher expression of BD-1 as compared to septic joints and higher expression of BD-3 when compared to normal and septic joints. No differences in expression of BD-2 were seen. The differential expression pattern between the specific BD proteins was not expected. In humans, BD-3 was increased in infected bone and synovium. Reasons for these differences may include variation among species in defensin function, variation among clinical cases, and samples from synovial fluid versus synovium, bone, or cartilage. Low case numbers and different types of cases in the aseptic inflammation group were main limitations. Differential expression of BD-3 between joint conditions was identified and could provide a new area for diagnosis and therapeutic intervention in aseptic inflammatory equine joint disease, though further study is warranted.

NO DIFFERENCE IN LEAF RETENTION IN SEXUALLY DIMORPHIC LINDERA BENZOIN

Katherine Lauro, Selena Martinez
Agriculture, Plant and Animal Science, Section 1
Presentation Number: 2
Mentor(s): Corrine Higley

Research suggests that differences in energy and resource allocation between males and females in sexually dimorphic Lindera benzoin affects growth and reproductive output. Due to the additional energy females put toward reproduction, they experience a higher reproductive cost than males, resulting in them exhibiting less reproductive output and growth throughout their lifespan. Our study focused on how this affects leaf retention between males and females of the deciduous shrub L. benzoin. To investigate this, we identified 19 male and 19 female L. benzoin and counted 50 leaves back from the tip of one branch on each individual, then marked the branch with tagging tape. We counted the leaves on each marked branch every week for 5 weeks. After the data were collected, we calculated the mean number of leaves remaining on male and female L. benzoin each week. We found there was no significant difference in leaf retention between the two sexes. This suggests that differences in energy and resource allocation in sexually dimorphic L. benzoin do not significantly impact leaf retention. Even though there was no significant difference in leaf retention rates between the two sexes, other factors that may be impacted by differences in energy allocation between male and female L. benzoin are overall rates of growth and leaf emergence in the spring.

EFFECTS OF SOYBEAN CYST NEMATODE (SCN, HETERODERA GLYCINES) POPULATIONS ON SOYBEAN BIOMASS ACCUMULATION

Hannah Eastman
Agriculture, Plant and Animal Science, Section 1
Presentation Number: 3
Mentor(s): Haddish Melakeberhan, Isaac Lartey

Soybean (Glycine max L.), a multi-value crop has several uses including its use as protein-rich animal food, soil nitrogen fixation, biodiesel, and lignocellulosic bioethanol. The benefits associated with soybean production, however, are hindered by the most destructive crop pest, the soybean cyst nematode (SCN, Heterodera glycines). In the 12 Midwestern states including Michigan, yield losses as a result of SCN are estimated to exceed 128 million bushels annually. Because chemical control is not a viable alternative, the use of host resistance has become the main strategy in combating SCN. However, due to the rapid adaptability of SCN, host resistance is a short-lived and unsustainable method of control. Further, SCN exhibits parasitic variability (PV), meaning that different populations look the same but act differently, thus managing the specific population becomes challenging. Using SCN populations from 5 different soybean fields in the southeast region of Michigan, a greenhouse experiment to analyze the effects of varying inoculated egg concentrations on soybean biomass after 31 days was assessed with each egg treatment replicated 6 times. Results of this 31-day study show SCN infectivity rates vary by field and inoculum concentration and that nodulation, a key factor in nitrogen fixation in soybeans, is negatively impacted by the presence of SCN. These factors, however, were not proven to impact final soybean biomass. Due to the inability to complete repeated trials, it is unclear whether or not SCN populations may lead to stunted growth and yield losses further into the plant's development.

STEMPHYLIUM ON SUGAR BEETS IN MICHIGAN

Jacqueline Metheny
Agriculture, Plant and Animal Science, Section 1
Presentation Number: 4
Mentor(s): Linda Hanson

Stemphylium sp. are a group of fungi that affects different crops. While this genus causes leaf spots on a range of crops, there has been no known Stemphylium spp. affecting sugar beets in Michigan. A serious disease caused by a species of Stemphylium-like fungus on sugar beets was first noted and researched in the Netherlands where a loss of yield greater than 40% was found from affected fields. Some known symptoms caused by this Stemphylium sp. include yellowing around the site of the fungus and a brown lesion. The disease particularly is noted for affecting damaged and undamaged leaves almost equally. In 2019, sugar beets were collected for a leaf spot survey. From these, a Stemphylium-like fungus was identified from leaves collected in two different fields in Michigan. The research reported here is on these fungal samples collected in Michigan that were isolated from necrotic lesions on leaves. Our current research has shown similar effects on a detached leaf assay, with necrotic lesions. Yellowing around the lesions was observed on at least two sugar beet cultivars. Continued testing with detached leaves is ongoing, with a delay while new plants are grown after the shutdown. Tests are also planned for whole plants. To prepare spore suspensions of inoculation of these materials, we currently are examining growth and sporulation under different lighting and nutrient conditions.

AQUAPONICS AT LAKE SUPERIOR STATE UNIVERSITY

Julianne Grenn*
Agriculture, Plant and Animal Science, Section 1
Presentation Number: 5
Mentor(s): Barbara Evans*

I am involved with a variety of aquaponics related activities occurring at Lake Superior State University. I started an Aquaculture Club at LSSU in October of 2019 with the goal of organizing a workforce to build, manage, and maintain two aquaponic systems. LSSU faculty provided us with laboratory space, which we call the Aquaponics Learning Laboratory (ALL). From October to the first week of March when the lockdown began, members met throughout the semester to clear out the ALL and build the systems. We dismantled an SEM machine, computed the system dimensions to build rectangular and octangular bases, cut the boards to size, stained the wood with linseed oil, plumbed the systems, and started growing basil and rearing tilapia. The basil seedings started in my aquaponic senior research project that looked at how hornwort, an aquatic plant, affected nutrient cycling within vertical systems. The seedlings were transferred into the Styrofoam floating mats of the newly built systems and are thriving. Currently, we are selling our products at local farmers markets and accepting donations for whole plants. In the future, these systems will be available for students to conduct senior research projects.
The pandemic has made it abundantly clear that more products need to be produced domestically. There is huge market potential for domestically grown fish and plants, but the research behind aquaponics is lacking. The Aquaculture Club is attempting to start filling that research void by providing LSSU students with unique opportunities.

LIMITING FACTORS OF NITROGEN FIXATION POTENTIAL IN THE SWITCHGRASS RHIZOSPHERE

Darla Knuth
Agriculture, Plant and Animal Science, Section 1
Presentation Number: 6
Mentor(s): Lisa Tiemann

Switchgrass is a bioenergy crop that can be a carbon-neutral energy source, provided it does not require nitrogen fertilization. In order to know whether switchgrass can be successfully grown without fertilization, we must better understand the controls on free-living N-fixation that can occur in the switchgrass rhizosphere. The purpose of this experiment was to observe the effects of phosphorus (P), Vanadium (V), iron (Fe), and molybdenum (Mo) availability on N-fixation potential in the switchgrass rhizosphere. P is known to be an important part of energy production and has shown to be a limiting factor in N-fixation. V, Fe, and Mo on the other hand are co-factors of different forms of the nitrogenase enzyme, which is responsible for N-fixation. Thus, these micronutrients have the potential to limit N-fixation. We grew switchgrass from seed in the greenhouse in field soils collected from two switchgrass cropping system experiments in Michigan and added either no nutrients or each of the nutrients separately. The switchgrass was harvested after ten weeks and we measured rates of N-fixation via 15N tracing, inorganic N (soil ammonium and nitrate), total plant biomass, plant tissue N concentrations and microbial biomass N. Total microbial biomass increased with nutrient additions, while Fe addition resulted in decreased ammonium and increases nitrate. We expect to see higher N-fixation rates in soils with nutrient additions and rates to be highest with Mo (most common nitrogenase co-factor) compared to other nutrient additions.

A GENETIC ANALYSIS ON THE INVASIVE SUCCESS OF CALIFORNIAN BRASSICACEAE SPECIES

Emily Parker, Jaclyn Melasi, Abby Wittkamp
Agriculture, Plant and Animal Science, Section 1
Presentation Number: 7
Mentor(s): Patrick Edger

Sisymbrium irio, also known as 'London rocket', is an invasive plant found throughout southwest California. Caulanthus amplexicaulis var. barbarae is endemic to California, adapted to serpentine soils throughout the San Rafael Mountains. While their ranges overlap, there is no evidence of interaction between the two species. By analyzing their genomes, along with preferred soil composition, phenology, and reproductive strategies, this study aims to identify the genes that contributed to major differences that discourage competition between these species. This research seeks to understand the complex relationship between genetics and ecology, and can be used as a foundation for future studies. In an era of rapid global change, it is now more important than ever to understand the dynamic interactions between organisms and their environment; protecting native species from exploitative foreign species will now be at the forefront of conservational research.

ARTS & HUMANITIES

ASTRO BLACK WOMEN: THE BLACK ARTS MOVEMENT, BLACK AESTHETICS & THE BLACK SURREAL

Triniti Watson
Arts and Humanities, Section 1
Presentation Number: 11
Mentor(s): Rashida Harrison

This paper holds the intention of critically engaging with the history and cultural productions of the Black Arts Movement (BAM) during the mid-60s and 70s in order to capture its lineage in the Black Radical Tradition. I will first observe the function of Black Aesthetics in the Black Arts Movement to reveal how Black art recreates/reconstructs Black subjectivity and notions of Blackness. I will then mediate between different forms of Black artistry by prominent Black women artists from the Black Arts Movement to analyze the social and political positions engrained in their work. Lastly, I will explore the spatial and philosophic depths of BAM and its legacy towards how one can imagine the futurity of Black life. I aim to answer "the surreal question" in Black cultural production and reproduction by examining Black aesthetics as an envisioned practice and mode of self-transformation beyond temporal location; Afrofuturism provides a theoretical framing to understand this voyage. By speaking on the affective process that is placed within Black art, I hope to reveal how creativity is tied to one's becoming in life which thus declares the futurity of how they can exist, and what they exist for.

LET'S GET (MORE) CREATIVE: LEARNING TO TEACH ARTS IN DETENTION DIGITALLY

Hannah Hawcroft*
Arts and Humanities, Section 1
Presentation Number: 12
Mentor(s): Emma Davis*

The transition to online operations and activities was unexpected. This presentation looks at the journey of holding online workshops and some of the challenges faced. The three programs discussed are Girls Dance, Girls Yoga, and Boys Theatre. The primary source of reflection is from the participation and observations of the Youth Arts: Unlocked research assistant. Take a look at the virtual performing arts programs offered to the youth at a detention center in

Michigan. Actions steps continue to be taken to review the feedback of youth and teaching artists all the while being conscious of opportunities to improve the services of the organization. Information shared is part of ongoing learning experiences.

EXPERIENCE ARTS IN DETENTION: AN INTERNAL LOOK AT HERSTORY: UNLOCKED

Hannah Hawcroft*
Arts and Humanities, Section 1
Presentation Number: 13
Mentor(s): Emma Davis*

Challenges are a standard part of life. When support is available, the horizon of hope becomes clearer to the individual(s) facing struggles. Art mediums are ways of expressing emotions and processing thoughts. First-hand observations were included from the efforts of the staff and volunteers from Youth Arts: Unlocked. Through focusing on the needs of youth and offering positive influences, gender-based workshops were implemented. These findings take a look at the programs offered to the female youth at a detention center in Michigan. The organization encourages the developmental impact on the youth through dedicating time to display the creative products by the youth to the public. Actions steps continue to be taken to review the feedback of youth and teaching artists and opportunities to improve the services of the organization.

THE CURIOUS CASE OF ANIMAL COMPUTERS: A CASE STUDY OF HOW ENVIRONMENTAL STIMULI INFLUENCED RESEARCH IN MUSIC COGNITION

Tushya Mehta, Grace Bonnema, Kat Murray
Arts and Humanities, Section 1
Presentation Number: 14
Mentor(s): Natalie Phillips, Mitch Carr, Soohyun Cho, Sarah Geist

The Digital Humanities and Literary Cognition Lab and the TAP Lab at MSU conduct a National Science Foundation-funded interdisciplinary study, "The Role of Narrative Listening in Music Perception," which explores if people imagine or hear stories when they are exposed to musical stimuli. The aim of the experiment in question was to act as a control for previous work regarding how strikingly often individuals perceive a narrative when listening to instrumental music. In the control experiment, participants were asked to sit in silence and to write narratives or thoughts that came to mind during the silent period. Unfortunately, the control experiment was conducted in a lab with computers physically labeled with animal names, such as "chipmunk", "squirrel", or "beaver." After data collection was completed, we recognized a pattern where various participants wrote narratives mentioning these computer labels. This sparked a conversation about how the smallest environmental stimuli can influence data collection, and how this could potentially affect online research in our current world situation. Using the case study, the researchers explore how environmental stimuli of this kind can increase during online data gathering. Several supporting examples, such as computer labels or conversations, pointing to a similar error strengthen the argument provided in the poster, "The Curious Case of Animal Computers: A Case Study of How Environmental Stimuli Influenced Research in Music Cognition." The ultimate aim of the poster is to remind researchers, through the case study, about possible experimental errors caused by unwanted environmental stimuli experienced during data gathering.

SELF-REPORTED VOICE USE IN STUDENT SINGERS: DOES THE METHOD OF REPORTING MATTER?

Grace Kuza, Alyssa Fritz
Arts and Humanities, Section 1
Presentation Number: 15
Mentor(s): Jeffrey Searl

Singers have more voice problems than non-singers because they use their voice a lot and in demanding ways. When singers are evaluated for a voice problem, they are asked to report voice history information that is generally considered a core part of the diagnostic process. What is not known is whether the method by which voice history information is gathered influences what a singer reports. The purpose of this study was to evaluate whether student singers differ in reporting voice use information when completing a one-time history form verses completing a daily log of the same items filled out over three weeks. The history form mimics what happens in voice diagnostics today and requires reflection and recall at a single moment in time on items that they may not have attended to previously. The voice log forces more regular reflection and reporting. Twenty-seven student-singers completed a voice history form first, and then completed a 21-day voice log to record information on the same parameters included in the one-time history form. Nonparametric procedures were used to compare data from the history form to the median values for each item calculated from the 21-day log. Results indicated that, in fact, some voice use parameters do differ based on the method by which the history information was gathered. Future studies are needed to determine whether one of the history gathering methods is more accurate than the other so that clinical procedures can be refined.

DO WE LOVE LITERATURE THE SAME WAY?: INTERDISCIPLINARY ANALYSIS OF READING PATTERNS ACROSS MAJORS

Jacob Phillips, Akanksha Kapur, Milena Sinistaj, Nikita Nambiar, Allison Simpson, Pranay Karnati
Arts and Humanities, Section 1
Presentation Number: 16
Mentor(s): Natalie Phillips, Mitch Carr, Soohyun Cho

The Digital Humanities and Literary Cognition Lab (DHLC) at Michigan State University is conducting an interdisciplinary study of sonnets seeking to understand similarities and differences in the aesthetic pleasure that English majors and non-English majors (students from the Psychology pool) experience when reading poetry. This study was run in two rounds, the first consisting solely of English majors, and the second round consisting of participants from the Psychology pool. In the study, participants were tasked with highlighting moments they found aesthetically pleasing in green (powerful, pleasurable, moving) and aesthetically displeasing in red. For this poster, we focused on positive highlighting data. The lab compiled the data by counting how many times each word was highlighted positively for each group. The lab compared the results of both parts of the study to visualize the most significant similarities or differences in the positive highlighting. While our original hypothesis predicted that English and non-English majors find different moments of the sonnets aesthetically pleasing, our data suggests the opposite. In fact, despite assumed differences in training, the two groups found similar sections of the sonnets aesthetically pleasing. The DHLC believes that understanding how people with different academic backgrounds interpret literature is important because it allows for further understanding of possible connections or distinctions between the humanities and the sciences. We believe that this project will provide valuable insight into how people interact with and respond to poetry.

BRINGING EMOTIONAL HEALTH INTO OUR SEXUAL RELATIONSHIPS

Elizabeth Brooks
Arts and Humanities, Section 1
Presentation Number: 17
Mentor(s): Sitara Thobani

General ideas regarding the topic of sex tend to fall into three categories: sex as a means of reproduction; a way of forming and strengthening particular relationships; or a means of experiencing pleasure. This research primarily focuses on; what does it mean to be sexually and emotionally intimate, how do gender roles and societal pressures affect how we view sex, and when are we able to practice sexual intimacy without emotions. My hope is that my research will encourage those who view my presentation, to look at sex from a wider perspective in order to challenge already existing notions of sex and sexuality. To accomplish this goal, I, draw on already existing research on sex; sexuality; and emotions as well as the results of a survey I designed and conducted with Michigan State students. From this information I was able to create a presentation focusing on three main ideas; how sex affects us psychologically and physiologically; how ideas of sexual normalcy are created; and how emotions and sex are linked.

BIOCHEMISTRY & MOLECULAR BIOLOGY

DESIGN AND ENGINEERING OF STARCH BASED BIOFOAM MATERIALS USING REACTIVE EXTRUSION TECHNOLOGY

Jakob Emrich
Biochemistry and Molecular Biology, Section 1
Presentation Number: 21
Mentor(s): Ramani Narayan

Current waste disposal habits and methods lead to many products being disposed of improperly. As a result, biodegradable replacements for LDPE and Polystyrene are highly sought after. Bench top reactions have proven the viability of starch-based foams for a variety of applications. However, limited production of such foams hinders the breadth of implementation. Reactive extrusion allows for the mass production of starch-based foams, a biodegradable product useful for packaging, insulation, food, and biomedical applications. Notably, research has shown the value of starch-based foams as hemostatic agents in the wound care of traumatic injuries. Chitosan, a derivative of second most abundant polymer chitin, has unique physicochemical and biomedical properties which make it useful for hydrogels, films and sponges. Cationic chitosan is known to form crosslinking with starch to form an insoluble polyelectrolyte complex. In the present work insoluble chitosan/starch foams were prepared via reactive extrusion using water as a physical blowing agent. A screw configuration made up of 3 kneading sections was designed for better mixing and foaming. Polyvinyl butyraldehyde (PVB) and sodium trimetaphosphate (STMP) was used for fine tuning of foam properties like density, cellular size, and moisture sensitivity. STMP acted as a crosslinking agent and also had a significant effect on the absorbency of foams (>600% wt/wt). Efforts will be made in the future to optimize the foam properties for wound care applications.

LITERATURE REVIEW: SEARCHING FOR THERMOPHILIC ENZYMES TO ENABLE SYNTHESIS OF CIS, CIS-MUCONIC ACID FROM METHANOL BY BACILLUS METHANOLICUS

Aaron Jacobs*
Biochemistry and Molecular Biology, Section 1
Presentation Number: 22
Mentor(s): Karen Draths, Yasheen Jadidi

Research done by Draths and Frost used genetically modified Escherichia coli to overproduce cis, cis- muconic acid (ccMA) from glucose. The ccMA was then hydrogenated to adipic acid, an industrially relevant chemical product. Three enzymes were heterologously expressed in E. coli to convert 3- dehydroshikimic acid, a shikimic acid cycle intermediate, into ccMA: 3-dehydroshikimate dehydratase, protocatechuate decarboxylase, and catechol 1,2-dioxygenase which correspond to genes aroZ, aroY, and catA, respectively. Through plasmid optimization, the group developed a WN1/pWN2.248 E. coli strain that had a ccMA titer of 36.8 g/L in 22% (mol/mol) yield from glucose after 48 h of culturing under fed-batch fermenter conditions. Glucose is an expensive feedstock and its use for adipic acid synthesis would compete with the food industry. Methanol is a cheap and widely produced alternative feedstock which can be used as a carbon source by the bacterial strain Bacillus methanolicus MGA3. This bacterium shows optimal growth at 40-60 °C. However, the three aforementioned enzymes expressed in E. coli significantly reduce activity or fully denature in this temperature range. If thermostable versions of these enzymes could be incorporated into the B. methanolicus genome, biocatalytic adipic acid synthesis from methanol could be achieved. This presentation will summarize a literature review of the kinetics and physiological characteristics (thermostability, pH stability, cofactors, etc.) of thermophilic isozymes of catechol 1,2-dioxygenase, protocatechuate decarboxylase, and 3-dehydroshikimate dehydratase that have high or optimal activity between 40-60 °C.

INTERACTIONS OF LATE STAGE ENDOSPORULATION PROTEINS IN BACILLUS SUBTILLIS

Maura Barrett
Biochemistry and Molecular Biology, Section 1
Presentation Number: 23
Mentor(s): Sandra Olenic, Lee Kroos

Bacillus subtillis, a Gram-positive soil bacterium, undergoes endosporulation during starvation conditions. During endosporulation, the intramembrane metalloprotease, SpoIVFB, activates the transcription factor σK. Two inhibitory proteins, SpoIVFA and BofA, regulate SpoIVFB activity, preventing cleavage of ProσK's pro-domain. Signaling from the forespore releases inhibition. When activated, σK 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 suggests 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-σK and SpoIVFB with Mono-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 Cu2+(1,10-phenanthroline)3. Multiple variants were tested; however, no complex was observed. Next, experimentation was directed towards BofA and SpoIVFA's interactions with SpoIVFB. We are constructing two plasmids to express SpoIVFB (one with cytTM), native BofA, and N-terminally truncated SpoIVFA in E. coli. Work from our lab shows that addition of cytTM to the N-terminal end of SpoIVFB may improve accumulation, and that truncated SpoIVFA is more stable and retains function when expressed in E. coli. Accumulation of these three proteins will be visualized by immunoblot analysis and interactions assessed through pull-down assays. Our work aims to improve knowledge of intramembrane metalloproteases and their regulation.

THE TRANSLOCATOR PROTEIN INFLUENCE ON ARYL HYDROCARBON RECEPTOR-MEDIATED TRANSCRIPTION

Mohamed Ahmed*
Biochemistry and Molecular Biology, Section 1
Presentation Number: 24
Mentor(s): John LaPres

The aryl hydrocarbon receptor (AhR), is a ligand-activated transcription factor known to mediate most, if not all, of the toxicity of specific planar aromatic hydrocarbons, such as 2,3,7,8-tetrachlorodibenzo-p- dioxin (TCDD). Recent evidence has shown that a portion of the cellular AhR is found in the intermembrane space of the mitochondria. The role of the mitochondrial pool of AHR (mitoAHR) remains unknown, however, many of the putative endogenous AHR ligands have also been linked to the translocator protein (TSPO). TSPO is localized to the outer mitochondrial membrane and is involved in the cellular stress response. We hypothesize that crosstalk exists between TSPO and AhR and that it modulates AHR-mediated transcription. To test this hypothesis, we analyzed quantitive real-time polymerase chain reaction (QRTPCR) data from three different mouse cell lines, BV2s, microglia cells, Hepa1c1c7s, hepatoma cells, and MLE12, lung epithelial cells. In addition, these cells were engineered using CRISPR-Cas9 to knockout AHR or TSPO expression. Each of the parental and engineered cell strains were also exposed to various activations (BV2s, only) and chemicals, including TCDD and/or PK11195, a TSPO ligand. Our results suggest that loss of TSPO and AHR can impact the transcription of key genes in certain circumstances. Moreover, preliminary results do support the hypothesis that crosstalk between the AHR and TSPO can impact AHR-mediated transcription. These data suggest that mitoAHR and its interaction with TSPO plays a role in TCDD-induced toxicity.

EXPRESSION AND CHARACTERIZATION OF A FLAVOPROTEIN OF UNKNOWN FUNCTION IN BACTERIAL MICROCOMPARTMENTS

Michael Cadigan
Biochemistry and Molecular Biology, Section 1
Presentation Number: 25
Mentor(s): Bryan Ferlez

Bacterial microcompartments (BMCs) are functionally diverse and modular metabolic organelles found in a wide variety of bacterial phyla. BMCs consist of a selectively permeable protein membrane encapsulating multiple enzymes and proteins in a polyhedral shell. Of interest to our group are the glycyl radical enzyme-associated bacterial microcompartments (GRMs) that contain glycyl radical enzymes which require an electron for their activation. However, despite the importance of redox reactions in the activity of GRMs, the identities and functions of the proteins involved are poorly understood. For example, little is known about a putative GRM flavoprotein with homologs found in variety of BMCs. To this end, we have cloned and expressed a GRM-associated flavoprotein from Rhodopseudomonas palustris BisB18 in Escherichia coli. Although using the native R. palustris BisB18 sequence resulted in undetectable levels of protein expression, codon optimizing the sequence for E. coli improved expression at all growth temperatures and induction conditions tested. To further increase expression to facilitate biochemical and structural characterization, we have designed new variants of this codon optimized construct using different expression plasmids, alternate locations and identities of terminal affinity tags for purification, or fusion with a small ubiquitin-like modifier (SUMO) domain. Biochemical characterization of this flavoprotein will provide valuable insight into not only the redox chemistry and biology of GRMs but also other BMC types that encode related homologs.

MEMBRANE PROTEIN ENGINEERING FOR SELECTIVE UPTAKE OF MRI CONTRAST AGENTS

James VanAntwerp
Biochemistry and Molecular Biology, Section 1
Presentation Number: 26
Mentor(s): Daniel Woldring

This project will use ancestral sequence reconstruction and computational modeling to design novel function in human OATP proteins with the dual goal of enhanced uptake of MRI contrast agents and non-immunogenic properties. These new functions will allow cells introduced into the body, such as stem cells or immunotherapies to be accurately tracked. This design will also lend insight into the sequence-structure-function connections in OATPs, which is invaluable for a number of therapies. In this study, to discover specific domains or positions that confer activity, we will compare ancestral sequences with a selection of extant sequences to discover the evolutionary changes within the family. That evolutionary data will inform mutational information such that any OATP could be given intentional, designed mutations for any desired functionality.

DEVELOPMENT OF A TRANSFORMATION-FREE METHOD TO GENERATE THERAPEUTIC DNA VECTORS

Nathaniel Pascual
Biochemistry and Molecular Biology, Section 2
Presentation Number: 27
Mentor(s): Masako Harada, Yuki Harada

The inefficient delivery of nonviral DNA vectors is an issue in the development of nonviral gene therapeutics. Among many various factors, the covalent linkage of bacterial DNA sequences has been associated with the silencing of episomal DNA vectors. By removing bacterial sequences such as antibiotic resistance markers, the bacterial origin of replication, and unnecessary promoter sequences, previous research has led to the development of small DNA vectors that offer higher transfection efficiency and transgene expression compared to traditional mammalian expression vectors. Seamless Ligation Cloning Extract (SLiCE) cloning uses the cell lysate of standard laboratory Escherichia coli strains to facilitate homologous recombination between linear fragments with flanking heterologous sequences in a simple, cost-effective reaction. We describe a novel application of SLiCE to generate circular DNA vectors devoid of bacterial DNA sequences without the use of bacterial transformation by facilitating the intramolecular homologous recombination of minimum expression cassettes PCR-amplified from a parental plasmid. The secretion of Gaussia luciferase from HEK-293T cells transfected with this methylation-free construct will be compared against a traditional mammalian expression vector. Furthermore, the role of methylation of template DNA in the SLiCE reaction is explored within the context of improving the SLiCE recombination reaction efficiency. In conclusion, this novel application of SLiCE offers the same improvements to transfection efficiency compared to previous methods to produce vectors devoid of bacterial sequences while also providing a more efficient process to develop these vectors due to the lack of site-specificity in designing parental plasmids.

THE EFFECT OF CALCIUM ON MITOCHONDRIAL ULTRASTRUCTURE AND FUNCTION

Benjamin West
Biochemistry and Molecular Biology, Section 2
Presentation Number: 28
Mentor(s): Jason Bazil, Jasiel Strubbe

Myocardial ischemia/reperfusion (IR) injury is an injury preceded by loss of mitochondrial function caused by calcium overload. Despite the well-known effects of this phenomenon, it is unknown how calcium alters mitochondrial bioenergetics through changes in mitochondrial

structure and cristae morphology. This is significant since the main cause of cardiac tissue and cell death after myocardial infarction is mediated by calcium overload. The objective of this project is to characterize how calcium modulates mitochondrial morphology using well-established cryo-electron microscopy (cryoEM) in the presence of the cardioprotective agent cyclosporin A and the calcium chelator EGTA during calcium overloaded conditions. The structural data reveal that increasing levels of calcium content disrupt cristae junctions with a lamellar rather than tubular appearance and it is associated with calcium phosphate deposits. In addition, the data also reveal the cardioprotective agent cyclosporin A preserves the cristae morphology. By correlating structural and functional data, we show that maintaining the cristae integrity prevents mitochondria from losing function. Overall, these findings establish a mechanism of calcium-induced mitochondrial dysfunction and reveal new, potential targets for cardioprotective therapies responsible for maintaining cristae structure and function.

IMPROVEMENT OF HYPERPHOSPHORYLATED TAU PRODUCTION FOR ALZHEIMER'S DISEASE DRUG DISCOVERY

Albert Ay
Biochemistry and Molecular Biology, Section 2
Presentation Number: 29
Mentor(s): Min Kuo

Alzheimer's Disease (AD) is an irreversible neurodegenerative disorder that affects more than 30 million people worldwide. Aggregation of phosphorylated tau (p-tau) protein in neurons is one of culprits for the disease. Glycogen synthase kinase 3b (GSK-3b) is one of likely kinases for tau phosphorylation in AD. Given the strong evidence for p-tau in AD pathology, a means to produce recombinant p-tau will impact significantly the studies of disease mechanism and drug discovery. Our lab developed the PIMAX approach to producing the first recombinant p-tau. Significant progress has been made from the use of our PIMAX p-tau. However, the yield of p-tau appears to have room for improvement. Upon close inspection of the construct for p-tau production, we suspected that by modifying the regulatory elements of the recombinant genes, the p-tau yield would be improved. My project takes a two-pronged approach for p-tau expression plasmid manipulation.

INVESTIGATING THE EFFECTS OF MITOCHONDRIAL TRANSPORT PROTEIN ON CARBON ALLOCATION IN CAMELINA SATIVA

Skylar Zemmer
Biochemistry and Molecular Biology, Section 2
Presentation Number: 30
Mentor(s): Danny Schnell

The low-CO2 inducible protein with a weight of 36kD (LIP36) is a mitochondrial carrier protein, in Chlamydomonas reinhardtii with an essential role in the algae's carbon concentrating mechanism. This research aims to investigate the effect of LIP36 on carbon metabolism in the roots of Camelina sativa. Previously, it has been observed that camelina seedlings expressing LIP36 produce a longer tap root than wildtype seedlings, a difference which is exaggerated in short day conditions. In order to study the root system, an efficient hydroponics system was developed for camelina. Plants grown on clay pebbles were fertigated with ¼ strength Hoagland's solution using an ebb and flow system. LIP36-48 and wildtype plants were harvested and measured for weight and length of roots and green tissue. Results of the growth trials confirmed that LIP36-48 plants produce a longer tap root shortly after germination although the weight of root tissue between LIP36-48 and wildtype plants is not significantly different. As the plants matured, root lengths became more similar. In another experiment, mature leaves and roots of LIP36-48 mutants and wildtype plants were collected and assayed for sucrose concentrations throughout the day. Assays for sucrose content will provide an overview of the plant's carbon utilization under various metabolic conditions influenced by

circadian rhythm and light availability. Preliminary results suggest that LIP36-48 plants do allocate and utilize carbon between the roots and leaves differently than wildtype plants. Further analysis provides insight as to how LIP36 affects carbon distribution, and how LIP36 may be affecting the overall metabolism to produce differences in early root development.

INVESTIGATING A LINK BETWEEN THE CANONICAL BONE MORPHOGENIC PROTEIN PATHWAY AND THE FIBROBLAST GROWTH FACTOR PATHWAY IN EARLY EMBRYONIC DEVELOPMENT

Carlos Ferran-Heredia
Biochemistry and Molecular Biology, Section 2
Presentation Number: 31
Mentor(s): Amy Ralston, Robin Seay

Because of their ability to develop into many cell types, human embryonic stem cells can be incredibly useful for regeneration of diseased tissues. However, the use of human embryos has many ethical dilemmas. Therefore, induced pluripotent stem cells (iPSCs), or somatic cells reprogrammed to stem-like cells, provide a better alternative for regenerative medicine. Because current methods for cell reprogramming are inefficient, we are studying what naturally occurs during stem cell derivation in mouse embryos. In doing so, we hope to determine a more efficient method for cell reprogramming. Our primary focus is on the fibroblast growth factor (FGF) pathway, which has been established to induce primitive endoderm (PE) cell fates in mouse embryos. Previously, mouse embryos treated with exogenous FGF4 developed an increased quantity of PE cells in the inner cell mass (ICM) of the blastocyst, and mouse embryos with a mutated FGF4 receptor gene developed all epiblast ICM cell fates. In this study, we observed that addition of exogenous bone morphogenic protein 4 (BMP4) decreased the PE promoting effect of FGF4. Therefore, we hypothesize that the canonical bone morphogenic protein (BMP) pathway inhibits the FGF pathway. We used engineered Smad4 knockout mice, which lack an essential component of the BMP pathway, to see if the repression of BMP induced genes changes the lineage specification of FGF4 treated embryos. If our hypothesis is correct, we expect to see that embryos which lack Smad4 will be more sensitive to FGF4 treatment due to de-repression.

EXPLORING THE BIOCHEMICAL PATHWAY OF ACYLSUGARS IN BLACK NIGHTSHADE

Rachel Arking
Biochemistry and Molecular Biology, Section 2
Presentation Number: 32
Mentor(s): Yann Ru Lou

Specialized metabolites in plants provide humans with medicines, food additives, and natural insecticides. The Solanaceae plant family produces a group of specialized protective metabolites called acylsugars that can act as plant defense against herbivores. There are a wide variety of structurally diverse acylsugars in plants. While tomato (Solanum lycopersicum) accumulates mostly acylsucroses, Solanum nigrum, or black nightshade, accumulates predominantly acylglucoses. We seek to figure out which enzyme contributes to the biosynthesis of this novel acylsugar to aid in agricultural advances. With phylogenetic approaches, we narrowed down a list of candidate genes. These genes are homologs of well-characterized ASATs (Acylsugar Acyltransferases) in S. lycopersicum and share characteristic trichome enrichment. A previous in vitro enzyme assay study revealed a hypothetical, biosynthetic pathway for acylglucoses in S. nigrum. We performed Virus-Induced Gene Silencing (VIGS) on candidate genes to confirm in vivo functions. Through VIGS, we took a viral vector with the gene of interest and initiated the silencing of five different ASAT target genes by infecting the plant with engineered Agrobacterium strains. Silencing early steps (ASAT1 and 2) of the hypothetical pathway resulted in a general decrease of acylglucose accumulation. Consistent with previous enzyme assays, our results revealed the critical role of Acylsucrose

Fructofuranosidase (ASFF) in acylglucose formation and confirmed that ASAT5 decorates di-acylglucoses with an acetyl group. Together, these experiments evaluate the biosynthetic pathway for acylglucose formation in S. nigrum. They provide interesting homologous enzymes with substrate that may be useful for enzyme engineering.

BIOSYSTEMS & AGRICULTURAL ENGINEERING

UNDERSTANDING THE IMPACT OF INOCULATION METHODS ON THERMAL INACTIVATION RATES OF EDIBLE INSECT POWDER USING ENTEROCOCCUS FAECIUM

Christina Abel
Biosystems and Agricultural Engineering, Section 1
Presentation Number: 36
Mentor(s): Sanghyup Jeong

Edible insect powder has grown in demand as a protein supplement. Despite the high risk of microbial contamination, thermal inactivation kinetics for pathogens in edible insect powders as low moisture foods remains poorly understood. The purpose of this study was to evaluate the effect of inoculation methodology on the thermal inactivation kinetics of Enterococcus faecium in edible insect powder and roasted ground whole crickets. Commercial cricket powder and whole roasted crickets were separately inoculated with Enterococcus faecium. After inoculation, the whole crickets were then milled into a powder of similar bulk density to the commercial cricket powder. Both powders were conditioned to 0.25aw prior to isothermal treatment at 78.6°C. Aluminum test cells (n=10) were filled with the powders, submerged in a water bath at the set temperature, with duplicate test cells removed at six different time points (0, 10, 20, 30, 40, and 50 min). Thermal inactivation was halted by submerging the test cells in an ice-water bath immediately after treatment. The powders within each test cell were then transferred into sterile bags, appropriately diluted and plated on modified tryoticase soy agar media containing esculin to quantity E. faecium survivors. D78.6°C values were 11.67+- 6.04 and 18.32+_ 3.9 min, for E. faecium in the whole ground cricket powder and commercial powder, respectively. No statistical differences were seen between the inactivation rates ($p>0.05$). Understanding the impact inoculation methodologies have on the thermal inactivation kinetics of pathogens in processed products will help to establish appropriate industrial kill-step validations for the edible insect powder industry.

EVALUATING A SALMONELLA LETHALITY PREDICTION TOOL FOR THE SURFACE OF COOKED MEAT AND POULTRY PRODUCTS

Ian Klug
Biosystems and Agricultural Engineering, Section 1
Presentation Number: 37
Mentor(s): Ian Hildebrandt, Bradley Marks

USDA provides guidelines for cooking ready-to-eat products based on core temperature; however, under dry cooking conditions, it is possible to get lower Salmonella lethality on the product surface than at the core. Current approaches to addressing surface survivors are limited in number and scientific support. This study aimed to determine the effectiveness of the USDA FSIS Appendix A time-temperature tables in estimating the reduction of Salmonella on the surface of beef and poultry. Meat samples were inoculated with an 8-serovar Salmonella cocktail. A full-factorial experiment was conducted, cooking beef and poultry samples to core temperatures of 70 and 74°C, respectively, varying oven humidity (0.7, 30, 70% v/v), temperature (218, 232°C), and fan speed (low, high). Samples were then immediately cooled, dissected, serially diluted, plated, and survivors enumerated. The leathality approach was evaluated by applying USDA Appendix A time-temperature tables to temperature profiles when the surface was below the dew point. Salmonella reductions were measured in 42 beef strips, 35

beef patties, and 36 chicken breasts. The time-temperature tables correctly classified lethality outcomes (i.e., classifying as greater or less than 6.5 (beef) or 7.0 (poultry) log) for 26/42 beef strips, 22/35 beef patties, and 20/36 chicken breasts. Most failures (36/45) were "fail-safe"; however, 9/45 failures were "fail- dangerous". While the time-temperature tables are an important tool to help understand the risks associated with surface Salmonella survivors, the classification accuracy was 60% and had considerable fail-dangerous samples.

EFFECTS OF SITE-SPECIFIC AND ENVIRONMENTAL FACTORS ON PHOSPHOROUS LEACHING THROUGH MICHIGAN CORN CROP SOILS

Rachel Shapin
Biosystems and Agricultural Engineering, Section 1
Presentation Number: 38
Mentor(s): Steven Safferman

Phosphorous application is essential to the growth and productivity of crops; however, excessive application can have unintended consequences for both humans and ecosystems. Further research is needed to determine site-specific and environmental factors that influence phosphorous leaching and to what extent. Conducting this research is vital to preserving human and environmental health, as phosphorous leaching from agricultural sources can have detrimental effects such as eutrophication and harmful algal blooms (HABs). When HABs decompose, they release water-soluble neurotoxins and hepatotoxins that, if consumed, can have severe negative effects on the health of humans and livestock. HABs also create hypoxic conditions in waterbodies. Creating a dynamic phosphorous index that qualitatively estimates levels of phosphorous available to plants for cropland that is specific to certain sites will help mitigate health risks and environmental consequences caused by eutrophication and HABs. To create this index, several pre-determined scenarios representing general conditions for Michigan corn crops will be run in HYDRUS 1D, which will model the movement of phosphorous in various soils. Parameters for these scenarios will be determined through literature reviews. Modeling in HYDRUS is an effective way to identify patterns that most effectively hold phosphorous within the soil's root zone, maximizing its availability for beneficial plant growth and minimizing discharge into the environment. Scenarios will be designed to estimate how the amount of phosphorous varies with depth and sensitivity of parameters. Data from HYDRUS will later be used in laboratory studies to create this dynamic phosphorous sorption index.

QUANTIFYING THE SURVIVAL OF SALMONELLA DURING THE LONG-TERM STORAGE OF MULTIPLE SUGAR PRODUCTS

Andrew Kearney
Biosystems and Agricultural Engineering, Section 1
Presentation Number: 39
Mentor(s): Ian Hildebrandt, Bradley Marks

The role of sugar as a mainstay ingredient in minimally processed food products suggests a need to evaluate the potential for Salmonella survival in sugar. This study assessed the survival of Salmonella in multiple sugar products during long-term storage. Granulated, powdered, brown, and liquid sugar obtained from a commercial supplier were inoculated with a 5-strain Salmonella cocktail. Samples were stored at three temperatures (4, 25, 37°C) in sealed containers, and sampled at 12 times up to ~1,000 days. Triplicate samples for each condition were serially diluted, plated on differential media, and survivors enumerated after incubation for 48 h at 37°C. Data were analyzed using ANOVA to determine the impact of sugar type and temperature on Salmonella survival. Survivors were quantifiable in some sugar products beyond 1,000 days. No significant differences were observed between granulated, powdered, and brown sugar reductions (~1.5 log reductions) at 4°C at ~400 days ($P>0.05$). Significantly less Salmonella survived at 400 days of storage at 25 and 37°C ($P<0.05$), with average reductions of 2.7 log reductions for granulated and powdered sugar and >5 log reductions for brown sugar.

At ~1,000 days, survivors were countable in 8/12, 1/12, and 1/12 of all samples stored at 4, 25, and 37°C, respectively. Salmonella decline during long-term storage increased with storage temperature, but most samples maintained detectable levels of Salmonella after a year. These results suggest that sugar contaminated with Salmonella could pose a risk even after long-term storage.

IMPACT OF DELAY IN WATER SAMPLE FILTERING ON DISSOLVED REACTIVE PHOSPHOROUS CONCENTRATION AND LOAD

Alex Seybold
Biosystems and Agricultural Engineering, Section 1
Presentation Number: 40
Mentor(s): Ehsan Ghane

Subsurface drainage is used to remove excess water from farm fields, which can contain nutrients like phosphorous and nitrogen. Certain Edge-of-Field agricultural research seeks to minimize the amount of nutrients lost from the field by monitoring nutrient concentrations and flow rate in drainage. Dissolved reactive phosphorous is a form of phosphorous that is readily available to organisms and can cause algal blooms in fresh bodies of water. Sampling of dissolved reactive phosphorous (DRP) is necessary to determine the amount of phosphorous that is lost from the field through subsurface drainage. The objective is to determine whether the amount of time between collection and filtering of samples from the field affects the concentration and daily load of dissolved reactive phosphorous. The samples were collected from four fields in the River Raisin watershed in Michigan. A filtered sample and unfiltered sample are taken from the bottle immediately. The unfiltered sample is filtered after one day to represent the one-day sample. After one week another sample is taken from the bottle and filtered to represent the seven-day sample. After two weeks the last sample is taken from the bottle and filtered for the fourteen-day sample. Statistical analysis of the data was used to determine if there is a significant difference between DRP concentration and load that is immediately filtered compared with those that are filtered with a delay. The amount of time between collection and filtering of field samples appears to affect the dissolved reactive phosphorous concentration and load significantly.

EFFICACY OF HOME-SCALE THERMAL TREATMENTS FOR MICROBIAL CONTROL IN A VARIETY OF FLOURS

Kase Nelson
Biosystems and Agricultural Engineering, Section 1
Presentation Number: 41
Mentor(s): Ian Hildebrandt, Bradley Marks

Pathogen contamination of flour has led to large recalls and an increase of associated risks with minimally processed products, such as raw cookie dough. Online consumer resources have offered home-scale solutions for reducing pathogens in such foods; however, there is little evidence of treatment efficacy. An online search of household flour heat treatments informed the experimental design. All-purpose, whole-wheat, and gluten-free flours were inoculated with Enterococcus faecium NRRL B-2354, a valid Salmonella surrogate for thermal treatment of flour, and conditioned to a water activity (a_w) of ~0.45 for ≥ 2 days. Samples were spread into a uniform layer ~0.5 cm thick, heat-treated in a convection oven at 177°C for 10 min, transferred to sterile bags, cooled, serially diluted, and plated on differential media. Endpoint temperature and aw also were measured. Online consumer flour heat treatment resources lacked scientific references for Salmonella inactivation in flour. E. faecium survival was impacted by flour type and cook time ($P < 0.05$). After 5 min of treatment, no lethality differences were observed between flour types (~2.1 log reductions), and average temperature and aw were > 95°C and < 0.10. After heating 10 min, E. faecium survived better ($P < 0.05$) in whole-wheat flour (~3.6 log reductions) than in gluten-free flour (> 6 log reductions). Public awareness of microbial hazards

associated with flour is increasing; however, none of the home-scale solutions evaluated were scientifically supported. Additionally, the results of this study illustrate the highly variable efficacy of such solutions.

BUSINESS & SOCIAL SCIENCES

THE EFFECT OF RADIOGRAPHIC ORIENTATION ON ANALYSIS OF HARRIS LINES

Ayla Schwartz
Business and Social Sciences, Section 1
Presentation Number: 45
Mentor(s): Gabriel Wrobel

Harris lines, first defined by H.A. Harris as transverse radiopaque lines found on tibiae, have been a staple of stress assessment since the late 50s. Thought to represent the position the epiphyseal plate of the bone was located at when a bodily or psychological insult caused growth arrests, Harris lines are used to assess stress levels as well as life history in bioarchaeological investigations. However, recent research by Scott and Hoppa (2014), Nowak and Piontek (2011), Durray (2011) has called into question both the validity of Harris lines as stress indicators as well as the consistency of the methodology we use to identify Harris Lines. We used microCT imaging analyzed in efXCT and BoneJ software to assess how changes in radiographic techniques, from angle to absorbance, can affect the results of a Harris line study, We also look at how differential morphologies observed among Harris lines can affect the chances of misidentification and error in analysis.

UNDERSTANDING OF CUSTOMER DELIGHT AND ITS ANTECEDENTS AND OUTCOMES

Christina Heydenburg, Vinh Le
Business and Social Sciences, Section 1
Presentation Number: 46
Mentor(s): Bonnie Knutson, Mi Ran Kim

Throughout the pandemic of COVID-19, the hospitality industry has been stripped. Given this reality, innovative customer service will become increasingly important as firms strive to survive and in the industry. Customer delight occurs when a customer is pleasantly surprised beyond satisfaction in response to a provided experience, and it can be the vital driving force to retain customer loyalty. The primary goal of the research project is to provide a better understanding of the concept of "customer delight" within the context of the hospitality industry. This study is comprised by two main purposes: (1) To identify how customer service factors (i.e., safety/healthy, innovativeness, uniqueness, fun/enjoyment, compliment/upgrade) impact on customer delight and (2) to examine how customer delight impact on customer loyalty (i.e., willingness to repurchase and willingness to recommend to others). This study has both theoretical and practical significance. This study will broaden the understanding of the concept of delight by examining customer service practices and their impacts on customer delight, which can ultimately lead to customer loyalty. Practically, this study will help hospitality practitioners clearly understand the importance of customer delight as a management tool to create advocates of customers, thereby increasing customer lifetime worth and generating referrals.

FROM THAN SHWE TO SUU KYI: UNDERSTANDING MYANMAR'S RECENT POLITICAL TRANSITION

Lockie Woods
Business and Social Sciences, Section 1
Presentation Number: 47
Mentor(s): John Waller

In 2015, one of the world's longest-standing military dictatorships came to an end. After taking control of Burma in 1962, the military ruled through various different leadership arrangements for the next fifty-three years. On November 8, 2015, that sustained period of oppression came to an end when the National League for Democracy (NLD) party—led by Suu Kyi—almost swept the country's first legitimate election in over half a century. Many scholars have attempted to explain this recent political transformation, pointing to a variety of factors such as the threat of political dissent, economic backwardness, and overreliance on China, but a consensus remains elusive. Any attempt to properly analyze this transition must recognize the historical context behind the decisions leading to the NLD's rise to power. Accordingly, this paper will seek to provide a detailed account of the contemporary and historical situation in Myanmar and use this to develop an explanation for the country's recent political change. After exploring the extent of political change in Myanmar, the paper analyzes the most pertinent political, economic, and military developments that occurred between 1990 and 2014. This analysis shows that the best explanation for this surprising transition comes from contemporary studies of military regimes which suggest that they prioritize continuity of the military over political power. The nature of military regimes and specific actions taken by Myanmar's military after transition both lead to the conclusion that the regime willingly chose to relinquish power in the face of internal divisions and declining legitimacy.

PERCEPTIONS OF FOSTER CARE WORKERS ON BIRTH PARENTING TIMES

Pallas Schuster*
Business and Social Sciences, Section 1
Presentation Number: 48
Mentor(s): Jennifer Farley*

Birth parenting time between children in foster care and their biological parents are often thought of as a standard path toward achieving reunification. The overall goal of parenting time is to create space for both the parent and child to have positive parent-child interactions and either work towards or maintain a healthy parent-child relationship. However, birth parenting times can be stressful for the parent, child, foster parent, and the foster care caseworker. To facilitate optimal parenting times, evidenced-based practices recommended foster care workers utilize a relationship-based approach when supervising parenting time. However, there is limited research on what relationship-based strategies are used or effective during the birth parenting times. Therefore, this mixed-method study aims to explore the perceptions of foster care caseworkers on birth parents with children in foster care, the relationships between birth parents and caseworkers, and the supports that caseworkers have when working with birth parents. A total of five foster care caseworkers at a Midwest foster care agency participated in this study and completed both an interview and a survey. Results from interviews highlighted the acknowledgment of the barriers birth parents face along with their strengths. Results emphasized the importance of caseworkers developing relationships with birth parents and tailoring services to meet their needs. Additionally, caseworkers reported being open and honest when communicating, which helps the birth parents feel supported and more comfortable. A majority of caseworkers reported finding their caseload somewhat manageable, and all caseworkers reported feeling confident in facilitating birth parenting times. Finally, a variety of inner agency supports were identified by caseworkers that helped support their work with birth parents. Further research along with practice implications will also be discussed.

THE ROLE OF THE POLICE AND THE MEDIA IN REPRESENTATION OF TRANSGENDER HOMICIDE

Harnoor Kaur
Business and Social Sciences, Section 1
Presentation Number: 49
Mentor(s): Christina DeJong

Public reports from the police and the media heavily influence how the world views transgender homicide victims, with most media outlets using official police reports as their initial source of information. If police deadname and misgender victims, the information and portrayal of victims absorbed by the general public is also information that reaffirms biases and stereotypes about transgender individuals. In addition, police are not always clear about whether these homicides are classified and investigated as hate crimes. Failing to identify these homicides as hate crimes can hide the true motives behind the attack, and often leads to a continuation of transphobia. The media can also report these homicides in biased ways, which plays a major role in forming public opinion about the issue—particularly when their reporting is based on hegemonic gender roles that paint the victim in a stereotypical light. My research will focus on several case studies of transgender homicide in police reports and by the media to determine the extent of bias and transphobia contained within. Recommendations on how these homicide cases could be reported will be addressed.

THE BETHLEHEM TEMPLE'S ROLE IN THE AFRICAN AMERICAN COMMUNITY STRUGGLE AGAINST URBAN RENEWAL

Berkley Sorrells
Business and Social Sciences, Section 1
Presentation Number: 50
Mentor(s): John Aerni-Flessner

The construction of Interstate Highway 496 forcibly relocated families between 1964 and the summer of 1966 in the community around Main St./ St. Joseph's neighborhood. As traffic roars across I496 through downtown Lansing, the effects of this Urban Renewal and stories of the families who used to call these neighborhoods home remain largely unacknowledged. Through the Stebbins Real Estate Collection in the Capital Area District Library, I have worked to highlight the importance that cultural hubs, like the Bethlehem Temple Church formally located at 835 W. Main, play in maintaining a sense of community among neighborhoods of families forced to relocate. Through tracing the various locations of the Bethlehem Temple Church and those who lived around it on W. Main St. in the 1930s, a narrative is formed of the persisting vitality within Lansing's African American community despite active displacement from their homes. While the stories of these individuals and the wider community need to be told so that people can better understand the harmful impacts of such programs, they do not limit the ways that African American residents saw themselves or their communities. The physical presence of the neighborhood may have been ultimately removed, but the deep bonds established within it through the cultural hubs and institutions within the community like the Bethlehem Temple allowed for its own kind of renewal—one of ultimate stability and longevity.

THE IMPACT OF INCLUSIVE LEADERSHIP ON EMPLOYEE DELIGHT AND TEAM-MEMBER EXCHANGE

Vinh Le, Christina Heydenburg
Business and Social Sciences, Section 1
Presentation Number: 51
Mentor(s): Mi Ran Kim, Bonnie Knutson

The COVID-19 pandemic has resulted in an unprecedented economic crisis globally, and particularly in the U.S. Under this circumstance, service innovation is vital for a sustainable

business, and it comes about when an employee develops, promotes, and implements new ideas which are critical components of employees' innovative work behavior. Highly inclusive leaders play an essential role in enhancing employees' innovative work behavior because they are committed to diversity and inclusion because these objectives align with their values and because they believe in the business case. This study is to explore the impact of inclusive leadership (openness, availability, accessibility) on employee delight, which can ultimately lead to customer delight and mutual delight between customer and employee.
Furthermore, this study is to examine similarities and differences in the relationships among inclusive leadership, team-member exchange, and employee delight across different generation groups. In particular, understanding the young generation's work attitudes and behaviors becomes more pressing as they become the majority in positions of power and influence. Thus, any hospitality business organization must develop effective management strategies for this generation as the literature indicates that Gen Yers differ distinctly from older generations in terms of their work attitudes and behaviors. Further, this study extends the concept of customer delight by expanding to internal customer delight (=employee delight). Thus, the findings of this study can broaden knowledge of delight within the hospitality industry.

THE BEST INTENTIONS: AN EXPLORATION OF CROSS-CULTURAL INTERACTIONS AND HUMANITARIAN AID IN RURAL MOZAMBIQUE

Ian Donahue
Business and Social Sciences, Section 2
Presentation Number: 52
Mentor(s): Omowumi Elemo

In 2019 the East African nation of Mozambique, currently ranked as having one of the lowest GDPs per capita in the world, suffered the impact of two devastating cyclones in as many months. In response to the damage inflicted, various international humanitarian teams directed their efforts to distribute emergency aid throughout the country, including in remote island and inland communities along the coast. This paper explores the effect of cross-cultural interactions on the distribution of aid within these rural communities via the lenses of Cultural Anthropology and theories of cross-cultural communications. Through a brief case study of the interactions between primarily international aid workers and the local recipients of aid, we can examine the influence of differences in culture, race, and class status on communication during the distribution of aid in a post-colonial nation. The insight for this topic comes from both scholarly sources, such as anthropologist Clifford Geertz, as well as anecdotal insights from primary sources, including my own reflections on personal experiences as an aid worker in Mozambique. This paper suggests ways in which inherited values, conceptions, and internalized histories may form barriers to communication and asks in what ways, if any, these barriers impacted the effective distribution of emergency aid in rural Mozambique.

RESILIENCE AFTER NATURAL DISASTERS: ENVIRONMENTAL JUSTICE IN PUERTO RICO AFTER HURRICANE MARIA

Nate Bollman, Andrea Vera
Business and Social Sciences, Section 2
Presentation Number: 53
Mentor(s): Susan Masten, Stephen Gasteyer

This study investigates the characteristics and distribution of resilience in the context of Hurricane Maria's legacy on Puerto Rico as a coastal area devastated by natural disaster. We begin by analyzing the effect of climate change on natural disasters. We then examine the political, ecological, and social context, specifically examining how inequality affects vulnerability and resilience to natural disasters. We investigate the regulations, policies, and conditions that exacerbated the impacts of and ability of Puerto Rico to adapt to disasters, including infrastructural disinvestment. We also evaluated the effectiveness of current or

proposed engineering solutions. The study concludes with recommendations for transformation and policy change in Puerto Rico that are aimed at ensuring environmental justice in future efforts for disaster response and relief.

EFFECTS OF TRANSRACIAL ADOPTION ON THE PSYCHE AND MENTAL HEALTH OF ADOPTEES

Abi Otwell
Business and Social Sciences, Section 2
Presentation Number: 54
Mentor(s): Jodi Yelinek

Transracial adoptees form a small minority group that is subject to an intriguing combination of social pressures that creates distinct stressors on mental health. Attempts to navigate two or more cultures when developing their racial/cultural self-identity can cause transracial adoptees to feel isolated from multiple social communities. Due to their minority status, ethnic transracial adoptees will also face greater discrimination than White parents which can create a divide between parent and child. Although White parents will never truly understand the "color-experiences" of their ethnic children, the creation of a color conscious, multicultural family that embraces and celebrates differences can combat threats against a transracially adopted child's sense of self which directly translates to greater mental health. These families have the chance to explore race relations with unique perspective by understanding psychological consequences of racial discrimination in the current American society, advocating for the development of multicultural identity, and amplifying the voices of marginalized people.

COURTROOM BIASES: IMPLICIT BIASES AND ASIAN AMERICAN ATTORNEYS

Shriya Yarlagadda*
Business and Social Sciences, Section 2
Presentation Number: 55
Mentor(s): Kevin Lorentz*

Previous studies in juror psychology have yet to adequately address the impact of defense attorney race and gender on trial verdicts. In a preliminary survey experiment performed by the researcher, participants were randomly assigned one of three vignettes describing a scenario based upon The Commonwealth of Massachusetts vs Johnson, a mock trial case. Each vignette was varied to either describe the defense attorney as an Asian Male, Asian Female, or not provide a description to produce a control group. It was determined that while the presence of an Asian Male attorney may decrease the level of guilt with which defendants are seen as compared to a control group, the proportion of guilty verdicts did not significantly vary. While this result refutes existing studies that have suggested that minority race defense attorneys are less likely to achieve successful outcomes for their clients, perhaps a result of the Model Minority stereotype that many Asians face, this study also points out numerous instances of implicit racial and gender biases that may be amplified by the courtroom. However, this study is limited by its small and nonrandom sample. This poster will outline steps that an upcoming study will take to alter the preliminary study in order to produce more accurate findings. This includes creating an interactive audiovisual trial experience using Camtasia and survey distribution through Amazon Mechanical Turk.

STIGMA AND STEREOTYPES ASSOCIATED WITH HIDDEN DISABILITIES ESPECIALLY IN THE WORKPLACE SETTING

Maya Stevelinck
Business and Social Sciences, Section 2
Presentation Number: 56
Mentor(s): Stacy Hickox

Employees with disabilities face the stigma and stereotypes associated with their impairment whenever supervisors or coworkers become aware of their condition. While some people with disabilities may choose to keep their disability a secret, many are unable to do so if the disability is readily apparent or if they need to disclose their disability to obtain an accommodation that enables them to perform their job. An original survey of employees with disabilities at a large university revealed that many faced negative consequences when they revealed their disability to supervisors and coworkers. After providing an analysis of those survey results, this paper explores how courts have applied the Americans with Disabilities Act (ADA) to claims by employees that knowledge of their disability led to negative consequences for them in the workplace. This review of court decisions reveals that the ADA's protection against discrimination rarely provides relief to employees who suffer those negative consequences because the courts fail to consider circumstantial proof of intentional stigmatization and stereotyping to a jury.

THE PERCEPTIONS OF GENDER EQUALITY IN THE HOSPITALITY INDUSTRY FROM THE PERSPECTIVE OF EARLY CAREER EMPLOYEES

Kailey Konkle
Business and Social Sciences, Section 2
Presentation Number: 57
Mentor(s): Mi Ran Kim

Women make up over 60% of employees, students, and the decisions within the hospitality industry but somehow only hold 5% of the CEO positions. Gender equality has been a looming issue for decades, how prevalent is it for those who are fresh into their careers? Using an online survey this study sought out to explore the thoughts and opinions of recent hospitality program graduates.

PROJECT WORKFLOW AND RESOLUTION ANALYSIS IN AEC PROJECTS

Kendal Albrecht
Business and Social Sciences, Section 2
Presentation Number: 58
Mentor(s): Sinem Mollaoglu, Kenneth Frank, Meltem Duva, Dong Zhao

Understanding interactions and workflow processes in Architecture, Engineering, and Construction (AEC) projects is vital to optimizing issue resolution and project outcomes. There is a need to understand how interdisciplinary and inter-organizational project teams work together on complex projects. This is emphasized in how they spend meeting time. The aim of this study is to investigate the workflow processes by analyzing the time spent resolving issues in meetings, discussing technical aspects of the project, and communication between team members during the Stay at Home Order. To better facilitate teamwork in the future, project managers can use this study to analyze their workflow process to optimize meeting time. To achieve the study goals, we collected weekly AEC project meeting recordings that took place virtually during the construction phase. We then coded the meeting content and grouped into different categories (i.e. technical, communication, and resolution). Moreover, the individuals attending the meetings were represented by their roles in the project and areas of expertise to understand the relationship between personal attributes and workflow processes. The results indicated that technical and resolution-based interactions have an inverse relationship and peak

mid- term in the intervals of the phase. With limited data, the issue resolution ability peaked when resolution-based discussions were higher in meetings. The expertise analysis in meetings illustrated that issues brought up in meetings needed a higher number of experts and project leaders to facilitate quick resolution.

CELL BIOLOGY, GENETICS AND GENOMICS

A COMPUTATIONAL APPROACH TO REPURPOSE HOST-DIRECTED THERAPEUTICS AGAINST MYCOBACTERIUM TUBERCULOSIS AND STAPHYLOCOCCUS AUREUS INFECTIONS

Phoebe Tuyishime
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 62
Mentor(s): Janani Ravi

Background Host-directed therapy (HDT) is a promising avenue for combating infectious diseases that continue to result in high mortality rates due to the rise of drug-resistant pathogens. An attractive route to HDT is by repurposing existing FDA-approved drugs designed for non-communicable diseases to fight infectious diseases at reduced cost and time. We are developing a computational workflow to repurpose approved drugs for HDT in infectious diseases. Methods We first obtain infectious disease-related and drug-related expression datasets from public gene-expression databases (NCBI GEO and LINCS). Based on the hypothesis that HDT candidates reverse the effects of the disease, we then identify potential drug-disease pairs that show anti-correlation between the drug and disease expression signatures. Results We are applying and testing this general workflow on both Mycobacterium tuberculosis and Staphylococcus aureus infection datasets to (i) identify critical genes and (ii) identify pathways that are consistently perturbed, and (iii) generate a list of candidate HDT drugs that could target the key dysregulated gene signatures/pathways. Data: https://github.com/jraviab/drug-repurposing

FUNCTIONAL ANALYSIS OF ENDOTHELIN LIGAND GENES IN THE ZEBRAFISH NEURAL CREST CELL POPULATION

Cameron Bennett
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 63
Mentor(s): Ingo Braasch

Neural crest cells (NCC) are an embryonic cell population that differentiates into many tissues including heart, vascular, pigment, neuronal, and craniofacial bone. Unique to vertebrate organisms like fish and humans, the neural crest forms along the dorsal neural tube before migrating throughout the body. The endothelin (Edn) signaling system is a key molecular regulator in cell fate determination, migration, and differentiation into different NCC derivatives. Endothelin ligands and their respective receptors make up the core of the endothelin system. Whole-genome duplication events have led to multiple Edn ligand and receptor genes in vertebrate genomes. As a result, vertebrate genomes contain multiple Edn ligand and receptor genes. Our objective is to better understand the function of several Edn ligands, focusing here on Edn4, in the zebrafish, Danio rerio. Currently, the function of Edn4 is unknown. We are using zebrafish because they are an established biomedical model organism with transparent embryos that allow visualization of gene expression and function during development. The CRISPR-Cas9 genome editing system was used to successfully knock out edn2a and edn2b genes in established edn4 mutant zebrafish thus creating a line of endothelin quintuple mutants. The findings of this study enhance our understanding of the functions of the endothelin ligand

gene family and provide insight into gene function in cases of gene and genome duplication and subsequent evolution.

IDENTIFYING DIAGNOSTIC SRNA TARGETS IN INFECTED HOSTS USING COMPUTATIONAL APPROACHES

Philip Calhoun
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 64
Mentor(s): Janani Ravi

Early diagnosis of many agriculturally relevant zoonotic diseases has always been problematic since the hosts often remain asymptomatic until it's too late. The second main problem has been with accurate and sensitive diagnosis often confounded by closely-related and environmental bacteria. We, therefore, focus on developing a computational workflow to identify pathogen-specific diagnostic targets that can be detected in infected hosts. Small RNA (sRNA) is a class of RNA that is used regularly in cellular housekeeping and is critical for gene regulation in immunological and developmental contexts. Upon infection, changes could occur in both host and bacterial sRNA. We are interested in identifying bacterial sRNA that are pathogen-specific, making them excellent candidates for diagnostic biomarkers. Although intra- and extracellular sRNA have been used extensively in cancer detection (host miRNA), few studies have addressed sRNA as biomarkers for detecting pathogens within the host. Here, we propose computational approaches to detect pathogenic sRNA in infected host samples. The computational workflow will be used to identify pathogenic sRNA in sequenced sera from white-tail deer (Odocoileus virginianus) infected with bovine tuberculosis (Mycobacterium tuberculosis bovis). We will use existing sRNA databases, host and pathogen reference genomes, measure differential expression, and benchmark against existing sRNA pipelines to help us discern uniquely bacterial sRNA that can be isolated and detected in infected host samples. Taken together, our approach will help us identify sRNA signatures unique to M. tuberculosis variant bovis in Odocoileus virginianus, and any combination of pathogen infected hosts, and facilitate early diagnosis of bacteremia.

SPERMATOGENESIS IN MEXICAN WOLF TESTIS OF DIFFERING AGES

Bridie McClusky
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 65
Mentor(s): Dalen Agnew

Mexican wolves are one of the most endangered subspecies in North America. From 1976 to 1998 the species was considered extinct in the wild until their reintroduction in Arizona and New Mexico. Due to their small population size, inbreeding has become necessary for the species to survive. Past studies have found evidence that the inbreeding in the male Mexican wolf population has reduced sperm quality compared to the generic grey wolf. The purpose of this study is to examine the quality of spermatogenesis in Mexican wolves, allowing population managers to determine the optimum age for breeding success. After puberty, we expect to see a decrease in spermatogenesis as age increases. Differentiation techniques using a digital imaging analysis program (Image Pro ®) will be used to establish the ratio of seminiferous tubules to leydig cells. Image Pro ® will also be used to measure the surface area of seminiferous tubules, including and excluding the lumen, in microscopic sections. These techniques will provide a morphological proxy for the quality of spermatogenesis in Mexican wolf testes.

FUNCTIONAL AND BINDING CHARACTERISTICS OF INSULIN-LIKE GROWTH FACTOR (IGF1) AND INSULIN-LIKE GROWTH FACTOR RECEPTOR (IGF1R) AS A THERAPEUTIC POTENTIAL OF TYPE 1 DIABETES

Katelyn Wiessner
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 66
Mentor(s): Masako Harada

Insulin-like growth factor 1 (IGF1) plays a crucial role in the development of growth in the body and almost every cell within. IGF1 is a protein consisting of 70 amino acids along with three intramolecular disulfide bridges. Type 1 diabetes is an autoimmune disease caused by the destruction of insulin- producing pancreatic beta cells, which results in reduced insulin secretion. In this regard, we examined the structural and functional characteristics of IGF1 and insulin-like growth factor 1 receptor (IGF1R) in mice and humans. IGF1 binds to and activates IGF1R, a receptor tyrosine kinase that is involved in cell growth. We examined the coding sequences of the protein and found the similarity between mice and human IGF1, which implies the functional similarity of the encoding proteins. The localization of IGF1 and IGF1R suggests a possible injection route in animal studies. The three-dimensional structural analysis revealed binding characteristics such as what makes up the individual atoms as well as hydrophobic and hydrophilic regions of the surface. Finally, focusing more in-depth at the binding structure of IGF1R showed through essential binding domains. In conclusion, IGF1 potentially mediates a therapeutic effect by promoting beta-cell growth upon binding to IGF1R in Type 1 diabetes therapeutics.

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

Katherine Lauro
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 67
Mentor(s): Masako Harada

This project investigated the therapeutic potential of the insulin growth factor 1 (IGF-1) gene as a treatment for type 1 diabetes (T1D). The most common T1D treatment is insulin-replacement therapy, which allows for the body to metabolize glucose reduced or lost insulin secretion caused by pancreatic β cell destruction. However, insulin-replacement therapy only serves as a symptomatic treatment rather than a permanent solution. An ideal cure for T1D counteracts the autoimmune damage to pancreatic β cells by promoting the regeneration of new β cells from islet cell precursors and preventing a future autoimmune attack. Previous studies suggested that because IGF-1 contributes to the growth and differentiation of pancreatic tissue, it could potentially promote β cell regeneration. However, targeted delivery of nucleic acids, such as the IGF-1 gene toward the pancreas, can be difficult due to their charge, larger size, and sensitivity to degradation, which led us to investigate various carrier molecules and targeted delivery techniques to overcome this obstacle. Extracellular vesicles (EVs) are potential carrier molecules for gene delivery due to their innate ability to transfer genetic materials and minimal cytotoxicity or evoke an autoimmune response in the body, which is a challenge with other delivery methods. A technique to load genetic materials to EVs is yet to be developed. Thus, various loading techniques were investigated as well as EV surface modifications to improve targeted delivery to the pancreas.

DETERMINING THE OPTIMAL DISEASE-DRUG CONNECTIVITY SCORE SUMMARIZATION METRIC FOR DRUG REPURPOSING

Kewalin Samart
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 68
Mentor(s): Janani Ravi, Arjun Krishnan

Drug repurposing is an efficient alternative for new drug discovery, which is both cost- and time- effective. We rest on the key principle that efficacious drugs will successfully reverse the disease signatures with minimal side-effects. Over the years, many methodologies have been developed towards finding reversal relationships between disease and drug gene expression profiles. In order to compute these disease-drug 'connectivity scores', enrichment scores (ES) built upon Kolmogorov- Smirnov tests (K-S test) are critical in revealing the level of similarity between two gene expression profiles of interest. Gene Set Enrichment Analysis (GSEA), a modified version of the K-S statistics, is one of the most-used methods for computing enrichment scores. However, different published drug-repurposing-related research papers have established distinct formulaic approaches to calculate connectivity scores and each of them has claims of improvement in robustness. We, therefore, are working towards reconciling multiple disease-drug connectivity scores including scoring calculations based on connectivity scores, cmap tau scores, and reverse gene expression score (RGES). This effort will help us and the community identify and establish the most robust way to quantify the drug-disease signature reversal and adapt them to our computational framework for drug-repurposing in infectious diseases.

ENGINEERING EXTRACELLULAR VESICLES FOR PANCREAS-SPECIFIC DRUG DELIVERY

Shakhlo Aminova
Cell Biology, Genetics and Genomics, Section 1
Presentation Number: 69
Mentor(s): Masako Harada, Anshu Malik

Cell-derived Extracellular vesicles (EVs) are our body's intercellular communication vehicles that may represent useful drug delivery tools due to their natural capacity as molecular cargo within the body. EVs transport molecules such as proteins, lipids, DNA, and RNA between cells or tissues in distant organs. The goal of this project is to develop pancreas-targeting EVs for the selective delivery of molecular drugs to the pancreas. At first, we generated a peptide-EV-display DNA construct using the Seamless Ligation Cloning Extract (SLiCE) method that mediates enzyme-free homologous recombination. DNA fragments encoding a pancreas targeting-peptide and tumor cell-targeting peptide were cloned into EV-display backbone construct harboring the C1C2 domain of the gene lactadherin, which displays peptides on the EV surface. Peptide-display EVs were generated by transfecting these plasmids into a human embryonic kidney cell line (HEK293T) and the EV isolation from the cell-culture media by ultracentrifugation. The expression of the peptide-C1C2 fusion on EVs was verified with western blotting using the antibodies against CD63 (EV marker) and HA-tag (peptide-C1C2 protein). Nanoparticle Tracking Analysis (NTA) confirmed the size distribution and particle number of the engineered EVs. In summary, we have successfully generated EVs decorated with pancreas-targeting peptide and verified the quality and quantity, which will be further used for in vitro and in vivo testing of these pancreas targeting EVs and their selective delivery of therapeutic drugs.

ENHANCER ACTIVITY IN THE INTRONIC REGIONS OF THE D. MELANOGASTER INSULIN RECEPTOR GENE

Gabby Hardy
Cell Biology, Genetics and Genomics, Section 2
Presentation Number: 70
Mentor(s): Sandhya Payankaulam, David Arnosti

The insulin signalling pathway is highly conserved and plays important roles in metabolism, growth, and development by regulating the uptake of glucose from the bloodstream. Alterations and malfunctioning of this pathway has been shown to cause serious disease. One way the insulin signalling pathway is regulated is through expression of the insulin receptor (InR) gene. However, the detailed mechanisms for transcriptional regulation of this gene is not well understood. In an extension of our labs previous work, we hope to create a finer image of regulatory elements in the non-coding region upstream of the InR gene. Certain fragments of the ~40 kb intronic region have already been shown to contain regulatory sequences. By breaking these pieces down further, we hope to uncover in greater detail which transcriptional factors may be binding and where on this gene. Thus far through luciferase assays in S2 insect cells, we've seen that dividing the regulatory regions into ~300 bp pieces makes them non-functional in altering expression of the InR gene. Further testing of relative activity with larger subfragments should show us more about transcription factor binding.

INVESTIGATING THE BINDING INTERACTION BETWEEN UHRF1 PHD D334A AND UHRF2 PHD D363N AT H3K9ME3

Kaitlyn Bricker*
Cell Biology, Genetics and Genomics, Section 2
Presentation Number: 71
Mentor(s): Brittany Albaugh*

Ubiquitin-like, containing PHD and RING finger domains protein 1 (UHRF1) is an epigenetic histone reader protein. D334 of UHRF1 within the PHD is proposed to ionically interact with R2 of H3. To test this possibility, we created a UHRF1 PHD D334A mutant by mutagenesis and analyzed its impact on the binding of H3 peptides by fluorescence polarization. We found that changing the negatively charged aspartic acid to neutral alanine ceased the ability for UHRF1 and H3 to bind. This study has allowed us to better understand the UHRF1-histone interaction.

VARIATION OF THE COMMON CAROTID ARTERY DIAMETER RELATED TO AGE

Atalie Garmo*, Adrienne Chaney*
Cell Biology, Genetics and Genomics, Section 2
Presentation Number: 72
Mentor(s): Mary Tracy-Bee*

In a multi-campus and multi-year study, we investigated the relationship of the size of the common carotid artery versus age of death. The common carotid artery is located bilaterally in the neck and is a common location for taking a pulse. The artery is vital in delivering blood to head and neck structures, including the brain. A significant and positive correlation was identified bilaterally in the diameter of the common carotid arteries in to age of death in human cadavers ranging from 24 to 104 years old (p=0.001) with a sample size of 162. Our data supports the observed relationship between the age of death to the diameter of the common carotid artery. This positive correlation may offer an insight into circulatory- related procedures in the cervical region or may be indicative of a related genetic predisposition to a higher vascular flow.

ERROR-PRONE DNA REPAIR DOES NOT INCREASE IN SGS1-FD MUTANTS OF SACCHAROMYCES CEREVISIAE

Beth Wasserman*, Joseph Oberlitner*
Cell Biology, Genetics and Genomics, Section 2
Presentation Number: 73
Mentor(s): Anne Casper*

Repair of DNA double-strand breaks (DSBs) can lead to mutations and rearrangements, potentially leading to cancer. We are investigating mmBIR, an error-prone DSB repair pathway in S. cerevisiae, also seen in cancer cells. We analyzed a previously documented mutation, sgs1-F1149D (Phe to Asp), which disrupts its normal interaction with Rad51p, a protein involved in the canonical BIR repair pathway. We hypothesized that sgs1-FD mutants will have more error-prone mmBIR than canonical BIR. We collected cells with repaired DSBs, and analyzed their genomic sequences and the sizes of the repaired chromosomes. In sgs1-FD mutants we observe no increase in mmBIR, inconsistent with our hypothesis.

A PANGENOME AND COMPARATIVE PATHOGENOMICS WORKFLOW FOR BACTERIAL PATHOGENS

Karn Jongnarangsin
Cell Biology, Genetics and Genomics, Section 2
Presentation Number: 74
Mentor(s): Janani Ravi

Whole-genome comparisons can be performed through the use of pangenomes: a master gene set derived from genomes of numerous related species. Pangenomes identify which genes are conserved across all genomes (core), present in multiple but not necessarily all genomes (accessory), and unique to single species/strains. The presence/absence of genes across genomes can, therefore, be used to study species evolution and diversity, and functional annotation of various bacterial groups. One use case for pangenomes is investigating Mycobacterial species as they have a wide range of associated pathologies in human and animal hosts, e.g., members of the Mycobacterium tuberculosis (MTB) complex are causative agents of tuberculosis, non-tuberculous Mycobacteria (NTM) may cause pulmonary and chronic pathologies in animals and humans. Another use case is investigating Staphylococci, which are notorious for their various antibiotics resistances, horizontal gene transfer capabilities, and enterotoxins similarity, e.g., S. aureus and its resistant strains (MRSA, VRSA, etc.), S. epidermidis and its pathogenicity islands. The process of constructing a pangenome from a large number of complete genomes involves multiple, computationally intensive, intermediary steps, including the annotation of constituent genomes and gene grouping based on feature/function. We are incorporating all these steps in a streamlined pangenome construction workflow to compare Mycobacterial/Staphylococcal pathogenic and nonpathogenic species. The comparative pathogenomics and pangenome workflows that we develop can be easily repurposed to address several critical pathogenesis and host-specificity related questions in any bacterial species of interest.

A COMPUTATIONAL MOLECULAR EVOLUTIONARY APPROACH TO CHARACTERIZE BACTERIAL PROTEINS

Samuel Chen
Cell Biology, Genetics and Genomics, Section 2
Presentation Number: 75
Mentor(s): Janani Ravi

Molecular evolution and phylogeny can provide key insights into pathogenic protein families. Studying how these proteins evolve across bacterial lineages, can help identify lineage-specific and pathogen- specific signatures and variants, and consequently, their functions. We are building a streamlined computational approach for the molecular evolution and phylogeny of

target proteins, widely applicable across protein and pathogen families. We applied this approach to examine the phage shock protein (Psp) system and its evolution across all three domains of life (~6500 genomes within bacteria, archaea, and eukaryota). Our process currently starts with one or more proteins and their homologs from thousands of species, along with their detailed functional characterization including domain architectures, genomic neighborhoods, and phyletic maps. We are creating a custom R package to analyze and visualize the conservation of domain architectures and genomic neighborhoods across lineages. To showcase the versatility of this approach, we build a web-app to allow dynamic analysis and visualization. Our ultimate goal is to build an online molecular evolution and phylogeny platform for biologists and an R package for computational biologists to use with their data by simply uploading a protein sequence file.

COMPUTATIONAL EVOLUTIONARY APPROACH FOR MOLECULAR CHARACTERIZATION

Lauren Sosinski
Cell Biology, Genetics and Genomics, Section 2
Presentation Number: 76
Mentor(s): Janani Ravi

A critical aspect of understanding the molecular basis of fundamental bacterial processes such as pathogenesis or energy acquisition is a thorough characterization of the underlying proteins. Several individual computational tools have been developed to characterize proteins at the level of sequence, structure, and function, especially in the context of molecular evolution and phylogeny. However, there is still a lack of a comprehensive and consolidated workflow for applying all the relevant tools for a protein of interest. Here, we describe a workflow that we have developed to address this challenge and apply it to study the proteins involved in sulfur acquisition in Staphylococcus aureus and virulence factors in Mycobacteria. For each protein of interest, our workflow begins by finding its homologs across pathogenic/nonpathogenic species (using BLAST tools) and then resolving all these related proteins into their domain architectures, secondary structural elements, and cellular localization signals (using RPSBLAST, InterProScan). In addition to these features within the protein, the genomic neighborhood of the gene encoding the protein plays a role in determining the protein's function. Hence, we also determine the genomic context of these proteins. Finally, we use all these findings to predict both sequence-structure-function relationships and lineage-specific adaptations. This comprehensive workflow results in concrete predictions about the molecular functions of the proteins across lineages that can be experimentally and clinically validated. We have made this workflow general by packaging it as a web-application to enable biologists to query any protein(s) of interest across vast groups of pathogenic and nonpathogenic bacteria.

CHEMICAL ENGINEERING AND MATERIALS SCIENCE

UNDERSTANDING KINETICS USING MARCUS THEORY IN DYE SENSITIZED SOLAR CELLS

Lauryn Gibbs*
Chemical Engineering and Materials Science, Section 1
Presentation Number: 80
Mentor(s): Thomas Hamann, Austin Raithel

Dye sensitized solar cells (DSSC) have emerged as comparable competitors to silicon based solar cells due to their superb efficiency converting light to electrical energy. DSSCs are more affordable and competitive if the DSSC operates at an efficiency similar to a silicon based solar cell. DSSC are ideal for applications like indoor light recycling, due to high indoor light efficiency, because they can be semi- transparent. A DSSC functions by capitalizing on the large surface area of the semiconductor to allow for effective light absorption by a sensitizing attached to the surface. DSSC's function similarly to photosynthesis, absorbing a photon and

performing a complex series of electron transfer reactions. Marcus theory, used to explain the rate constants of these electron transfer reactions, should provide a framework to understand the kinetics of dye sensitized solar cells. Specifically, differences in reorganization energy and driving force (activation free energy) of reactions should allow a general understanding about key electron-transfer reactions and result in design rules for new system components. Such an analysis is lacking in the majority of literature reports on DSSCs, however. Due to the lack of exploration of this link, there is not a consensus on the results and their relation to Marcus Theory. This project aims to study the current literature linking Marcus Theory and kinetics in DSSC's to gain a comprehensive understanding of dye regeneration kinetics.

ENDOCYTIC PATHWAY STUDY THROUGH RELIEFF

Ryan Jin
Chemical Engineering and Materials Science, Section 1
Presentation Number: 81
Mentor(s): Christina Chan

Current small molecule drug treatments typically rely on passive transport through the cell membrane, limiting the number of treatable diseases. Small interfering RNAs (siRNAs) have been shown to down- regulate gene expression in human cells through the degradation of mRNA, allowing for the potential to treat currently undruggable targets. However, siRNAs cannot diffuse through the cell membrane and must be transported into target cells by a process called endocytosis. Multiple mechanisms for endocytosis exist including macropinocytosis, Clathrin-, Caveolin-, Arf6-, GRAF1-, and Flotillin-mediated endocytosis While the mechanisms for macropinocytosis, Clathrin-mediated endocytosis, and caveolin- mediated endocytosis are reasonably well-understood, the molecular level regulation of the remaining pathways has not been clearly established. Further study of endocytic pathways can improve treatments using siRNAs, as prior research has shown that different human cells utilize different endocytic pathways to internalize the same substances. Using ReliefF, a nearest neighbor feature selection algorithm, and GENEVESTIGATOR, a commercial gene expression database, we are studying the genes involved in endocytosis in multiple cell lines. We are using ReliefF to compare multiple cell types and experimental conditions simultaneously and rank the gene expression data from GENEVESTIGATOR to identify cell- specific regulators of endocytosis.

RECYCLED POLYSTYRENE FOAM: POTENTIAL ADHESIVE FOR BAMBOO COMPOSITES

Kelli Weigold
Chemical Engineering and Materials Science, Section 1
Presentation Number: 82
Mentor(s): Lawrence Drzal, Per Askeland, Carl Boehlert

As the human population continues to grow, the sustainability of the materials used to build our infrastructure, means of transportation, and everything around us becomes of increasing importance. Due to its high tensile strength, fast growth rate, and biodegradability, bamboo is an excellent candidate for a sustainable material with countless possible applications, from housing and transportation to toothbrushes. Additionally, expanded polystyrene foam, more commonly known as "styrofoam," is a popular choice for single-use insulating storage containers and building insulation, but lacks an effective recycling strategy. The purpose of this project is to create a useful structural material that takes advantage of the high sustainability of bamboo while combining it with an adhesive made from post- consumer styrofoam to produce bamboo composites. To assess the potential of this idea, two types of bamboo "sandwiches" were created, consisting of two layers of bamboo held together with a thin layer of polystyrene adhesive; a surface treatment was applied to one type. The tensile properties of each sample were measured, and fracture surfaces were analyzed using scanning electron microscopy. In this presentation, the results and conclusions of the above experiments will be discussed, along with comments on possible future work.

CARBON FIBER RECLAMATION THROUGH REVERSIBLE SIZING

Kelli Weigold
Chemical Engineering and Materials Science, Section 1
Presentation Number: 83
Mentor(s): Robert Ferrier

Carbon fibers (CFs) are added to polymers to create very strong, lightweight materials for use in everything from aircraft to tennis rackets. Unfortunately, CFs are expensive to produce. At a price of around $10 per pound, they currently cost ten times more than steel. Existing recycling strategies for carbon fiber reinforced polymer (CFRP) composites fail to retain the full utility of the CFs. The purpose of this project is to identify a means to effectively recycle CFs at the end of the material's life, without altering their mechanical properties. Covalent adaptable networks (CANs) are polymeric materials held together by reversible chemical bonds. Attaching CFs to the surrounding polymer matrix via reversible bonds will allow the CFs to dissociate from the matrix upon introduction of a specific trigger, thus providing a way for CFs to be reclaimed from CFRPs and later reused. The project's focus will be on identifying potential coatings, known as sizings, for the CFs themselves, that could be applied to produce the desired recycling capabilities with minimal changes to the manufacturing process. Additionally, the project will explore how the sizing can be designed to cause bond release when not one, but two independent triggers are introduced, such as heat and exposure to a certain solvent. This approach will prevent catastrophic degradation of the material if accidentally exposed to one trigger during use. This presentation will discuss existing strategies for reversible bonds and sizings in CANs and evaluate their potential in forming a recyclable carbon fiber composite.

STRUCTURE AND REACTIVITY OF FUNCTIONALIZED DOUBLE-DECKER SILSESQUIOXANES USING X-RAY CRYSTALLOGRAPHY DATA

Maxwell Birmingham*
Chemical Engineering and Materials Science, Section 1
Presentation Number: 84
Mentor(s): Robert Maleczka, Andre Lee, Badru-Deen Barry

Our group has developed several synthetic routes to symmetric and asymmetric double-decker shaped silsesquioxanes (DDSQ). Hybrid polymers built of DDSQ molecules can exhibit enhanced properties of materials with possible industrial applications. Physical properties of our synthesized DDSQs were determined by differential scanning calorimetry (DSC) and other methods. The structures of several synthesized DDSQ molecules were also captured using x-ray crystallography. These images were processed and visualized using the Mercury software system. These images will be analyzed for the impact of differing substituent groups on the bond length and dihedral angles within the molecule. The information from the varying substituents could lead to additional understanding of the interplay between the DDSQ molecules' physical properties and structure. This analysis of the x-ray crystallography data will also allow for selection of a static image for presentation in future literary articles.

ADDITIVE MANUFACTURING AND ELECTROCHEMICAL BEHAVIOR OF AEROSPACE ALUMINUM ALLOYS

Megan Shaw*
Chemical Engineering and Materials Science, Section 1
Presentation Number: 85
Mentor(s): Greg Swain, Isuri Dammulla

Research in additive manufacturing (AM), or 3D printing, has greatly increased in the past decade using many materials including metal alloys. Reasons for this research include favorable lightweight structures with comparable strength to traditionally manufactured parts, mass customization, reduced waste, and low costs. The production of 3D printed aluminum alloys

shows promising potential for its application in aerospace. This presentation will discuss the major methods for printing aluminum alloys including electron beam melting (EBM) and selective laser melting (SLM). In addition, the mechanical and electrochemical properties of these alloys will be considered to determine if the aluminum parts are well-suited for aerospace, giving a glance into a more sustainable future of aerospace engineering.

UNEXPECTED NANOPARTICLE SIZE EFFECT ON THE PHYSICAL AGING OF POLYMER NANOCOMPOSITES

Zipeng Xu
Chemical Engineering and Materials Science, Section 2
Presentation Number: 86
Mentor(s): Shiwang Cheng

Thermoplastic polymer nanocomposites (TPNCs) are typically used structural materials due to their lightweight and high mechanical strength. However, the mechanical strength of the TPNCs reduces progressively due to physical aging at application. Recent studies show that including nanoparticles can significantly retard the physical aging process, which can be explained by the free volume hole diffusion model (FVHD). In this study, we investigate the kinetics of the physical aging process of TPNCs of different nanoparticle sizes and different polymer-nanoparticle interactions. For TPNCs with particle diameter DNP larger than the radius gyration of polymer, Rg, the physical aging rate slows down. The larger the particles, the faster the aging. These findings are consistent with the literature report. Interestingly, when the DNP is comparable to the size of the statistical segment size of the polymer, lk, a significant speeding up in the physical aging of TPNCs has been observed, at odds with the conventional understanding of the FVHD. These observations indicate the unexpected effect of small NPs on the physical aging of TPNCs and call for revisions on the current understandings of the mechanism of the physical aging of TPNCs.

MONITORING INTERACTIONS BETWEEN MOLECULES AND LIGHT

Aijalon Bettis*
Chemical Engineering and Materials Science, Section 2
Presentation Number: 87
Mentor(s): Marcos Dantus

Light is a form of energy that interacts with matter. These interactions include absorption, emission, transmission, reflection, and scattering. The objective of my study is to learn about the interaction of light with molecules and how this interaction is influenced by the surrounding solvent. Studying the wavelength and intensity of emitted light from excited molecules is a tool for learning about the interactions with light. Often times, an excited molecule emits light with a longer wavelength than the light absorbed to excite the molecule. This study will focus on the way molecules that are photoactive react when interacting with light. Photodynamic therapy or PDT has been useful in treating esophageal cancer with Porfimer sodium, a drug extremely sensitive to light and approved by the Food and Drug Administration. This research will inform about the importance of light and photoactive molecules and how phototherapy can be used in medicine.

LOW-COST LAUE CAMERA STAGE WITH RASPBERRY PI

Megan Rylko
Chemical Engineering and Materials Science, Section 2
Presentation Number: 88
Mentor(s): Mario Calderon Cueva, Alexandra Zevalkink

A back-reflection Laue camera is a device that takes diffraction patterns of single crystals by using x-rays. These patterns contain information about the atomic structure and orientation of

the crystal. There is currently a Laue camera in MSU's Engineering Building, but small samples can be difficult to move to collect multiple images while remaining aligned with the x-ray beam. To facilitate data collection, a new, low-cost, electronically movable stage will be created to mount samples on. This stage will be constructed with stepper motors and a goniometer, which will be connected to a Raspberry Pi. The purpose of the Raspberry Pi is to program the motors with Python to move the goniometer as specified by user inputs. A GUI (Graphical User Interface) will also be created for ease of use. This stage will then be used in current and future projects to help, for example, characterize single crystals grown by the Bridgman method to determine the lattice parameters as a function of growth conditions by gradually taking images in precise positions across the height of the sample.

PLA RECYCLING VIA THERMODEPOLYMERIZATION

Nicole Mancina
Chemical Engineering and Materials Science, Section 2
Presentation Number: 89
Mentor(s): Ramani Narayan, Mo Alhaj

Poly(lactide) (PLA) is a bio-based, biodegradable polymer that has been used in widespread commercial and industrial applications. Known for its biodegradable behavior, PLA is composted in a two-step process, disintegration and biodegradation, where the polymer chains are split apart into lactic acid; natural organisms then metabolize the lactic acid to produce carbon dioxide and water. However, there are limited composting facilities due to the specific conditions required within the process. In addition, there is no efficient recycling method for PLA, and it must be separated from other plastics for end use. Researchers have studied the unique chemical behavior behind PLA in that it undergoes a reversible reaction. Thermodepolymerization of PLA occurs at temperatures above melting in order to convert the polymer back to lactide. The Biobased Materials Research Group (BMRG) has developed an efficient method to recover lactide from PLA waste via thermodepolymerization. The reaction was carried out at 200º C, and stannous octoate was added as a catalyst at 0.1 wt% due to its low toxicity, fast reaction rate, and economic benefit. Greater than 50% recovery of lactide from PLA waste was achieved with this method based on mass balance. Verification of pure lactide was obtained via differential scanning calorimetry (DSC) and gas chromatography (GC), whereas optical purity and isomeric composition was analyzed via polarimetry. The next step of this research is to scale-up PLA recycling in an extruder, where PLA can be depolymerized to lactide and put through an additional feeder to polymerize again for application use.

THEORETICAL AND APPLIED TREATMENT OF HYDROGEN BONDING IN ALCOHOLS UTILIZING FOURIER TRANSFORM INFRARED SPECTROSCOPY

Andrew Norfleet
Chemical Engineering and Materials Science, Section 2
Presentation Number: 90
Mentor(s): Carl Lira, Bill Killian

Industry requires robust techniques of predicting the phase behavior of systems. This is accomplished with the aid of a thermodynamic mixture models; however, current engineering models fail to accurately represent the behavior of mixtures with components that self-associate, such as alcohols. Model improvement requires incorporation of molecular behavior, which can be examined with spectroscopy. Infrared spectroscopy provides insight into hydrogen bonding behavior by quantifying the hydroxyl stretching vibration for four dominant bond types. In this work, the spectra of alcohols is scaled by the Beer-Lambert law to represent concentrations of hydroxyls vibrating at each frequency. Curve- fitting of the scaled spectra allows for assignment of various regions of the spectrum to specific bond types, resulting in an improved understanding of the association. This work compares the results of curve-fitting with the bond type distributions predicted by Wertheim's perturbation theory (TPT-1) and resumed

perturbation theory (RTPT). The spectroscopic data is then leveraged to provide the association term of Wertheim's perturbation theory to obtain activity coefficients and ultimately predict the phase behavior of alcohol + inert systems.

CLOSED CELL LIGNIN FOAM RESEARCH

Brett Cesar
Chemical Engineering and Materials Science, Section 2
Presentation Number: 91
Mentor(s): Per Askeland, Mojgan Nejad, Christian Henry, Carl Boehlert, David Hernandez Escobar

Low density, closed cell polyurethane foam is an extremely common insulation product because of its unique properties that include preventing heat transfer and being non water absorbent. Currently, researchers are working on implementing lignin, a plant based molecule often discarded in paper product production, to the foam in order to create a more sustainable and environmentally friendly product. This project will compare six samples of low density foams ranging from 0-90% lignin. Using scanning electron microscopy (SEM), this project will be able to compare how lignin affects the microstructure of the foam. These results, in accordance with the research of others, will put researchers one step closer to industrializing lignin based polyurethanes.

EFFECT OF TEMPERATURE ON MARINE BIODEGRADATION OF BIOBASED POLYMERS

Melissa Joslyn
Chemical Engineering and Materials Science, Section 3
Presentation Number: 92
Mentor(s): Ramani Narayan, Apoorva Kulkarni

The production of millions of tons of plastic debris and its leakage and accumulation in the world's oceans and freshwater reserves as microplastics have raised concerns over the last few years. Biobased and biodegradable polymers like PLA, cellulose and PHBV have not attracted any attention as a cause for this pollution because of the misconception that they can degrade easily and quickly in any environment. In reality, they are found to degrade only under certain conditions (temperature, humidity, light, oxygen availability, and microorganisms). This work demonstrates the importance of temperature in measuring and reporting biodegradability of fully biodegradable polymers like cellulose and PHBV. ASTM/ISO laboratory scale standards for measuring and reporting ocean biodegradability are conducted at 25-30°C. However, except the surface layer, almost 90% of the ocean water is at temperatures between 0-4°C. Thus, the rate and extent of biodegradation at such temperatures will be very low and the plastics will persist in the ocean environment for long time periods. During this time, the plastics will impact marine life and habitats. We are testing for the biodegradation of these polymers at three different temperatures- 10, 30 and 40°C. The amount of carbon dioxide evolved each day is measured and is used to calculate percent biodegradation of material. The % biodegradation data at different temperatures was compared and it was found that the rate of biodegradation is dependent on temperature. In future, efforts will be done to quantify this dependence on temperature to estimate the environmental buildup of the polymer in low temperatures of marine environments.

THE EFFECTS OF HEATING RATE ON RECRYSTALLIZATION ON DEFORMED POLYCRYSTAL NIOBIUM

Elizabeth Nicometo
Chemical Engineering and Materials Science, Section 3
Presentation Number: 93
Mentor(s): Thomas Bieler

Niobium superconducting radio frequency cavities are the central core structure of particle accelerators. When in use, the cavities are cooled to the superconducting state. Ideally, when a material is superconducting, it does not experience resistance due to electric currents, and it expels all magnetic fields. However, defects such as dislocations and low angle grain boundaries can trap magnetic flux and degrade superconducting properties. These defects ultimately depend on details of the ingot production, and the processing methods used to make sheet metal used to form the cavities. Heat treatments can reduce these defects and eliminate most of them through recrystallization. We hypothesize that a more rapid heating rate than in current use will make recrystallization more effective in removing defects. Two sets of polycrystal niobium samples (one from the cavity itself and one from the corresponding adjacent trimmed material before forming the cavity) were studied. By studying local average misorientation values collected by electron backscatter diffraction analysis on specific sections of the samples before and after heat treatment, it can be determined how initial deformation related to forming near and far from the surface of the sample influenced the microstructure present after heat treatment. By understanding how initial deformation influences recrystallization microstructure in polycrystal niobium, adjustments in the process can make future cavities more consistently efficient by minimizing defects.

DYNAMICS AND VISCOELASTIC PROPERTIES OF SUPRAMOLECULAR POLYMERS WITH END-CAPPED FULLERENE

Destiny Collazo
Chemical Engineering and Materials Science, Section 3
Presentation Number: 94
Mentor(s): Shiwang Cheng

Supramolecular polymers, which are connected by non-covalent interactions, have tremendous applications in smart materials design. For instance, it has demonstrated excellent self-healing as well as shape memory properties and has been widely applied in sensors and medication. Their dynamic and viscoelastic properties are among the two most important parameters that control the applications and processing. In this study, we demonstrate the symmetry break Fullerene can also be utilized to design the supramolecular polymers through Van der Waals interactions. Moreover, the end-capped Fullerene exhibits a distinct dielectric signature that enables direct quantification of the mobility of the capped chain ends. Our dielectric and rheology studies demonstrate unexpected dynamic effects of the associating chain-ends, which also exhibit a strong molecular weight dependence. These results should offer additional molecular guidance on new supramolecular polymer design.

ANALYSIS OF WATER ADSORPTION ON ACTIVATED CARBON USING ANALYTICAL MODELS

Husain Alnaji
Chemical Engineering and Materials Science, Section 3
Presentation Number: 95
Mentor(s): Scott Calabrese Barton

Understanding the mechanism and kinetics of water adsorption is vital in many areas of science and technology because water is the most common solvent in nature. However, current understanding of water adsorption on carbonaceous materials is still incomplete, which

motivated the development of many models that attempt to describe water adsorption. Although computer simulation models have been successfully developed to describe water adsorption, analytical models are often favored to cut down the computation time significantly. Analytical models have also the potential to measure the concentration of surface active centers with different heterogeneities and functional groups. The mechanism of water adsorption on carbonaceous materials is influenced by the weak carbon-water attractions and the strong water interactions, which results in the formation of multiple layers of water molecules. It is complicated further by the heterogeneity of adsorption centers, which leads to enhanced water adsorption. Additionally, water adsorption on porous carbons strongly depends on the pore size distribution on the surface due to the phenomenon of capillary condensation. To better understand the mechanism and kinetics of water adsorption, the adsorption isotherms of six different samples of activated carbon were measured using Micromeritics Accelerated Surface Area and Porosimetry System (ASAP). The adsorption isotherms curves were then fitted to six adsorption models to determine the parameters in each model. The physical parameters were then analyzed to examine the possibility of measuring surface active centers on the activated carbon.

INCREASED CELL MIGRATION BY PALMITATE INDUCED DSP LOSS VIA IRE1

Sean Foster, Kevin Chen
Chemical Engineering and Materials Science, Section 3
Presentation Number: 96
Mentor(s): Christina Chan

Elevated uptake of saturated fatty acid palmitate is associated with metastatic progression of cancer cells; however, the precise signaling mechanism behind the phenomenon is unclear. The loss of cell adhesion proteins, such as desmoplakin (DSP), is a key driving event in the transformation of cancer cells to more aggressive phenotypes. Here we investigated the mechanism by which palmitate induces the loss of DSP in liver and breast cancer cells. We propose that palmitate activates the IRE1-XBP1 (inositol- requiring enzyme 1α – X-box binding protein 1) branch of the endoplasmic reticulum (ER) stress pathway to upregulate the zinc finger E-box binding homeobox (ZEB) transcription factor, leading to transcriptional repression of DSP. Using liver and breast cancer cells treated with palmitate, we found loss of DSP leads to increased cell migration independent of E-cadherin. We report that the ZEB family of transcription factors function as direct transcriptional repressors of DSP. We found with breast cancer cells that comparing IRE1 knockdown to wildtype (WT) cancer cells, the cells without IRE1 showed reduced expression of DSP and cell migration as compared to WT upon culture with palmitate. We will present preliminary results showing that palmitate activates IRE1-XBP1 (inositol-requiring enzyme 1α – X-box binding protein 1) of the endoplasmic reticulum (ER) stress pathway to promote colon cancer migration.

ADDITION OF NANOCELLULOSE IN FLEXIBLE, POLYURETHANE FOAM

Madeline Robison
Chemical Engineering and Materials Science, Section 3
Presentation Number: 97
Mentor(s): Ramani Narayan, Alper Kiziltas*

Cellulose nanocrystals (CNC) introduce an environmentally friendly way to improve the properties of flexible, polyurethane foam in automotive applications. Cellulose, derived from plants, is being used in many different applications as its abilities to improve the properties of various materials. Furthermore, cellulose is not just good for its amazing properties, but also it is a sustainable and renewable resource. By using cellulose as a filler in polyurethane foam, we are introducing an environmentally friendly way to improve the properties of this important material. Foam is a unique and important material because if its versatile abilities. It can withstand a wide range of temperatures, needed for automotive applications because of the

varying weather patterns around the world. It is a lightweight material that has impressive compression abilities. This is important for automotive applications because it provides better fuel economy and is able to retain its shape. Compression, wet compression and density testing were improved. Tensile and tear did not improve, however compression and NVH values are most important for under hood applications of foam. Future tests will be done to ensure better CNC dispersion throughout the foam and to improve tensile and tear testing.

DEVELOPING PROTOCOLS TO RECORD OCCUPANCY SENSORS? DATA IN A RESIDENTIAL SETTING

Sam Evans
Civil and Environmental Engineering, Section 1
Presentation Number: 100
Mentor(s): Kristen Cetin

The research being conducted involves reducing energy for HVAC systems in commercial and residential settings. This presentation will specifically review the methods of recording occupancy sensor data in a residential setting using a home automation hub called Home Assistant. The occupancy sensors, provided from another research team, will need to be tested to help further the research goals, so different communication protocols will need to be tested with Home Assistant to determine the best integration methods. Once Home Assistant is connected to the intended sensors for data collection, an analysis of the occupancy sensors' effect of the energy savings in a HVAC system can begin. All recent research in May, June, and July 2020 related to recording residential occupancy sensor data with Home Assistant has occurred remotely at research team member's residence due to COVID-19 concerns. It is expected the residential lab site to be set up with Home Assistant remotely in July 2020. A Raspberry Pi will be needed to upload Home Assistant and will most likely be sent to a research team member's residence. Once the research team member finishes with the configuration of Home Assistant, the Raspberry Pi will be sent to the lab to finish any additional set up. Any modifications to the Home Assistant configuration can be accessed remotely anytime in the future.

CIVIL & ENVIRONMENTAL ENGINEERING

EFFECTS OF RAISING SPEED LIMITS IN MICHIGAN

Kate Costello
Civil and Environmental Engineering, Section 1
Presentation Number: 101
Mentor(s): Timothy Gates

In 2017, Michigan legislature voted to raise speed limits from 55 mph to 65 mph on non-freeway rural roads and from 70 mph to 75 mph on freeway segments. It was required in the law that research be conducted to evaluate the impacts of the change. We hypothesize that the change in speed limits will increase the average speed of drivers, create less speed variance between cars, promote speed limit compliance, reduce passing, and lower air pollutant emissions. To observe changes, cameras were set up on roadways with changed speed limits. The recorded data was then compiled to find the speed of each car. This data was then compared to control data which showed the difference in speed. All of the final data was compared to find average speed, variance among cars, compared to the newly posted speed limits, passing frequency, and carbon emissions.

FORECASTING THE CARBON FOOTPRINT OF ELECTRIC VERSUS COMBUSTION VEHICLES IN THE US

Rohan Challa
Civil and Environmental Engineering, Section 1
Presentation Number: 102
Mentor(s): Dipti Kamath, Annick Anctil

Transportation accounts for 29% of greenhouse gas (GHG) emissions in the US. Electric vehicles (EVs) are an option to reduce GHG emissions, especially given the planned decarbonization of the electric grid. Regulations can also reduce GHG emissions by increasing fuel efficiency requirements of internal combustion engine vehicles (ICEVs) or mandating the use of ethanol-gasoline mixes, such as E10. As per previous studies, EVs have a 67% lower carbon footprint compared to ICEVs. However, it is unknown how the changing fuel efficiency, electricity generation sources, vehicle choice, miles-driven, and local temperature can alter the relative benefits of EVs. The carbon footprint of EVs and ICEVs from 2018 to 2030 was calculated using a life-cycle assessment of their production and use phases. The study was carried out for the US average, Arizona, California, New York, and Oregon, to account for the factors as mentioned earlier. The electricity grid decarbonization was as per the Energy Information Agency projection, while the fuel efficiency was assumed to increase by 50% by 2030 compared to 2018 levels. Our results show that in 2018, EVs and ICEVs in the US had a carbon footprint of 166 and 315 g CO_2 eq./km, respectively. In 2030, the carbon footprint of EVs and ICEVs is expected to decrease by 6% and 33%, respectively. The electricity generation source over time and the vehicle choice played a crucial role in the relative benefits for each location. The implications of these factors on the relative carbon footprint of both vehicles will be presented.

THE EFFECTS OF DYNAMIC SPEED FEEDBACK SIGNS IN MAKING THE ROADS A SAFER PLACE

Lauren Hull
Civil and Environmental Engineering, Section 1
Presentation Number: 103
Mentor(s): Timothy Gates

Each year, a substantial number of traffic crashes and fatalities occur due to excessive speeds. Some of the most common types of sites for such crashes to occur include curves and construction work zones. Dynamic speed feedback signs are designed to reduce the speeds of drivers, which will subsequently result in a decrease in traffic injuries and fatalities. These signs vary in their effectiveness primarily based on their placement and message content. Specifically, signs that are placed further in advance to the curve or construction site are more effective. The extra distance gives drivers more time to react. Other factors such as traffic volumes, road conditions, and surrounding infrastructure also play a role. Additionally, the amount of words placed on these signs should depend on the speed limit of the location. The faster the drivers are traveling, the less words there should be, and a larger display is necessary to provide adequate message preview time. In fact, at a site in California where these signs were implemented, the amount of crashes was reduced significantly. Other studies have shown similar results. Overall, the goal of these studies is to determine the effective applications of dynamic speed feedback signs, and to make recommendations as to their use.

EVALUATION OF MICHIGAN'S 2017 SPEED LIMIT INCREASES ON RURAL HIGHWAY TRAFFIC OPERATIONS

Myles Overall
Civil and Environmental Engineering, Section 1
Presentation Number: 104
Mentor(s): Timothy Gates

Speed limits have been increased all over the state of Michigan as of the past few years. A new law, which was enacted in 2017, required speed limits to be increased from 55 mph to 65 mph across 900 miles of non-freeways and speed limits increased from 70 mph to 75 mph on 600 miles of freeway. The Michigan Department of Transportation (MDOT) selected sites across Michigan to be monitored over a several year period to determine how speeds increased on roads where the speed limits were increased. Segments of highway were chosen based on low safety risks and a lack of costly geometric upgrades. To monitor the effects of these speed limit increases over time, video recordings of traffic flow are taken annually at numerous highway segments across the upper peninsula and the northern part of the lower peninsula. These videos allow for assessment of various attributes of the traffic stream, including free flow speeds (mean and 85th percentile), speed variance, vehicle platooning, and passing maneuvers for both passenger and heavy vehicles. By collecting data from these videos, it allows for the speeds and other operational attributes to be analyzed at the locations where the speed limits were increased, and then compared to control sites where the speed limits weren't increased.

THE QUANTIFICATION AND DIVERSITY OF THE FUNCTIONAL GENES ASSOCIATED WITH THE BIODEGRADATION OF ORGANIC POLLUTANTS AT FIVE CONTAMINATED SITES

Andrea Vera
Civil and Environmental Engineering, Section 1
Presentation Number: 105
Mentor(s): Alison Cupples

Human activity has resulted in the contamination of groundwater aquifers with organic contaminants such as benzene, RDX, polycyclic aromatic hydrocarbons, and chlorinated solvents. Traditional methods of remediation, such as pump and treat, are typically expensive and can require decades to completely remediate sites. To address these limitations, environmental engineers have turned to the use of microorganisms to biodegrade organic contaminants, a method also referred to as bioremediation. The goal of this project is to determine the presence, abundance, and diversity of a set of functional genes associated with organic contaminant biodegradation at five contaminated sites across the US. The approach involved the analysis of high throughput shotgun sequencing data using bioinformatics tools such as FunGene, DIAMOND, RStudio, and the R package taxonomizer. The sequencing data were previously generated from DNA extracted from multiple groundwater wells. This research is novel because the majority of molecular studies on bioremediation have been limited to quantitative PCR, and this method provides no information on gene diversity and is further limited by primer design. Little is known about the true diversity and abundance of bacteria at contaminated groundwater sites potentially involved in biodegradation. Thus, determining the presence, abundance, and diversity of genes and bacteria associated with contaminant biodegradation using shotgun sequencing will result in a better understanding of contaminant biodegradation in situ and has the potential to improve the remediation efficiency of contaminants that pose risks to human health.

COMMUNICATION ARTS & SCIENCES

THE EFFECTS OF POOR TRANSPORTATION ON HEALTH: A REVIEW

Paige Cordts
Communication Arts and Sciences, Section 1
Presentation Number: 109
Mentor(s): Tamara Bush

Access to transportation has been shown to be a major contributor in the overall health of individuals. Accessible transportation can facilitate trips to necessary facilities such as grocery stores and medical appointments, which are important activities for overall health. In our survey (n=468) of individuals with physical disabilities, we found that over 75% reported having to cancel medical appointments due to issues with transportation. Data show missed medical appointments can negatively impact the health of individuals, including increased mortality rates. It has also been shown that opportunities for social engagement become more available with accessible transportation, and that social engagement is a key factor in a person's well-being. Our survey found several short answer responses detailed missed opportunities for social activities due to poor transportation. Transportation lacking in key factors for accessibility, including flexibility, availability, and punctuality have been shown to result in decreased access to medical care, social interactions, and necessary living activities that contribute to a person's health. It is crucial that people consider the importance of transportation to an individual's daily life when designing these systems and implementing rules and policies for them.

EXPLORING STORY-BASED TRAINING TO REDUCE PHISHING SUSCEPTIBILITY

Faye Kollig
Communication Arts and Sciences, Section 1
Presentation Number: 110
Mentor(s): Rick Wash

Phishing emails are messages from senders that pretend to be someone they aren't to steal sensitive information from the recipient. Well-crafted phishing emails can result in financial loss, identity theft, the transmission of malware and viruses, and more. Extensive work has been done to improve systems' abilities to recognize and filter out phishing emails, as well as to train the user to catch attacks the computer misses. Our research explores a potential method of training that has not been fully realized in the phishing context: stories about other peoples' experiences. We will test participants' abilities to apply lessons from stories by sending them fake phishing emails without their knowledge before and after they read the training. The stories in the training will vary in whether they describe "good" actions with positive outcomes, or "bad" actions with negative outcomes. I predict that "bad" actions will be more effective and memorable, which will be measured by whether participants click on links in the fake phishing emails and asking for self-reported changes in behavior and thinking. The results will provide data about any measurable differences that story-based training makes to click rates and how stories were or were not applied. Our sample population is a protected inbox where attacks may have higher stakes; future work in different populations with different stories can further refine what retellings are most memorable and effective in reducing the rate of falling for phish.

QUALITATIVE AND QUANTITATIVE METHODOLOGY IN CRISIS COMMUNICATION

Chloe Peter
Communication Arts and Sciences, Section 1
Presentation Number: 111
Mentor(s): Manuel Chavez

Climate Change. Mexico's War on Drugs. Violence against journalists. Foreign interference in the 2016 presidential election. Families being separated on the United States' southern border. And now, COVID- 19 These are just a few types of crisis the United States and the World faced in the past few years. Unfortunately, crises will likely continue to arrive in years to come. In today's 24-hour news cycle, there is no shortage of reporting about these crises. But how can the news media frame these events in a way that most effectively communicates to the public? Accurate framing of crises is further complicated by the rise of social media, particularly Twitter, which allows newsmakers to communicate with media consumers constantly and directly. In addition, anybody would be able to post inaccurate, misleading, or fake news and information. The crises that arise worldwide are diverse and challenging, as are the mediums used to report on them. By using qualitative and quantitative research, sources including tweets, headlines, and scholarly articles can be used to determine and analyze frames used in communicating crisis to the public.

HOW ELECTRONIC TOYS IMPACT THE QUALITY OF PARENT LANGUAGE INPUT PROVIDED TO YOUNG CHILDREN WITH AUTISM

Kaylee Commet, Kaitlin Gaynor, Libby Fernau
Communication Arts and Sciences, Section 1
Presentation Number: 112
Mentor(s): Mackenzie Sturman, Courtney Venker

Electronic toys have become increasingly popular over the past decade, but they may decrease the quality of adult language input provided to young children. This is especially important in the case of children with autism, who often experience language delays. In this study, we asked whether the quality of parent language input to young children with autism differed between electronic and traditional toy play. We hypothesized that lexical diversity (number of different words) and grammatical complexity (words per utterance) would be significantly lower during electronic toy play than traditional toy play. Participants were ten children with autism (2 to 4 years old) and their parents. Parent-child dyads completed two 10-minute play samples. They played with a traditional toy set on one day and an electronic toy set on the other (counterbalanced across participants). Toys sets included a barn with animals, a shape sorter, sensory balls, vehicles, a puzzle, and a toy dog. The electronic toys played music, flashed lights, and made sounds (speech and animal noises). Trained research assistants transcribed the samples. Lexical diversity was significantly lower during traditional toy play than during electronic toy play ($p = .027$), but grammatical complexity did not significantly differ ($p = .700$). An exploratory analysis revealed that electronic toy play produced a higher percentage of parent utterances with overlapping background noise than traditional toy play ($p < .001$). Given the importance of providing high-quality language input to children with autism, the potential impact of electronic toys is an important clinical consideration.

MOTIVATIONS TO USING FACEBOOK, INSTAGRAM, TWITTER AND TIKTOK PREDICTING FUTURE USE INTENTIONS AND PROBLEMATIC USE

Anvita Suneja, Anish Nimmagadda
Communication Arts and Sciences, Section 1
Presentation Number: 113
Mentor(s): Saleem Alhabash

While much of the studies within the Uses and Gratifications (U&G) theoretical framework tradition were set to predict facets of media use, the current examines how use motivations, nature of platform use, and privacy-related perceptions predict users' use continuance intentions for Facebook, Instagram, Twitter, and Tiktok and their problematic use of that platform (i.e., addition), simultaneously. The study uses a cross-sectional survey of undergraduate students at a large Midwestern university (N =373), where participants answered questions related to their motivations to use each of the four platforms (depending on their active use of the platform), platform affinity and other usage factors, their intentions to continue using the platform and their problematic of the platform. Findings showed superiority of Instagram in terms of U&G. Regression models highlighted differences in the four platforms' problematic use and continuance intentions Findings are discussed within the framework of reconceptualizing U&G outcomes within the evolving environment of social media use.

CREATIVE MEDIA HELPING FAMILIES

Dylan Kissel
Communication Arts and Sciences, Section 1
Presentation Number: 114
Mentor(s): Amol Pavangadkar

For the past two years I have been working with the Michigan Department of Health and Human Services in conjunction with Michigan State University. This project's goal is to film promotional videos for the Parent Management Training program (PMTO). While working with my mentor, Professor Amol Pavangadkar, I have produced twenty-two videos based around six different families and the effects this program has had on their lives. Throughout the process I have had the chance to work with and study dynamic family situations while interviewing them about their experiences with the program. The project has been in the editing phase since September of 2019. Throughout the editing process there has been constant communication between me and external sources such as my partners, the state government, and the University giving me the chance to work in a real world editing environment that involves constant changes and deadlines.

THE DOCUMENTED

Ben Goldman
Communication Arts and Sciences, Section 1
Presentation Number: 115
Mentor(s): Geraldine Zeldes

This multimedia project documents the stories of Michigan State University students who are new U.S. citizens who deal with the undocumented status of family or international students who face persistent uncertainty that they will not be allowed to enter the country because of new travel bans.

KIN-DREAD

Himashi Hewagama, Rachel Allen, Jason Wu
Communication Arts and Sciences, Section 1
Presentation Number: 116
Mentor(s): Geraldine Zeldes

Kin-dread is a game about empathy, family, and taking a look at what people can be beneath the surface. Players play as a small but diverse cast of characters who are deciding who to take with them on a road trip, from a wide variety of eccentric family members.

COMPUTER SCIENCE & ENGINEERING

DEVELOPMENT OF PATH PLANNING SOFTWARE IN A SIMULATED ENVIRONMENT

Dom Mazza
Computer Science and Engineering, Section 1
Presentation Number: 119
Mentor(s): Hayder Radha

The way an autonomous vehicle follows a path is deceptively simple, as all drivers follow a path in similar fashion during their day to day life. The intricacies of obstacle avoidance and traffic laws, however, are not that simple, as the combination of speed and accuracy that everyday drivers utilize is computationally intensive. In this project, the CARLA open source driving simulator will be integrated with current vehicular path planning software in order to further develop its capability to respond to different obstacles and hindrances on the road. The development is being done in this simulated environment due to the relative ease of integration and the ability to test far more frequently than currently possible.

ARE SMART CONTRACTS RELIABLE? AN EXPANDED AGENCY MODEL USING DETERRENTS TO ENFORCE TRUTHFUL BEHAVIOR

Samuel Grone*
Computer Science and Engineering, Section 1
Presentation Number: 120
Mentor(s): Weitian Tong*

A core tenet of blockchain technology is trust in the execution of smart contracts. However, selfish users may manipulate the outcome of smart contracts for personal financial gains. Furthermore, interest groups may be formed via bribing by creating dependent smart contracts. To counter such behaviors, applying financial penalties upon dishonest users is a promising approach. We will explore this idea in application by simulating a blockchain environment and identifying the threshold of penalty. In our experiments, simulated users executed smart contracts based on their preprogrammed confidence in the rationality and trustworthiness of others while also accounting for the potential penalty. Our findings suggest that the largest factor influencing the decision-making of users was the proportion of users that had to agree upon the result of a smart contract before it could be executed. Further, our finding suggested that a simple majority of users was a large enough proportion to deter bad behavior.

OVARIAN TORSION IDENTIFICATION USING MACHINE LEARNED INTERPRETABLE

Raymond Lesiyon
Computer Science and Engineering, Section 1
Presentation Number: 121
Mentor(s): Adam Alessio

Ovarian torsion results from obstruction of blood to an ovary due to twisting of its vascular pedicle. The common symptoms and clinical tests for ovarian torsion are relatively nonspecific making it difficult to pinpoint the conditions. Some of these symptoms are nausea, vomiting, abdominal pain and tenderness. Torsion is classically seen in women of reproductive age, with 17% to 20% of cases occurring in pregnant women. The diagnosis of ovarian torsion involves a combination of patient's history, medical examination and color Doppler ultrasound (CDC). The criteria investigated in ultrasound imaging includes the presence of enlarged ovary, free fluid in the pelvis, lack of arterial or venous blood flow and existence of twisted pedicles (1). A delay in the diagnosis of the ovarian torsion might lead to ovary loss and additional co-morbidities. The routine analysis of patient's history and imaging data create an opportunity of exploring machine learning algorithms to identify the occurrence of ovarian torsion in the patients. This project aims to identify ovarian torsion using different machine learning algorithms and compare their performance. In an IRB approved study, data from ultrasound imaging were used with the following features; age, laterality, ovarian volume, ovarian position (whether medialized) peripheral follicles, presence of mass cyst and free fluid. Decision trees, random trees and logistic regression modules were learned based on these data sets leading to interpretable, clinically practical models for classification of the ovarian data. The project also involved the development of a nomogram for an easier visualization of the logistic regression result.

MULTI-ROBOT LEARNING AND COVERAGE: BALANCING EXPLORATION WITH EXPLOITATION UNDER UNCERTAINTY

Andrew McDonald
Computer Science and Engineering, Section 1
Presentation Number: 122
Mentor(s): Vaibhav Srivastava

Robotic systems must remain robust and resilient in the face of uncertainty, capable of making autonomous decisions under the influence of imperfect and incomplete information. Real-world environments are unpredictable, noisy, and stochastic by their nature—variable factors including weather, terrain, and human behavior combine with changing mission goals and operating constraints to necessitate adaptive control policies. In order to successfully deal with uncertainty, robotic systems must strike a balance between exploration and exploitation, simultaneously learning about their environment while accomplishing a task that depends on their collective knowledge of it. We consider this idea through the lens of swarm robotics, a field which studies the control of multi-agent robotic teams, and investigate the problem of optimal allocation under uncertainty—given an unknown demand function which specifies the degree to which a robot is "needed" at each point in an operating region, we propose a control strategy which combines exploration with exploitation. Robotic agents explore the environment by sampling the demand function at points within the operating region to learn where need is greatest, gradually shifting to exploit by constructing an estimate of the demand function from collected samples and distributing themselves accordingly. Through Python simulations, we compare our strategy with literature baselines and discuss avenues by which the proposed approach could be further improved. Potential applications of our work span the challenges of search and rescue, wildfire fighting, smart agriculture, ecological surveying, environmental cleanup, climate monitoring, ridesharing, and others—including challenges we cannot even imagine today.

TAG: AUTONOMOUS IMAGE CAPTION GENERATOR

Nathan Funckes*
Computer Science and Engineering, Section 1
Presentation Number: 123
Mentor(s): Erin Carrier*, Greg Wolffe*

Unfortunately, many websites remain non-ADA compliant (i.e. they contain images without accompanying tags or descriptive text). This leaves a significant portion of the world's population, the sight-impaired, unable to fully enjoy the rich wonders of the web. To address this inequity, our research aims to create an autonomous system capable of generating semantically accurate descriptions of untagged images, which can then be read and vocalized by assistive technology devices. This problem, Image Caption Generation, is composed of two tasks that humans perform with ease: recognizing an image and linguistically describing it. An autonomous system can "learn" these tasks through a process called deep learning, which refers to a machine learning model based on a deep neural network architecture. To understand images, our system will use a Convolutional Neural Network (CNN), proven highly effective for computer vision and spatial pattern recognition tasks. For the text generation component, we will employ a Recurrent Neural Network (RNN) specialized towards sequential information. Finally, we will combine these two networks into an Encoder-Decoder, with the encoder (CNN) taking an image as input and generating a vector embedding and the decoder (RNN) taking that embedding and generating a caption as output. We will train our model on a pre-existing dataset consisting of images with supplied captions, and we will evaluate the accuracy of our model using the Bilingual Evaluation Understudy (BLEU) automated validation metric. After training, we hope to serve the community by deploying our model on the local Grand Valley State University social media feeds.

PERFORMING IMAGE SEGMENTATION AT SCALE IN THE CLOUD

Kai Pinckard*
Computer Science and Engineering, Section 2
Presentation Number: 124
Mentor(s): Dirk Colbry

Image segmentation is a common step in many scientific workflows. However, it remains a time consuming and often expensive part of the research process. To address this problem, the see-segment tool aides researchers in finding algorithm(s) to automatically segment images used in their research. The algorithm search space explored by see-segment is extremely large and often requires a large amount of computation. To speed up the search process many copies of the see-segment search algorithm should be run in parallel to quickly obtain good results. Unfortunately installing and running see-segment at scale is difficult, as computational environments can differ in the tools and packages that are available. This research encapsulates the see-segment tool into Docker containers which allow them to easily be run anywhere Docker containers are supported (ex AWS, Google Cloud, AZUR, etc). Furthermore, Kubernetes is used to manage the multiple instances of the containers to make running at scale on preemptible machines easy. Hundreds of these containers can work together and communicate with a lead container running an easy to use web interface that allows scientists to upload images in the same manner they would on any other website. The current best segmentation algorithm is then displayed to the user's web browser in real time as the see-segment containers run in the background.

A MACHINE LEARNING APPROACH IN DIAGNOSING HEARING LOSS

Nicole Keller
Computer Science and Engineering, Section 2
Presentation Number: 125
Mentor(s): Ethan Tu

Auditory brain response (ABR) is a test used to measure the hearing nerve and brainstem's response to sound. Stimulus at different frequencies produce unique ABR waveforms which can be used to identify hearing abnormalities. ABR tests have been utilized in studies and in hospitals for more than 40 years due to their ease, non-invasiveness, and reliability. Clinicians can easily identify abnormal waveforms; however, automating the identification of such a process can increase efficiency. The primary focus is to compare the effectiveness of two different types of machine learning methods to differentiate normal from hearing-impaired subjects. The machine learning techniques can uncover previously unidentified peaks or patterns that humans cannot see and can identify indicators for hearing loss. The two types of machine learning that we will explore is regression analysis and 1D convolutional neural network.

ANALYSIS OF SCALING TECHNIQUES IN SEE IMAGE SEGMENTATION SOFTWARE UTILIZING EVOLUTIONARY ALGORITHMS

Nicholas Grabill
Computer Science and Engineering, Section 2
Presentation Number: 126
Mentor(s): Dirk Colbry

Image analysis is an integral part of many modern scientific research workflows. Studies in everything from self-driving cars to the makeup of cells; rely on image understanding through computer vision techniques. The SEE-Insight group led by Dr. Dirk Colbry in the Computational Mathematics Science and Engineering (CMSE) department at Michigan State University (MSU) is developing tools to speed up the search for image understanding workflows by applying genetic algorithms commonly used in evolutionary biology to computational problems in order to not only find useful algorithms, but also viable input parameters for these algorithms. For example, the Simple Evolutionary Exploration in segmentation (SEE-Segment) tool was developed by the SEE-Insight group to help research search for segmentation algorithms that may be applied to their particular research image data. The SEE-Segment tool is computationally intensive, so large-scale parallel computing services are needed to enable the software to traverse the search space of algorithms and their parameters in a reasonable time. The goal of this research is to study the scalability of the SEE-Segment tool and to explore ways to improve scalability.

ALGORITHMS FOR COMPLETE PHYSIOLOGICAL MONITORING DURING SPACEFLIGHT

Aven Zitzelberger
Computer Science and Engineering, Section 2
Presentation Number: 127
Mentor(s): Mohammad Ghassemi

Detecting early symptoms of health problems within a spacecraft is both challenging and critically important. Current approaches to comprehensive health monitoring require an array of sensors that are individually prone to malfunction, potentially irreplaceable, and collectively cumbersome to the mobility of astronauts. Blood pressure is one such health index that simply cannot be monitored continuously due to the sensor's invasive and obstructive nature. These challenges motivate the development of physiological interpolation algorithms that can accurately reconstruct missing or unavailable physiological data with high fidelity using other measures. To address this challenge, we will (1) develop deep learning approaches to enable reliable, real-time reconstruction of missing physiological waveforms using one or more other

available waveforms and (2) endeavor to discover the minimal subset of monitoring systems needed to obtain the best overall picture of physiological status. To accomplish these goals, we will build software designed to stream sensor data to a central server where they will train our deep learning algorithms. We will be using this system to aid in collecting training data first from an available data set before moving on to our own research.

STUDYING COOPERATION IN THE CONTEXT OF THE PRISONER'S DILEMMA AND INFORMATION THEORY

Grant Carey
Computer Science and Engineering, Section 2
Presentation Number: 128
Mentor(s): Christoph Adami

The evolution of cooperation has traditionally been understood in the context of the Price equation, which relies on the covariance between phenotypes and fitness. However, it may be possible to formulate an information theory of cooperation which would be more insightful and intuitive. Creating such a theory is the subject of this research endeavor. In this research project we utilize evolutionary game theory simulations to study information flow in the iterated prisoner's dilemma. Through such simulations it is possible to calculate the critical information value at which agents deviate from cooperative strategies to defective ones. Additionally, it is possible to vary the payoff table for the prisoner's dilemma, affecting the costs and benefits of cooperative behavior. By identifying an empirical relationship between the cost and benefits of cooperation and the critical information value at which cooperative strategies occur, we hope to develop a formula to understand cooperation in the context of information theory.

EDUCATION

ANALYSIS OF PRE-CLASS ASSIGNMENTS FOR TEACHING PRACTICAL LINEAR ALGEBRA

Claudia Chen
Education, Section 1
Presentation Number: 131
Mentor(s): Dirk Colbry

In this paper, we examine how pre-class assignments affect the learning of students in the class MTH 314. MTH 314 is administered by the Computational Mathematics Science and Engineering Department. Pre-class assignments give a basic introduction to the topic before the class meets for the main lecture. At the end of each pre-class assignment, students fill out a form to answer a chosen question in the assignment. Students also submit any questions they have about the topic so the professor can go over questions in class. In class, the class works through an in-class assignment to practice using the linear algebra topic in a practical manner, and the professor answers questions from students on the pre-class assignment. To analyze how effective pre-class assignments are for helping students learn linear algebra, we sorted the questions students submitted into two categories: High level questions and surface level questions. High level questions show that the student has a basic understanding of the material, and needs some more clarification and practice to solidify their understanding. Surface level questions show that the pre-class assignment has not really helped them grasp a basic understanding, indicating that the pre-class assignment may need to be improved. By analyzing the ratio of high level and surface level questions, we can show whether pre-class assignments help with students' learning.

DISSECTING THE HIGH SCHOOL HISTORY TEXTBOOK: A CONTENT ANALYSIS ON THE ERASURE OF RACIAL MINORITIES

Erykah Benson
Education, Section 1
Presentation Number: 132
Mentor(s): John Waller, Heather McCauley

This study aims to investigate how historical narratives of the Civil Rights Era are presented in high school history textbooks through a visual and textual content analysis of the book Visions of America: A History of the United States. This research aims to identify the prevalence of the master narrative in K- 12 history education curriculum, which normalizes White privilege while erasing structural racism. Overall, previously held theories that identify the dominance of the White male perspective in history education materials (e.g. curriculum, textbooks, and extra learning materials) are held consistent in this study both visually and textually. Further examinations of the text indicate that the discussion of racial inequality is intensely focused on the legislative and judicial milestones of the classical Civil Rights Movement, with a complete lack of direct examples of structural inequality such as redlining and inequities in health, education, and employment.

EVALUATING CURRICULUM GOALS IN UNDERGRADUATE EVOLUTION EDUCATION

Meghan Chapko
Education, Section 1
Presentation Number: 133
Mentor(s): Alexa Warwick

Evolution is central to the biological sciences and a core concept for undergraduate biological literacy (AAAS Vision and Change). Despite its importance, an agreed-upon set of learning objectives for undergraduate students has yet to be developed. A set of community-validated undergraduate evolution learning objectives is a novel and important contribution to providing a consistent framework for publishing evolution assessment and instructional materials and research. By incorporating responses from a wide range of instructors and higher education institutions the learning objectives should be broadly applicable and serve as a guide for faculty and institutions. Specifically, we looked at the institutional requirements for evolution courses to frame how evolution is taught across institutions. We reviewed undergraduate course syllabi to assess which learning objectives are currently being taught. In addition, we surveyed life science faculty in the United States regarding their level of agreement and prioritization of a series of evolution learning objectives. Of the sampled institutions, preliminary results show that an introductory biology course is a required prerequisite for 71% of evolution courses whereas a genetics course is required as a prerequisite by 33% of evolution courses. Additionally, the average course meeting time is 150 minutes a week and the most common textbook used by institutions is Evolutionary Analysis. The final list of community-validated learning objectives will be submitted as part of CourseSource's Learning Framework for the Evolution Course section, which is the only area lacking a learning framework at present.

ALIENATION AND ISOLATION OF MINORITY STUDENTS AT PREDOMINATELY WHITE UNIVERSITIES: HOUSING SEGREGATION AT MICHIGAN STATE UNIVERSITY

Jasmine Jordan
Education, Section 1
Presentation Number: 134
Mentor(s): Terry Flennaugh

This poster presentation concerns the distribution of minority students among the dormitories of Michigan State University. MSU requires all freshmen to live on campus which means that experiences inside of them will have a significant impact on students' welfare. The racial

composition of these dorms may affect the wellbeing of those who live there. Black and Latinx students who choose to go to Predominately White Universities/Institutions (PWIs) routinely face challenges associated with their minority status. Alienation and isolation are two of the most significant factors that negatively affect students of color in college. There is a widespread impression on MSU's campus that certain dorms have higher proportions of African American and other minority students than others. Ascertaining if this is actually the case is important because it may shed important light on how integrated minority students are and how they feel about living in predominantly white versus disproportionately non-white dorms. Given the tight relationship between housing and welfare, this research strives to answer the following questions: 1) Are there a disproportionate number of Black and LatinX students in specific dorms at MSU? 2) if this is the case, how can we explain this pattern? 3) what are the possible effects on minority students with respect to feelings of isolation and alienation of being concentrated in certain dorms? And 4) what solutions have other universities devised that MSU might emulate so as to reduce isolation and alienation among minority students.

EDUCATIONAL METHODS FOR SUSTAINABILITY AWARENESS IN THE STEM FIELD

Taya Smith, Serene Abu-Hamdan
Education, Section 1
Presentation Number: 135
Mentor(s): Shahnaz Masani

Students have the potential to create an impactful change regarding the current decline of our environment. To achieve this potential, students must be empowered to create actionable solutions that can be implemented in the classroom and beyond. Students often learn about sustainability only in classes that explicitly teach environmental sciences and ecology; however, systematic integration of sustainability education and values is lacking across the curriculum. With the quality of our environment declining at an alarming rate, it is imperative our students are able to appreciate, understand, and think critically about complex environmental problems. Students are most receptive to such interventions when they are able to direct their learning and synthesize knowledge independently. To investigate these claims, we studied students in cellular/molecular biology and physics labs. The biology lab students were tasked with conducting a literature search and an annotated bibliography on a specific laboratory waste item. Next students were asked to take that information and create an artifact to present to the class. Additionally, students documented how much lab waste and materials they used during their normal research. Concurrently the physics lab students were tasked with researching a specific piece of waste in the physics classroom and presenting those findings to the class. To analyze the effect of integrating sustainability education into the curriculum, students will be given a pre and post-test using the MEV-2 questionnaire to assess changes in opinions about sustainability over the course of the semester.

SURVEY PARTICIPATION, TYPES OF INCENTIVES, AND DEMOGRAPHIC INFORMATION AMONG ENGINEERING COLLEGE STUDENTS

Benjamin Hickey, Sawyer Perpich
Education, Section 1
Presentation Number: 136
Mentor(s): Lisa Linnenbrink-Garcia, Stacy Priniski, Goun Choi, Amalia Lira

Recruiting participants is a vital component of psychological research because broader participation increases the representativeness of the sample and, in turn, confidence in our findings. Many studies have analyzed the most effective methods of gaining college participants, concluding that monetary incentives and in-class credit are among the most persuasive offerings. Additionally, studies have found differences in the extent to which students of different racial and gender groups participate in experiments. These findings suggest that it's important to consider both the demographics of your sample and types of incentives to ensure that college samples are representative of the growing diversity of student

bodies. Our study expands on prior work by considering multiple demographic groups (gender, first-generation status, and race/ethnicity) to examine rates of participation as a function of incentive type, as well as whether students completed all or only part of the survey. First- year engineering students were recruited (using either extra credit, course credit, or monetary compensation as incentives) to participate in an online survey at a large public Midwestern university. The sample consisted of 24% females and 18% first-generation students. In terms of race, the sample included 0.6% Native American, 0.2% Native Hawaiian, 21% Asian, 6% Black, 69% White, and 4% Latinx. The data will be analyzed using chi-square tests of independence. Analyzing the participation levels of students who have been offered different incentives based on demographic factors will give valuable insight to researchers aiming to recruit a large, diverse sample, especially in a college setting.

WHAT DO YOU WANT ME TO DO?? FACULTY PERSPECTIVE ON ULA TIME USAGE IN LYMAN BRIGGS COLLEGE CHEMISTRY COURSES

Madeline Shank
Education, Section 1
Presentation Number: 137
Mentor(s): Rachel Barnard

The two overarching goals of this study are to better understand the motivation and time usage of chemistry undergraduate learning assistants (ULAs) in Lyman Briggs College (LBC). ULA time usage was surveyed from the student, faculty, and ULA perspectives. The survey asked respondents to rank various instructional practices on a scale of "no" to "high" portion of time. Instructional practices that were listed on the survey included approaches such as listening to a question from a student, open dialogue (no individual person controls the conversation), and not interacting with students. This presentation will focus on the faculty perspective. We probed the following questions: (1) Which practices were most frequently listed by the chemistry faculty as instructional practices that the chemistry ULAs should do in lab or recitation with a "high" or "low" proportion of their time? (2) Are there patterns in how many practices individual faculty list as practices that chemistry ULAs should do in lab or recitation with a "high" proportion of their time? Within those groups, are there patterns of which practices appear more or less frequently? The goal of this part of the research project is to clarify how faculty members expect their ULAs to spend their time in both lab and recitation settings. Preliminary results will be presented.

HOW THE SELF-SERVING ATTRIBUTIONAL BIAS AFFECTS STUDENT LEARNING

Natalia Anderson*
Education, Section 2
Presentation Number: 138
Mentor(s): W. John Koolage*

The self-serving attributional bias (SSAB) is a very common human bias. The SSAB, however, is at odds with being a good learner, since learning (often) requires learning from failure. In this paper, I explain controlled failure as part of good learning activity design. This design (among others) should include a metacognitive component wherein students are asked to learn about learning from failure, which requires them to come face to face with their own SSAB. In order to alleviate this conflict, I advocate for including guided reflection after failed experiences so that students come to internalize their failures.

SUPPORTING STUDENT COMPETENCY IN MIDDLE SCHOOL SCIENCE CLASSROOMS

Marvella Gutierrez, Mary Kott, Brooke Harris, Harmony Murray
Education, Section 2
Presentation Number: 139
Mentor(s): Stacy Priniski, Pei Pei Liu, Jennifer Schmidt, Lisa Linnenbrink-Garcia

Self-perceived competency beliefs have a powerful impact on student academic performance. Competence refers to a feeling of ability within a task or subject. Research shows that educators can influence student competence beliefs through instruction design, meaningful feedback, and challenging work. Positive impacts within a classroom are beneficial to student academic achievement. To further look at how teacher actions provide opportunities to support or hinder student competence beliefs we performed a qualitative observation method. We studied two videos from the same teacher/classroom and looked at the comments on teacher actions and if they were supportive or unsupportive of competence in the classroom. Our hypothesis is that teachers will have more examples of competence supporting actions within the construct of the study as opposed to competence hindering actions.

EXPLORING THE IMPACT OF FIRST-GENERATION STATUS ON STUDENT EDUCATIONAL ASPIRATIONS THROUGH THE LENS OF MASTERY GOAL ORIENTATION

Rae Smith, Aubrey Sneed
Education, Section 2
Presentation Number: 140
Mentor(s): Alexandra Lee, Garam Lee, Stacy Priniski, Lisa Linnenbrink-Garcia

Higher education is believed to lead to increased opportunity and social mobility in the United States, the focus of the current study is to examine factors that may enhance students' persistence in higher education. First-generation college students (i.e., neither of a student's parents have attended college) may encounter more challenges in completing college, and pursuing post-baccalaureate education. This study seeks to understand the relation between first-generation status and students' educational aspirations (i.e., how far students would like to go in school). Specifically, we are interested in the role that mastery goal orientation might play in determining first-generation college students' educational aspirations. Mastery goal orientation is an adaptive pattern of learning, where the student's focus is on mastering new material rather than performing well in comparison to others. We chose to examine mastery goal orientation specifically because previous research suggests that this motivational construct promotes persistence in education. In the current study, we examine whether: (1) there is a relation between first-generation status and educational aspirations, and (2) this relation, depends on students' level of mastery goal orientation. Students (N = 1,741; 57.4% women, 11.2% underrepresented minority, 11.9% first-generation college students) were recruited from first-year chemistry courses. Our findings may indicate a need to foster mastery goal orientation within students generally, and first-generation college students, more specifically, in order to promote their academic success and educational aspirations.

WHY INDIVIDUALS WITH LEARNING DISABILITIES REFUSE TO ACCESS AVAILABLE ACCOMMODATIONS IN HIGHER EDUCATION

Karlee Fillmore*
Education, Section 2
Presentation Number: 141
Mentor(s): Rhonda Kraai*

Individuals with specific learning disabilities that use accommodations in higher education experience less difficulty with completing assignments; however, only a minority of individuals with specific learning disabilities report using accommodations. This quantitative research study aims to explore why individuals with learning disabilities refuse to request available

accommodations in higher education. Using electronic survey sampling, individuals with a specific learning disability attending a midwestern university were asked questions about their disclosure status with the university and their use of accommodations. Approximately 44% of participants primarily chose not to use accommodations because they felt they did not need them. Additional reasons participants chose not to use accommodations included: not knowing what accommodations are available, worry that peers or professors will think they are cheating, worry that professors will think they are less intelligent, not being comfortable approaching the professor, and the accommodations they find helpful are not offered by their institution. Possible solutions to these issues will be discussed.

EXAMINING HOW TEACHERS BOTH SUPPORT AND UNDERMINE STUDENTS' SELF-EFFICACY

Danielle Berry, Becca Koskiewicz, Daijin He
Education, Section 2
Presentation Number: 142
Mentor(s): Harmony Murray, Stephanie Shin, Stacy Priniski, Pei Pei Liu, Jennifer Schmidt, Lisa Linnenbrink-Garcia

Among the many motivational constructs, self-efficacy (i.e., a student's belief in their ability to successfully perform a task) is one key factor in promoting student learning and academic performance. The current literature on self-efficacy indicates that teachers play a crucial role in influencing students' self-efficacy. Evidence from Self-Determination Theory and Social-Cognitive Theory suggest that there are specific teacher behaviors that may support students' self-efficacy including providing clear expectations and informational feedback, presenting challenging work, and helping students identify adaptive learning strategies. To understand these interactions, this study seeks to examine the extent to which teachers use these specific instructional behaviors to support students' science self-efficacy over the course of the semester. We used previously coded video-recorded classroom observations of two middle school science teachers who each implemented different science units that consist of several lessons. The lessons were coded based on specific instructional behaviors that can support and undermine students' perceived science self-efficacy. Coded data will be analyzed to identify specific patterns of teachers' instructional behaviors that are presumed to support and undermine students' self-efficacy. Taken together, this study highlights the importance of developing effective instructional practices that revolve around supporting students' self-efficacy beliefs. Further, the results of this study could be utilized in providing new information to teacher education programs and in supplying classroom teachers with meaningful feedback.

ANALYZING CONNECTIONS BETWEEN ENERGY AND INTERACTIONS IN STUDENT RESPONSES TO ASSESSMENT PROMPTS

Robby McKay
Education, Section 2
Presentation Number: 143
Mentor(s): Melanie Cooper

Through a knowledge-in-pieces lens, we can think of student knowledge as being both the ideas students have and how they connect those ideas. Two ideas that should be closely connected in chemistry are energy and interactions. This study explores undergraduate students' utilization of causal mechanistic reasoning, a useful form of scientific reasoning which addresses how and why a phenomenon occurs, when responding to two summative assessment prompts. One prompt addresses the electrostatics involved in the formation of London Dispersion forces between two neutral atoms and the other prompt addresses the changes in potential energy as two atoms approach each other. By examining student reasoning across content areas, we can determine where students are and are not making connections between these foundational concepts in chemistry. Understanding student reasoning is imperative to

informing current and future teaching as well as for refining learning experiences for students in the classroom.

LABORATORY WASTE AND THE MSU SYSTEM

Jake Namovich
Education, Section 2
Presentation Number: 144
Mentor(s): Isaac Record

For the past year, I have explored the inconspicuous phenomenon of laboratory waste. As a student of the natural sciences, I found myself drawn to learn about sustainability, but I noticed that I was not always embodying these teachings in my laboratory practices. It is time to begin questioning our relationships with the materials we use to create knowledge. The goals of this project were to 1) model the MSU laboratory waste system; 2) understand behaviors, technologies, and practices that contribute to the generation of laboratory waste; and 3) design productive and effective strategies for change. Not only has this project brought about new knowledge of laboratory waste generally, but also new questions that we must address. Through reflection, we might rethink how we teach, how we organize our laboratory spaces, how we design our experiments, and even how we impact other communities through this waste stream. The study was made possible by networking and dialoguing with laboratory teams, laboratory managers, procurement officers, MSU EHS, MSU IPF, and MSU Sustainability. By communicating with these community members and immersing myself in various on-campus laboratories, I was able to create a model that is sensitive to the intricacies of our laboratory waste management system. Furthermore, these opportunities have given me insight into the structures and characteristics of these laboratory spaces. Finally, I have helped foster new considerations and awareness in the MSU STEM community through the promotion of interventions and metrics that have the potential to enact meaningful change.

ELECTRICAL & COMPUTER ENGINEERING

DESIGN AND FABRICATION OF 3D PRINTED PIEZOELECTRIC ULTRASONIC SENSORS

Avi Rajendra-Nicolucci*
Electrical and Computer Engineering, Section 1
Presentation Number: 148
Mentor(s): Prem Chahal

Additive Manufacturing or 3D printing has become an increasingly popular tool for fabrication of RF and microwave circuits. The advantages of 3D printing, such as freedom along the z-axis and rapid customization has been exploited for printing complex geometries which are often difficult to realize using traditional manufacturing techniques. 3D printing has grown into an important tool for low cost mass commercialization of light-weight, complex electronics. In this work a piezoelectric ultrasonic sensor is coupled to a 3D printed microfluidic substrate for chemical sensing and mixing. Ultrasonic waves have been increasingly utilized as a non-invasive sensing instrument with applications in the biochemistry, automotive and pharmaceutical fields. Piezoelectric crystals when electrically excited produce ultrasonic waves which can be utilized for agitation and sensing of liquids. The substrate will consist of a microfluidic channel through which the liquid to be tested enters. Two piezoelectric crystals will be placed on either end of the substrate. The substrate itself will be designed in such a way that the ultrasonic waves will be focused on the microfluidic channel. COMSOL Multiphysics® will be used to design the entire structure and also to determine the resonant frequency of the structure at which the ultrasonic waves will cause maximum vibrations in the liquid to be tested. The key challenge will be optimizing the design of the microfluidic channel such that the ultrasonic waves are focused on

the microfluidic channel. The characteristics of different liquids when exposed to the piezoelectric ultrasonic transducer will be studied.

SHOLL ANALYSIS OF NEURONS SURROUNDING IMPLANTED ELECTRODE ARRAYS IN THE BRAIN

Kathleen Williams
Electrical and Computer Engineering, Section 1
Presentation Number: 149
Mentor(s): Erin Purcell, Bronson Gregory

The development of neural electrode implants has become a crucial component to the growing field of neural engineering due to their ability to detect signals directly from brain tissue in vivo. However, a consequence of these electrodes' invasive implantation in the brain is the subsequent damage to neighboring neurons which causes a loss of signals at the recording sites. This limitation in signal strength may be due to alterations in neurons' dendritic arbors, for dendrites integrate and generate electrical signals. The purpose of this study is to compare the dendritic arbors of neurons near electrodes fabricated from materials used in both traditional (silicon) and newer (polyimide) polymer- based designs. In order to assess the effects on these dendritic arbors, adult rats were implanted with either a silicon or polyimide device in their primary motor cortex. Neurons within 100μm of the device were filled with a fluorescent dye and imaged using a 2-photon microscope, and the dendritic arbors were analyzed for branch-complexity using tracing and Sholl analysis plugins in ImageJ. Neurons greater than 500 μm from the device and neurons in naïve rats were assessed as controls. This study provides a new characterization of the impact that electrodes have on brain tissue. The results of this study may inform neural engineers on which device materials could minimize damage to surrounding tissue. Improving device design through material choice could increase the accuracy and longevity of data collected from neural implants, and this advancement would benefit both medical and basic science applications.

THE REPLACEMENT OF HARDWIRE DATA LINES IN AUTOMOBILES WITH WIRELESS NETWORKS

Andrew Caldarone, Saikat Mondal, Yihang Chu
Electrical and Computer Engineering, Section 1
Presentation Number: 150
Mentor(s): Prem Chahal

Vehicles are an increasing hub of embedded devices. Legacy systems such as the powertrain and engine computers are becoming more complex to allow for autonomous driving, and more refined climate control and entertainment options give more choice to each individual passenger. All of these things make for a more pleasant driving experience, but it also leads to design challenges in handling this data. In current design, information to/from sensors and systems around the vehicle are handled by harnesses consisting of hard-wired conductor. However, excess material contributes to excess weight – a critical factor in high performance vehicles - as well as acts as a weak point for corrosion which can limit the lifetime of the system. This is especially true for vehicles deployed in rugged environments, with temperature extremes or high air salinity. The proposal is to investigate how wireless systems can be used to reduce or replace the wired harnesses within vehicles. While a wireless network does have the added complexity of requiring RF modulation and demodulation circuitry, it ultimately requires a fraction of the material resources compared to the existing many meters of wire. Advances in the miniaturization of RF hardware also make it easy to create small, embeddable, rugged devices with potential service lifetimes that can exceed that of a wired system prone to environment-induced damage. The wiring could be reduced to but a single power line, or in the case of extremely low power systems, transponder-style RF energy harvesting is also possible.

VISUAL ODOMETRY-BASED LOCALIZATION FOR AUTONOMOUS VEHICLES

Ahmad Nasralla*
Electrical and Computer Engineering, Section 1
Presentation Number: 151
Mentor(s): Hayder Radha, Daniel Kent

Autonomous driving is recently of high interest due to proposed reduced transportation costs, traffic, and road accident fatalities. Localization, the process by which an autonomous vehicle detects its own position within a map, is a key component of the overall autonomous driving problem. Although precise localization can be realized through the use of a real-time kinematics global positioning system (RTK- GPS), the required hardware is prohibitively expensive for the urban autonomous vehicle application. Thus, this project aims to implement existing computer vision and signal processing algorithms for the estimation of visual odometry. In contrast to RTK-GPS, the estimation of vehicle trajectory using visual odometry only utilizes low-cost digital cameras. Visual odometry will be used in conjunction with other sensors to solve the overall localization problem. The visual odometry algorithm has been implemented in the CARLA (Car Learning to Act) environment, an open-source simulator developed for the implementation, training, and validation of autonomous driving systems. The CARLA simulation provides ease of data collection, software testing, and scenario replicability. The visual odometry algorithm is written in the C++ programming language for fast execution that would allow for real-time usage. The algorithm heavily relies upon OpenCV, an open-source programming library aimed at real-time computer vision. The C++ implementation is built upon ROS (Robot Operating System), a robotics middleware framework that would ease the transition to hardware in later stages of development. ROS is used for its modularity, ease of use, and existing interface with CARLA.

LOCALIZATION AND DATA PROCESSING OF WIRELESS SENSOR NETWORKS USING RSSI AND LORAWAN

Kanishka Wijewardena
Electrical and Computer Engineering, Section 1
Presentation Number: 152
Mentor(s): Prem Chahal

Wireless Sensor Networks (WSNs) have many applications in agriculture, healthcare, supply chains and transportation. Localization of nodes in a WSN is important to help take meaningful decisions that combine the sensor data transmitted by nodes along with each node's location. With localization, the environment of the WSN could be mapped, obstacles could be detected, and scalar data can be extrapolated to predict future conditions. Although methods such as GPS are commonly used for localization of nodes, due to computational expenses associated with such technologies, a more efficient method of localization is necessary. For this work, LoRaWAN technology was chosen for the WSN due to its wide range and low computational expense. The position of an unknown node could be localized using the location of three anchor nodes and the relative distances between the unknown node and the anchor nodes, found by the Received Signal Strength Indicator (RSSI). Trilateration was combined with iterative multilateration to effectively estimate the positions of the unknown nodes, along with the variance. The total error and time taken when using localized former unknown nodes as new anchor nodes was evaluated. Our objective is to design an efficient and accurate algorithm, having taken the variance and the localization time by different methods into consideration. After localizing all the nodes, the node positions along with their sensor data would be processed via data processing software. The processed data would be filtered, mapped, and used to make decisions regarding the broader system in which the WSN is present.

WINCH-BASED DELIVERY SYSTEM: A SAFER AND MORE EFFICIENT WAY FOR AERIAL DELIVERY SYSTEMS

Dong Mangalindan
Electrical and Computer Engineering, Section 1
Presentation Number: 153
Mentor(s): Vaibhav Srivastava, Connor Boss

Unmanned Aerial Vehicles are machines that vary in sizes, based on their use. They can be programmed to fly autonomously. In order to fly autonomously, they should be pre-programmed and equipped with sensors such as GPS, Lidar and Infrared sensors. These sensors can be used to identify location, flight path and collision avoidance. These multicopters can be used in multiple purposes such as inspection and photography. In this project, we focus on aerial delivery systems and append a winch system to the drone. We also focus on design of control design for the aerial delivery system. The resulting system can be used to deliver items commercially, and even access remote areas that are unable to be accessed by land vehicles. Using a winch-based delivery system is more efficient and safer compared to the common descend-ascend delivery protocol used by many. It is more efficient as it provides better power consumption and less collision by hovering rather than going up and down.

ENVIRONMENTAL SCIENCE & NATURAL RESOURCES

EXAMINING CONNECTIONS BETWEEN AGRICULTURE AND FECAL CONTAMINATION IN MICHIGAN

Parker Renberg
Environmental Science and Natural Resources, Section 1
Presentation Number: 157
Mentor(s): Sherry Martin

Human agricultural practices have large impacts on water quality, especially due to runoff around large scale farms. Raising crops and accompanying fertilization introduce large amounts of nutrients to nearby waterways. Similarly, waste from animal agriculture (cows and pigs) has comparable effects, along with potential spread of disease. This research will analyze water samples from multiple watersheds to understand the impacts of agricultural activity (including animal agriculture) and potentially associated water contamination. The selected watersheds were chosen based on results from a previous study showing differing levels of nitrogen and phosphorus in comparison to other nearby areas. The samples were taken from multiple sites within each watershed under different hydrologic conditions. This analysis will utilize microbial source tracking (MST) markers to understand how agricultural practices affect fecal contamination in surface waters. MST specifically is useful as it aids in identifying sources of pollution that are otherwise hard to trace and measure. Current analyses are focused on the relationships between fecal contamination from different sources (humans, cows, pigs), water chemistry, and types of land cover. There will be a specific focus on temporal trends in farming practices, as said practices and associated contamination may be highly dependent on season.

A LONGITUDINAL ANALYSIS OF ECOLOGICAL SYSTEMS IN THE LAKE CHAD BASIN

Nicholas Grabill, Yifei Li
Environmental Science and Natural Resources, Section 1
Presentation Number: 158
Mentor(s): Frederi Viens

The Yobe river and its tributaries Northeast Nigeria and Southeast Niger drain the northern portion of the Lake Chad basin in West Africa's Eastern Sahel region. This system provides waters to millions of people and livestock across the five adjacent states and two provinces. By

international standards the people of this region live in extreme poverty, although this belies the rich environment which the lake and its basin provide for the agricultural economy. Agricultural productivity and prices are tracked, to the highest accuracy given the paucity and unreliability of the data, as we compare it to the lake and basin's highly variable hydrology from year-to-year. Using statewide production, pricing, and rainfall data, and using a hydrology reconstruction for the lake levels, we find evidence that the Yobe river provides for robust ecosystem services to all states in its basin. Much of this activity appears to originate from small-scale systematic informal irrigation practices. There is also statistical evidence that Nigeria's Borno state profits particularly from recessional agriculture. Northeast Nigeria and Niger boast the world's highest birth rates, and Borno state, with a population in excess of 5 million, also harbors the world's most vicious and unpredictable terrorist group, Boko Haram, with more than 2 million internally displaced victims. Despite this reality, Lake Chad and the Yobe River provide for millions of fishermen, pastoralists, and farmers, who adapt continuously to their ever-changing environment.

USING A SPLIT-POT SYSTEM TO STUDY LOCALIZED VS. DYNAMIC ROOT RESPONSES IN SWITCHGRASS (PANICUM VIRGATUM)

Hope Meyers
Environmental Science and Natural Resources, Section 1
Presentation Number: 159
Mentor(s): Tayler Ulbrich, Sarah Evans

Dynamic communication networks in plants contribute to root plasticity. A perceptible change in the plant's environment such as water shortage, nutrient deficiency or presence of a plant neighbor calls for the mechanism of root plasticity to positively act upon these challenges. Root morphologies are highly dynamic and can be impacted by nitrogen availability, soil moisture content as well as plant neighbors. One of the most frequently-studied plant traits is Specific Root Length, a ratio of total root length to total root biomass. Specific root length may be high in times of N-limiting stress causing plants to invest energy toward the growth of many long, thin roots with a greater surface area for nutrient uptake. In the presence of a plant neighbor, plants often find themselves in competition for water and nutrients, leading to a similar response. Likewise, differences in root morphology may contribute to differences in plant communication by volatile organic compounds and root exudates leading to implications for microbial communities and their respective activities in the rhizosphere. Through the creation of a split- pot system studied under variable nitrogen, water and plant neighbor regimes, it is my hope to learn why roots of Panicum virgatum differ in morphology and whether their roots experience a net systemic or localized response across treatments. The results of this study may or may not implicate possible future analyses of whether root traits (morphology) among different treatments impact microbial community composition and/or extracellular enzyme activities at the level of the rhizosphere

BOMBARDED BY BUGS: THE USE OF BIOBLITZES TO ASSESS ARTHROPOD DIVERSITY AT COREY MARSH ECOLOGICAL RESEARCH CENTER

Brenna Jeffs
Environmental Science and Natural Resources, Section 1
Presentation Number: 160
Mentor(s): Amanda Lorenz

A BioBlitz is a citizen science initiative to survey the organisms of a specific area in a short (1-2 day) timeframe. Corey Marsh Ecological Research Center (CMERC) is a newly-established MSU field research site in Laingsburg, MI, dedicated to ecological restoration. In May and September of 2019, BioBlitzes were held at CMERC to assess the biological diversity of the site prior to restoration, including arthropod biodiversity. Arthropod specimens were collected from a variety of habitat types including forest, prairie, and wetland habitats, and identified to the

Order or Family level. Here we report on the communities of arthropods collected during both BioBlitzes in order to represent a snapshot of current arthropod diversity at CMERC. Data from this study will contribute to a long-term record of arthropod diversity as the site proceeds through ecological restoration in the coming years.

HEALTH SCIENCES

THE AFFECT OF PIEZO1 ON ADIPOGENESIS AND LIPOGENESIS IN RAT ADIPOSE TISSUE

Alyssa Clements
Health Sciences, Section 1
Presentation Number: 164
Mentor(s): Andres Contreras, Stephanie Watts

The perivascular adipose tissue surrounds and supports the vascular system; it functions to regulate the vasculature's homeostasis and secretes materials for the use of the paracrine and autocrine systems, such as adiponectin. The PVAT is composed of adipocytes, which develop from preadipocytes through adipogenesis. The adipogenesis process is composed of cellular determination and differentiation. Adiponectin is a type of adipokine, that is released from the adipose tissue only when mature adipocytes are present. PVAT secretes many vasoactive molecules including adiponectin and nitric oxide that support vascular relaxation. When a balanced amount of PVAT is present, it functions to maintain the dilation of the blood vessels. Piezo 1 is a echanosensitive ion channel, meaning that it is a type of membrane protein that is activated by mechanical stimulation It is expressed, specifically in mice, in mechanosensitive areas such as the skin, bladder, lung, kidney, and colon. Mechanical forces driven by high blood pressure can activate Piezo 1. The activation of Piezo 1 can potentially inhibit adipogenesis, however, it is unknown if this occurs in the PVAT. Peroxisome proliferator-activated receptor gamma (PPARγ) ligands most commonly aid in preadipocyte differentiation. But when activated PPARγ allows the adipose tissue to better secrete adiponectin. The objective of this research is to explore the relationship between Piezo 1 activation and adipogenesis. We hypothesize that if Piezo 1 is activated, then adipogenesis will be inhibited. If adipogenesis is inhibited, there will be a reduction of adipocytes in number and size. The results are currently pending.

WHAT PATIENTS REPORT ABOUT THEIR SYMPTOMS COMPARED TO HEALTH PROVIDER ASSESSMENTS

Kate Frederick
Health Sciences, Section 1
Presentation Number: 165
Mentor(s): Gwen Wyatt, Sarah Brewer

Symptom management for cancer patients is critical and must be based on valid data. However, cancer patient self-reported symptom severity will sometimes differ from the health care provider assessment in the medical records. The aim of this project was to evaluate the concordance of patients' self-report of symptom severity for 13 cancer and treatment related symptoms, and health care providers' documentation in the medical record. The symptoms included anorexia, nausea, vomiting, diarrhea, constipation, dry mouth, sore mouth, cough, dyspnea, anxiety, pain, and numbness or tingling. An unpowered subsample (n=10) of data was used. The parent study of 377 patients examined the impact of reflexology and meditative practice on cancer symptom management. Patients were randomized to both groups and completed the intervention at least once a week for 30 minutes. All patients completed a telephone interview regarding symptom severity at baseline and week 12. The medical chart audit and self-report questionnaires were reviewed by hand and 13 symptoms were collected from both sources. Overall, the self-reported data indicated higher severity than the chart audit

data. This subsample finding is consistent with a report by this team on a previous study by Wyatt and Sikorskii (2012). The symptoms that were most similar between the two sources were vomiting, constipation and cough. While the most dissimilar symptoms were anorexia, dry mouth, anxiety, and insomnia. Medical charts are an important source of communication between members of the health care team. Charts that do not accurately reflect symptom severity may negatively impact patient care.

NICOTINE REPLACEMENT THERAPY TREATMENT OR ASSISTED TAPER PLUS BEHAVIORAL SUPPORT FOR ELECTRONIC NICOTINE DELIVERY SYSTEMS CESSATION

Noah Blower*
Health Sciences, Section 1
Presentation Number: 166
Mentor(s): Michelle Sahr*

While an increasing number of youths use electronic nicotine delivery systems (also known as ENDS, e- cigarettes, e-cigs, or vape) and adults begin to use them instead of traditional cigarettes, practitioners have little guidance to provide cessation assistance for patients using ENDS. With this in mind, we designed and ran a prospective, randomized, 3-arm parallel group study with the approval of the Ferris State University Institutional Review Board. We enrolled 24 motivated participants to quit vaping using nicotine replacement therapy (NRT) along with behavioral counseling, a vape taper schedule developed by the researchers along with behavioral counseling, or their own self-established quit methods without behavioral counseling (control). By the end of the study, all participants had seen a decrease in nicotine dependence as measured by a modified version of the Fagerstrom Test for Nicotine Dependence, and quit rates were observed that were much higher than the average 20-25%. The study was not powered to assess the superiority of one quit method over another, nor to establish a cessation protocol. However, it did show that each method could be effective in reducing a patient's nicotine dependence, especially when paired with high levels of contact with a health care professional.

FINITE ELEMENT UTERINE MODEL FOR UNDERSTANDING BRACHIAL PLEXUS INJURIES

Lily Craigmalich
Health Sciences, Section 1
Presentation Number: 167
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.

UNDERSTANDING PATIENT AND PUBLIC PERCEPTIONS ABOUT PSYCHIATRIC ELECTROCEUTICAL INTERVENTIONS AND THEIR EFFECT ON SELF

Emily Castillo
Health Sciences, Section 1
Presentation Number: 168
Mentor(s): Laura Cabrera Trujillo, Robyn Bluhm

Psychiatric electroceutical interventions (PEIs) deliver magnetic or electrical stimulation to the brain to treat disorders such as major depressive disorder. One ethical question about their use is whether electrical stimulation of the brain might affect some aspect of patients' selves. Neuroethicists have mainly considered this question with respect to deep brain stimulation (DBS), given documented cases of striking personality changes post-surgery. However, they have not considered similar effects of PEIs, e.g., electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), and adaptive brain implants (ABI). We conducted interviews with patients and members of the public and identified perceptions, concerns, and beliefs around effects on self by PEIs when used for treatment-resistant depression. We found a spectrum of perceptions that range from a positive effect on self to a negative effect on self. These views mostly seem to be influenced by whether PEIs succeed or fail in treating depression. We also asked participants to compare PEIs to more common therapies such as psychotherapy, medication, and DBS for movement disorders. Participants emphasized self-reflection and differences in the duration of therapy and permanence of its effects as important distinguishing factors between PEIs and other therapies. Our results add to the literature by providing a broader range of beliefs about the effects of DBS on the self while exploring how other PEIs are perceived to impact the self. Understanding patient and public perceptions is important to help inform clinicians' conversations with patients, help patients distinguish between treatment options, and contribute to public understanding of these interventions.

PATIENT AND PUBLIC PERCEPTIONS OF THE INVASIVENESS OF PSYCHIATRIC ELECTROCEUTICAL INTERVENTIONS

Marissa Cortright
Health Sciences, Section 2
Presentation Number: 169
Mentor(s): Robyn Bluhm, Laura Cabrera Trujillo, Eric Achtyes, Aaron McCright

Psychiatric electroceutical interventions (PEIs) – therapies that use electrical or magnetic stimulation of the brain — are being used or developed for the treatment of major depressive disorder. PEIs include electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), deep brain stimulation (DBS), and adaptive brain implants (ABI). The neuroethics literature relies upon the dominant medical connotation of invasiveness as the physical insertion into a body, and therefore, there has not been an in-depth analysis of the concept of invasiveness. In this study, we aim to provide insights into how different stakeholders perceive invasiveness. Here we present results about patients' and public's views on the invasiveness of PEIs. Our participants perceived invasiveness to be multidimensional, including physical invasiveness (use of IV, implants, etc.), psychological invasiveness (perceptions of intruding into personal information and emotions), and lifestyle invasiveness (treatment time, travel to treatment, etc.). Further, we found that three key characteristics of interventions influenced our participants' judgments of invasiveness. One aspect was the localization of the intervention's effects; for some participants, the less localized the effects of a treatment, the more invasive it seemed (pharmaceuticals compared to PEIs). Another feature was the perceived length of effects, permanence of the interventions, and/or the temporal frequency of use. The last characteristic was familiarity with the intervention; for some participants, familiarity reduced perceived invasiveness. Both the invasiveness dimensions and intervention characteristics inform participants' judgements of an intervention's overall invasiveness. This study is an important contribution to furthering discussions about how the invasiveness of PEIs is perceived.

THEORY-BASED CORRELATES OF PHYSICAL ACTIVITY IN OVERWEIGHT AND HEALTHY WEIGHT FRESHMEN

Chloe Catallo*
Health Sciences, Section 2
Presentation Number: 170
Mentor(s): Catherine Gammon*

Correlates of health-enhancing physical activity (PA) may vary by weight status; this has implications for PA promotion. This study explored theory-based psychological correlates of PA among overweight (OW) & healthy-weight (HW) college freshmen. Students had height & weight measured & completed a survey on PA & psychological factors. For OW freshmen (n=35) the strongest correlates of PA were 'identified motivation' (r=.64; p<.05) & self-efficacy (r=.65; p<.05); for HW freshmen (n=62) the strongest correlates were 'integrated motivation' (r=.39; p<.05) & perceived competence for exercise (r=.41; p<.05). PA interventions tailored to weight status may be more effective than a generic approach.

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

Dev Acharya
Health Sciences, Section 2
Presentation Number: 171
Mentor(s): Gordan Srkalovic

Cytokines, chemokines, and co-stimulatory/inhibitory molecules are critical players in the immune responses against cancer. The specific role of T Helper (TH)-1/pro-inflammatory, TH2, TH17, and T- regulatory pathways in cancer immunotherapy are incompletely understood. Whether the systemic levels of immune markers might serve as predictors of effective responses to immunotherapy is largely unknown. The central hypothesis guiding this project is that specific immune markers will serve as predictors of effective vs. ineffective immunotherapy in patients with malignant diseases. Towards this end, the objective of this feasibility study was to establish baselines of immune markers in patients treated (T) with immunotherapy (n=10), 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 analysis using a protein microarray method (RayBiotech Life). Differences among the three groups were analyzed for significance using Mann- Whitney U test (2-tailed, p<0.05). Patients in the group T had significantly elevated levels of IGF1, IP-10, IL-6, and ICOS compared to the group W. Patients in the group S had significantly elevated levels of IL- 1a, IGF1, OPN, IL-12p70, IP-10, IL-17A, IL-10, and TGF-b1 compared to the W subjects. Elevated levels of CD28 and B7-1 were present in patients in the T group compared to the patients in the S group. Future studies are needed to evaluate whether immune markers will be able to predict effective vs. ineffective responses to immunotherapy and whether they may have therapeutic potential.

IMPROVING BIRTH OUTCOMES BY BECOMING DESIGNATED AS MOTHER-FRIENDLY: A QUALITY IMPROVEMENT PROJECT

Kamila Mendela
Health Sciences, Section 2
Presentation Number: 172
Mentor(s): Joanne Goldbort

Maternal mortality is the general report card with regards to the quality of obstetric care. The United States ranks 48th in maternal mortality, and women have a higher risk of dying of pregnancy-related complications than those in 49 other countries with the increase in Cesarean births as a major contributing factor. The overall Cesarean rate in the US is 37%, which means 1

in 3 women may end up having a Cesarean. The Mother-Friendly Childbirth 10-Steps Initiatives (MFCIs) were developed by the Coalition for Improving Maternity Services (CIMS) in 1996, with the purpose to improve the birth process and birth outcomes for women, while also encouraging physiologic childbirth and increased breastfeeding rates. Mother-Friendly practices reduce maternal complications due to pregnancy and complications during hospitalized labor and birth; reduce Cesarean births among low-risk women to a rate of 15%; reduce the rate of maternal mortality; reduce rate of post-partum complications and re- hospitalizations. The MFCIs increase women's feelings of greater birth satisfaction, confidence, and ultimately long-term benefits to the mother, baby, and family. Implementation of this quality improvement project begins by healthcare providers using the MFCI Self-Assessment tool. The MFCIs represent the need for a paradigm shift from the medicalized birth model to the Mother-Friendly physiologic birth model. The MFCIs is an evidence-based collaborative process that aligns with current maternity care health quality initiatives supported by these professional organizations: ACOG, AWHONN, AAFP, ACNM, the Institute of Medicine, Joint Commission, the National Quality Forum and others.

ASSESSING CAPACITY TO CONSENT IN PATIENTS WITH ALZHEIMER'S DISEASE: EMPIRICAL RESEARCH AND ETHICAL IMPLICATIONS

Nina Darwich
Health Sciences, Section 2
Presentation Number: 173
Mentor(s): Robyn Bluhm, Jennifer Carter-Johnson

The objective of this research is to compare Alzheimer's Disease (AD) patients' capacity to consent to treatment and research against AD patients' capacity to designate a healthcare surrogate decision- maker. This distinction is important because patients may lack capacity to consent to treatment or research, while maintaining capacity to choose a surrogate. Many studies have examined AD patients' capacity to consent to research and to treatment. This presentation provides an overview of the empirical research on determining whether a patient with AD has the capacity to consent. The majority of the studies surveyed administered the MacArthur Competence Assessment Tool (MacCAT). Although this tool is widely accepted, it fails to consider a patient's values and is mainly concerned with cognitive abilities. There has been little research done on AD patients' capacity to designate a surrogate decision- maker; however, this review of the empirical literature provides insight into the abilities that must be considered in developing clinical tools to assess the capacity to designate a surrogate decision-maker. Michigan, among other states, does not have a default surrogate law stating who is able to make decisions on a patient's behalf if that patient is deemed incompetent and has no advance health care directive. It is crucial for an AD patient's surrogate to be someone that will make decisions in their best interests. Along with reviewing literature on capacity to consent to treatment and research as well as literature on capacity to designate a surrogate decision-maker, this presentation will also address related ethical and legal implications.

A QUALITATIVE ANALYSIS OF THE TEXAS PRIVACY ACT (SENATE BILL 6)

Aren Kurth
Health Sciences, Section 2
Presentation Number: 174
Mentor(s): Jae Puckett, Kaston Anderson-Carpenter

An alarming amount of legislation in the United States has sought to restrict the rights of transgender people, often targeting access to public spaces or restrooms. One example of this legislation is the Texas Privacy Act (Senate Bill 6; 2017), which details "regulations and policies for entering or using a bathroom or changing facility" (Texas Legislature Online). The hearing for SB 6 saw over 18 hours of public testimony. The testimony was transcribed and a thematic analysis was conducted to better understand arguments for and against this bill. Overall, 13.49%

of individuals testified in support of SB 6 and 86.51% testified against it. In contrast, 65% of senators supported the bill and 35% opposed it. Supporters of SB 6 frequently framed their arguments in terms of safety and security, economic impact, and privacy and dignity. Those opposing SB 6 focused more on discrimination, safety and security, and the effects of transgender people being forced in the wrong facilities. Interestingly, not a single mental health provider testified in support of the bill. Information from this analysis can be used to determine what kind of education could help to combat viewpoints that lead to passing such legislation.

INTEGRATIVE & ORGANISMAL BIOLOGY

HATCHING ENZYME AND HATCHING GLAND IN ANNUAL KILLIFISHES

Harrison Wojtas
Integrative and Organismal Biology, Section 1
Presentation Number: 177
Mentor(s): Ingo Braasch, Andrew Thompson

Animals develop as embryos inside eggs and must hatch to allow the organism to begin its free-living stage. Embryos hatch by producing hatching enzymes in hatching glands that digest the proteins of the chorion, the egg envelope that protects the embryo from the environment. Killifish are a group of freshwater fishes in the order of Cyprinodontiformes. Many are found in tropical regions, including annual killifishes. Annual killifishes inhabit seasonal freshwater pools that periodically dry up, killing the adult population. Before dry season, killifish spawn their eggs in the soil, and the embryos tolerate long periods of desiccation. Embryos enter different states of arrested development, called diapauses, and require environmental cues like flooding to trigger hatching after the final diapause. In teleost fishes, hatching enzyme genes have duplicated and subfunctionalized, resulting in several high choriolytic enzyme (hce), and low choriolytic enzyme (lce) genes. These genes are highly dynamic with extensive copy number variation between species. The hatching enzyme repertoire and hatching gland location is unknown in annual killifishes. Consequently, we infer the evolutionary history of killifish hatching enzyme genes in five species and investigate hatching gland morphology in the annual Rio pearlfish, our central killifish model species. We show lce genes are expressed in the pharyngeal and buccal cavities, consistent with literature data from other fish species that experience environmental cued hatching. By understanding the temporal and spatial expression of hatching genes and their evolutionary history, we can better understand how environmental triggers induce hatching, a fundamental process of animal life.

THE CLINICAL SIGNIFICANCE OF HEMORRHAGE AND CONGESTION IN THE UTERUS OF MEXICAN WOLVES

Heather Sayles
Integrative and Organismal Biology, Section 1
Presentation Number: 178
Mentor(s): Dalen Agnew

Mexican wolves are carefully monitored and their reproduction controlled because of their endangered status. The genetic variability in this species is low due to inbreeding, which lowers their reproductive success and overall population health. To better understand the reproductive issues plaguing this species, uteri and ovaries from Mexican wolves after death or elective sterilization were evaluated grossly and microscopically in order to identify abnormalities. Vascular changes such as vasodilation and hemorrhage in the uteri and ovaries were common and several criteria were then examined in greater detail using digital image analysis. We hypothesized that increased blood flow and hemorrhage were associated with the stage of the estrous cycle. The degree of vasodilation was scored based on the surface area of the blood vessels in microscopic sections. Other parameters recorded include presence and location of

hemorrhaging and stage of the estrous cycle (based on ovarian structures). Comparisons were made between canid uteri with and without vasodilation or hemorrhaging to identify other possible correlations with age, parity, and cause of surgery or death. By understanding the role and possible causes of vasodilation and hemorrhaging in Mexican wolves' reproductive tracts, we can determine the significance of this finding in poorly reproducing animals in the Mexican wolf population.

ESTIMATING ELECTRIC SIGNAL PREFERENCE IN PARAMORMYROPS KINGSLEYAE

Kristen Lounsbury, Douglas Maldonado-Torres, Emily Parker
Integrative and Organismal Biology, Section 1
Presentation Number: 179
Mentor(s): Sophie Picq

Species of weakly electric fish demonstrate the ability to communicate with each other and interact with their environment by emitting electric organ discharges (EODs). A particular species in Gabon, Africa -Paramormyrops kingsleyae - exhibits remarkable variation in its signal: populations of P. kingsleyae have either biphasic or triphasic EODs. A previous study has shown that P. kingselyae can discriminate between both EOD types. In order to identify the driving factor behind this polymorphism we conducted a field paired playback of EODs recorded from biphasic vs triphasic individuals. By analyzing certain behaviors - such as time spent close to the playback electrodes and circling the electrodes - we were able to investigate whether P. kingsleyae preferentially associate with a certain signal type. This study explores the behavioral preference for local vs. foreign EODs in P. kingsleyae, which will provide insight on the role that EODs play in driving evolutionary diversity among the species rich African weakly electric fish.

EFFECT OF CAFFEINE AND COLD TEMPERATURE ON NERVE CONDUCTION VELOCITY

Syed Feeroz
Integrative and Organismal Biology, Section 1
Presentation Number: 180
Mentor(s): Erica Wehrwein

Nerve conduction studies are widely used to test for neuropathies and conduction disorders. Previous studies have shown effects on many electrophysiological tests, including those measuring nerve conduction velocity, after caffeine intake and exposure to colder temperatures, that may result in erroneous baseline data. The purpose of this study is to determine the extent to which caffeine and cold temperatures modify nerve conduction velocity. Male subjects with no previously diagnosed conduction disorder (N=10, ages 18-22, BMI 18-25) partook in recordings of ulnar nerve conduction velocities for baseline readings; immediately after submersion of the arm into 0 degree water for 45 seconds; and 60 minutes after intake of a 300mg caffeine tablet on a separate day. There was no significant difference found in conduction velocities before and 60 minutes after the intake of the caffeine tablet. There was found to be a significant decrease in ulnar nerve conduction velocity after exposure to 45 seconds of an ice-water bath. ($p<0.01$) The results of this study show that nerve temperature must be taken into account to obtain accurate recordings of nerve conduction velocities, and that caffeine intake may be overlooked for nerve conduction tests, at quantities under 300mg. These findings may also provide useful context to exercise physiologists who aim for greater nerve conduction and subsequent muscular efficiency.

EFFECTS OF PARASITISM ON REPRODUCTION IN THREESPINE STICKLEBACK (GASTEROSTEUS ACULEATUS)

Brooke Harper
Integrative and Organismal Biology, Section 1
Presentation Number: 181
Mentor(s): Janette Boughman, Murielle Aalund

Reproductive success is a key component of an organism's fitness, indicating how well adapted it is to its environment. Individuals that are well adapted to local environmental conditions are thus expected to show high reproductive success, measured as a high number of offspring produced either during a given breeding season or over their lifetime. Reproductive success can be greatly influenced by parasites. Since parasites steal nutrients from their hosts, individuals who are parasitized require more energy to maintain their body condition. However food is often a limited resource, making it hard for individuals to forage enough to maintain body condition and produce energetically costly gametes. This causes a trade-off between survival and reproductive success. Here we analyze data on female ovary size and egg number for 171 individuals from 15 populations of threespine sticklebacks (Gasterosteus aculeatus), and present results on the effect of parasitism by the cestode Schistocephalus solidus on ovary size and egg production. We discuss the value of comparing wild datasets from multiple populations for understanding how local ecology can influence reproductive strategies.

THE EFFECTS OF CUTICULAR HYDROCARBONS ON THE DESICCATION RESISTANCE OF DROSOPHILA SPECIE

Cole Richards
Integrative and Organismal Biology, Section 1
Presentation Number: 182
Mentor(s): Henry Chung, Zinan Wang

Understanding how organisms deal with abiotic stress can help predict the adaptation and evolution of different species to diverse environments. For terrestrial organisms, one of the most important abiotic stresses is desiccation. Insects are the most diverse and abundant organisms on the planet and crucial to the environment. Their small body size positively correlates with water loss rate and therefore makes them vulnerable to desiccation. To prevent water loss, insects possess a lipid layer containing various types of hydrocarbons known as cuticular hydrocarbons (CHCs), which help to retain moisture. Due to the varying physical properties of different hydrocarbons, such as the melting temperature, the varied composition of this CHC layer has different efficiencies in retaining water and could confer different levels of desiccation resistance. Fruit flies (Drosophila spp.) have long been a model organism for the study of abiotic adaptations. Previous studies have shown that Drosophila species have different CHC profiles as well as varied levels of desiccation resistance. However, the way in which these CHCs contribute to the desiccation resistance is less understood. In this study, we investigated the desiccation resistance of 24 Drosophila species and analyzed the CHC composition of each using Gas- Chromatography/Mass-Spectrometry. We then applied a linear mixed model to understand the effects of the chemical type, length, and quantity of each CHC on desiccation resistance. This study will contribute to understanding how insect species may be able to adapt to warmer and drier environments as climate changes occur in the coming years.

THE ROLE OF FOOD SCARCITY IN DETERMINING SOCIAL TOLERANCE IN FEMALE SPOTTED HYENAS

Ashley Dunn
Integrative and Organismal Biology, Section 1
Presentation Number: 183
Mentor(s): Kay Holekamp

The distribution of resources plays an important role in determining the structure of animal social systems. Abundant and evenly distributed resources favor the evolution of absent or weak dominance hierarchies, while scarce and clustered resources favor strong ones. In some primates, it's been shown that the degree to which dominant individuals tolerate the presence of subordinates varies in response to food availability. This study explores the effects of food scarcity on social tolerance in a large social carnivore, the spotted hyena (Crocuta crocuta). Spotted hyenas live in large fission-fusion societies with stable female-dominated hierarchies. Access to food is controlled by dominant females. Here we predicted that social tolerance of subordinates by dominant females would increase when food is more abundant. The Mara Hyena Project has been collecting data on hyena behavior in the Masai Mara National Reserve since 1988. Between 1988-2016, we calculated social tolerance within each female- female dyad as the proportion of time the subordinate female fed relative to the time that both hyenas were present at observation sessions with carcasses. We then compared the average social tolerance in months with high versus low prey abundance, determined by whether or not the wildebeest migration was present. The results of this study will provide further insight into spotted hyena behavioral flexibility as well as the importance of ecological factors in shaping social behavior. The effects of food scarcity also have important implications for conservation, as human expansion continues to disrupt wild habitats and increase resource scarcity for wild animals.

KINESIOLOGY, NUTRITION & FOOD SCIENCE

NUTRITIONAL COMPOSITION AND CONSUMER ACCEPTABILITY OF READY TO EAT BEAN AND SILVERFISH SAUCE

Fleur Mushumba
Kinesiology, Nutrition and Food Science, Section 1
Presentation Number: 187
Mentor(s): Lorraine Weatherspoon

Iron and folic acid (IFA) supplements are necessary in pregnancy because of dietary limitations. However, in Uganda adherence to tablet supplements is low with an associated increase in negative maternal and child outcomes. This project addresses the problem creatively with the development and analysis of a culturally acceptable food that is rich in IFA for pregnant women. Bean and Silver Fish flour were prepared using cooking and oven drying methods and formulated based on 5 different ratios of beans and silver fish as follows: BS1 (90:10), BS2 (80:20), BS3 (75:25), BS4 (70:30) and BS5 (60:40). The composite flours were analyzed for proximate and mineral composition according to validated procedures. Physicochemical and hedonic (taste) properties were also assessed. Sensory evaluation included 20 panelists using a 9-point hedonic scale. Analysis of variance determined significant differences, All the composite flours were low in moisture content (6%-7.8%) and high in protein, 37.06% (BS2) to 26.63% for BS3. The highest iron content (35.3 mg/100g) and least (30.3 mg/100g) were recorded for BS4 and BS3, respectively. All samples had the required amount of folic acid except BS3 and BS5. All samples were moderately liked except for BS5 and BS4that were only slightly liked. It was concluded that the composite bean and silver fish flour is overall acceptable and a rich source of iron, folic acid. The flour could be helpful in reducing IFA deficiency in pregnancy.

TOTAL FAT QUANTIFICATION OF GRASS-FED VS CONVENTIONAL GRAIN-FED CATTLE

Taya Smith
Kinesiology, Nutrition and Food Science, Section 1
Presentation Number: 188
Mentor(s): Jenifer Fenton

Health-conscious consumers are becoming increasingly concerned with the amount of fat present in foods. The current trend towards "low fat" foods can be found in any grocery store across the country. Current methods of quantifying total fat content are labor-intensive and time-consuming. Microwave- assisted extraction (MAE) has been proposed as a more efficient method of determining total fat content. MAE not only reduces the time needed to determine total fat content but also results in similar yields as the current reference method for total fat determination. The objective of this study was to develop MAE methodology to quantify the total lipid content in grass-fed Red Angus and Angus Akaushi beef from the Lake City Research Center. Samples were taken from between the 11th and 12th rib of 30 grass-fed cattle and transported to Michigan State University. 0.5±.05g of beef was placed into a vessel containing 10mL solution 1:1 hexane/acetone. Extraction parameters were programmed to run at a max power of 1200W, temperature ramped at 5°C/min to 80°C and held constant for 15 minutes followed by an automatic cooling period. Cooled samples were filtered into a flask and the filtrate was further concentrated using a rotary evaporator. The flasks were dried in a forced-air oven at 100°C for 10 minutes to eliminate residual water content. The total fat content was determined by subtracting the original weight of the vessel from the weight of the vessel plus oil. Total fat differences will be used for diet comparison.

EFFECT OF MICHIGAN WHEAT CONSUMPTION ON THE MICROBIOTA

Gigi Kinney
Kinesiology, Nutrition and Food Science, Section 1
Presentation Number: 189
Mentor(s): Sarah Comstock

The bacteria that comprise the gut microbiota affect the metabolism and immune system of the host. A diet rich in whole grains has been associated with increased bacterial diversity and improved human health. The goal of this study was to determine the effect of different types of Michigan whole wheat on the gut microbiota. This four-week study was conducted by distributing crackers to participants weekly consisting of 100g of wheat crackers (about 500kcal) per day and collecting a fecal sample from the participants at the end of each week. During the first and third weeks of the study, participants ate refined white wheat crackers; during the second week, white whole wheat; and during the fourth week, red whole wheat. Of 33 enrollees, five (15%) dropped out prior to the first sample collection. DNA from fecal samples was extracted and a 16S rRNA gene library was created consisting of a sample from each time point (n=4) for each participant (n=28). The library was sequenced, and the results were analyzed for community diversity and relative abundance of specific bacteria. Bacterial alpha diversity was stable throughout the study. The overall fecal bacterial community composition did not shift in response to the cracker treatments. Participant body weights also remained stable. An analysis by enterotype was not conducted due to low sample size within some enterotypes. Future studies should enroll more participants from each enterotype as well as increase the dose of wheat.

EXAGGERATED BLOOD PRESSURE RESPONSES IN MIDDLE-AGED ATHLETES: EVALUATING THE AGREEMENT BETWEEN TWO DIFFERENT CRITERIA

Rachael Cohen, Anna Nguyen
Kinesiology, Nutrition and Food Science, Section 1
Presentation Number: 190
Mentor(s): Katharine Currie

Exaggerated blood pressure (BP) responses during exercise, traditionally defined as a systolic BP >190 and >210 mmHg for women and men, respectively, are predictive of future cardiovascular events. More recently, the change (D) in BP relative to the change in cardiorespiratory fitness [assessed using maximal oxygen uptake (VO2max)], has been shown to predict future mortality. The purpose of this study was to assess the agreement between these two criteria used to define an exaggerated BP response. Eighty- eight life-long endurance athletes (61 men: 54±6 years; 27 women: 53±5 years) completed a custom treadmill protocol to assess their VO2max. Speed and incline increased as the test progressed until volitional exhaustion. BP was measured throughout the test and VO2max was determined at end of test. An exaggerated BP response was identified as 1) a maximal systolic BP >190 and >210 mmHg for women and men, respectively, and 2) a D systolic BP/ DVO2 > 6.2 mmHg/metabolic equivalent, and the agreement between these two criteria was determined using Cohen's Kappa. There was moderate agreement (k=0.52, p<0.001, 95% confidence intervals 0.32-0.72) in men and fair agreement (k=0.36, p=0.05, 95% confidence intervals 0.00-0.74) in women, between the two criteria. Thus, despite evidence demonstrating the prognostic value of both criteria, our findings suggest that they may not be interchangeable. Furthermore, we observed sex differences in the level of agreement between exaggerated BP criteria which warrants further investigation.

LINGUISTICS, LANGUAGES & SPEECH

WHAT'S IN A PRONOUN?

Daniel Greeson
Linguistics, Languages and Speech, Section 1
Presentation Number: 194
Mentor(s): Cristina Schmitt

All natural languages share the ability to refer back to and track previously mentioned individuals in an efficient way. One way languages achieve this is with pronouns like "he": (1) Daniel came, then he left. Although all languages use pronouns, not all are alike. English "he" marks gender, person, number and animacy, i.e. "he" is singular, a third party, and a man. However, Mandarin encodes less information (person and number only), while French encodes more (levels of formality). Even within one language, pronouns may differ in content. One example is English singular "they", contrasting with "he"/"she" in being gender neutral, a usage dating back centuries: (2) Every fool can do as they're bid. Meanwhile in Spanish, subject pronouns may be either fully pronounced (e.g. "él" = he) or completely omitted, e.g. "él es americano" (=he is American) vs. "Ø es americano" (=is American), respectively. Crucially, silent pronouns are ambiguous for gender. While the contrasts between Spanish pronounced/unpronounced pronouns and English gendered/non-gendered pronouns are generally considered separately, I highlight a context where both languages behave alike: when the pronoun refers back to a generic noun phrase like "every person". In both languages, the equivalent of "he" is dispreferred to refer back to "every person". Instead, Spanish prefers a silent pronoun; English prefers singular they. I argue these preferences are due to a universal principle: To refer to a generic phrase like "every person", use the pronoun that carries less semantic content.

THOUGHTS ON HOPE

Andie King, Elaine Paiz
Linguistics, Languages and Speech, Section 1
Presentation Number: 195
Mentor(s): Catherine Ryu

An analysis on the idea of hope during times of crisis. Through a bilingual reading and analysis of the Japanese children's book, "Farm of Hope" by Mori Eto, we hope to draw parallels between two major health crises in order to explore the hope we hold onto during times of great uncertainty.

THE ACQUISITION OF GENDER IN SPANISH PRONOUNS AND DEMONSTRATIVES: A CASE OF DIALECTS IN CONTACT

Anthony Delsanter
Linguistics, Languages and Speech, Section 1
Presentation Number: 196
Mentor(s): Cristina Schmitt

In Spanish, demonstrative pronouns inflect for gender: demonstratives ending in /-e/ are masculine (este, ese), in /-a/ feminine (esta, esa) and in /-o/ are neuter (esto, eso). Object pronouns also derive the Latin demonstratives. In Standard Spanish, while the correspondence between /-a/ and feminine is maintained, the object pronoun "lo" corresponds to the masculine and "le" is a genderless pronoun for indirect objects. "la" is feminine, "lo" is masculine in Standard Spanish and "le" is the genderless pronoun for indirect objects. In Paraguayan Spanish where the demonstratives are used as in Standard Spanish, but the object pronouns do not have a gender distinction and are reduced to "le" for animates and zero for inanimates. Paraguayan children and adults living in Buenos Aires (where the Standard is used) have a mixed system and use "le", "lo", and "la" as direct objects with a still ill-understood distribution. In this project, our goal is to understand the distribution of these pronouns in relation to demonstratives. We ask two questions: do Paraguayan children and adults have problems with the gender of demonstratives? If not, can we explain the preference of "le" for masculine animate to be related to the influence of the demonstrative series? We used corpus data of child-adult interactions and we coded the use of the demonstratives and object pronouns. Preliminary results suggest that children and adults use the demonstratives appropriately and overuse of "le" for masculine nouns and masculine animates is a parallel with the demonstratives ending in -e for masculine.

YOU CAN USE "OR" OR "AND": A C"OR"PUS STUDY OF "OR"

Ben Airola, Holly Langenstein, Callista Lupa
Linguistics, Languages and Speech, Section 1
Presentation Number: 197
Mentor(s): Alan Munn, Cristina Schmitt, Rachel Stacey

The conjunction 'or' allows for two interpretations: exclusive (one or the other but not both), and inclusive (one or the other or maybe both). The basic meaning of 'or' is inclusive, and the exclusive 'or' is derived through an inference process. Past studies have shown children tend to allow the logical, or inclusive, interpretation of 'or,' but other studies have shown they are able to calculate these inferences and interpret 'or' as exclusive when given improved contexts. The inclusive interpretation of 'or' can be made more prominent in contexts such as free choice ("You can invite John or Bill") or negation ("I didn't see John or Bill"). Outside of such structures, the preferred interpretation of 'or' appears to be exclusive ("Yesterday, I played flute or clarinet"). A majority of the work done on this phenomenon has been experimental in an effort to determine children's abilities to interpret 'or' compared to adults, but thus far there has not been a comprehensive investigation into what contexts children hear and produce 'or.' This

corpus study examines the usage of 'or' in child-directed speech. Our goal is to see to what extent 'or' is used in various sentence structures which may favor one interpretation over another. Preliminary results show that children's and adult's uses of 'or' are very similar. Children and adults have roughly the same proportion of inclusive and exclusive uses, with the exclusive interpretation being predominant.

USES OF DEMONSTRATIVES IN CHILDREN'S SPEECH

Zander Rose
Linguistics, Languages and Speech, Section 1
Presentation Number: 198
Mentor(s): Cristina Schmitt

Demonstratives are pronouns whose interpretation is always related to the speaker center: this is close and that is far from the speaker. Additionally the demonstrative refers to something somehow identifiable or accessible, and implies a contrast set (this one vs. that one). Although information about proximity to the speaker seems to be a basic property of demonstratives, demonstratives can also take on meanings that are more abstract and do not relate to physical proximity. For example, demonstratives can be used to refer to clauses rather than objects and can have other types of connotations (that is her boyfriend?). In this project we ask when and how children learn the various interpretations of demonstratives. We hypothesize that children first use demonstratives to identify/contrast referents in terms of physical proximity (i.e. I want that ball) and as they become linguistically more proficient they begin to use demonstratives in situations unrelated to physical proximity. We test our hypothesis using data from corpora of child-adult interactions via automatic and manual searches. After extracting instances of demonstratives from the corpora, we coded for several syntactic and semantic factors such as the presence or absence of a noun following the demonstrative, type of referent (entity, event or proposition), the animacy of the referent, and the extent to which the demonstrative emphasizes contrast. Preliminary results suggest that there is an increased use of "that" compared to "this" as children get older, which can we argue shows a movement towards more abstract uses of the demonstrative.

THE IMPACT OF HEAD AND NECK CANCER TREATMENT ON COMMUNICATION

Stacey Partain, Kate Shabet
Linguistics, Languages and Speech, Section 1
Presentation Number: 199
Mentor(s): Jeffrey Searl

The purpose of this study is to understand how communication is impacted in people treated for head and neck cancer. Particularly of interest is how communication has changed over time or as a function of age since completing the cancer treatment. Participants are adults with a diagnosis of cancer in the head and neck who completed their cancer treatment a minimum of 3 months before enrollment. Information about their cancer treatments, speech-language therapy, abilities to communicate in daily activities, motivation for continued improvement in their communication, and perceptions of communication change I the months and years since cancer treatment ended will be explored through a 60-minute face-to-face interview and 4 written surveys. Study outcomes will inform the understanding of the long-term impacts of head and neck cancer treatment and the evolving impact on a person's quality of life.

EFFECTS OF BILINGUALISM ON CULTURAL AND LINGUISTIC IDENTITIES

Anna Burbo*
Linguistics, Languages and Speech, Section 1
Presentation Number: 200
Mentor(s): Wendy Wang*

This presentation reports on a case study of a Chinese student's experiences learning English and attending school in the United States, and how such experiences have shaped his cultural and linguistic identities. Sociocultural and sociolinguistic factors, such as choice of language use, are examined in relation to the transient nature of the sociocultural identities of a bilingual speaker.

MECHANICAL ENGINEERING

FREESTANDING LAYERS OF SILICON NANOCRYSTALS: PHOTOLUMINESCENCE AND MECHANICAL PROPERTIES

Cameron Papson
Mechanical Engineering, Section 1
Presentation Number: 204
Mentor(s): Rebecca Anthony

Silicon nanocrystals (SiNCs) have many applications in electronic devices due to their efficient and tunable optoelectronic properties. In the many methods for creating SiNCs, they are nearly always either embedded in an inorganic matrix or supported by a substrate. While this has not hindered their use in technologies such as light-emitting devices (LEDs) and solar photovoltaics, it also raises questions about SiNC properties in standalone layers. It is well-known that the local environment of nanocrystals can influence their optical properties, and many of the methods for testing the mechanical behavior of thin layers of SiNCs rely on substrate-supported techniques. Here we present our work on fabrication of freestanding layers of SiNCs, and their optical and mechanical behavior. SiNCs were synthesized in a nonthermal radiofrequency plasma reactor using silane, argon, and hydrogen gases. We created freestanding layers by using inertial impaction of SiNCs directly out of the reactor onto sacrificial layers, such as NaCl and sucrose. We used thermal evaporation to deposit thin layers of NaCl onto substrates, block-like substrates entirely from sucrose, and other surface coatings of sucrose, as our sacrificial bolsters for the SiNCs. We deposited SiNC layers of varying thicknesses onto these substrates. We then liberated the SiNC layers via dissolution in water at controlled temperature. The SiNCs, which are hydrophobic, rose to the surface of the water where we collected them. Our ongoing experiments include testing the SiNC layers' photoluminescence and mechanical properties without the support of a substrate beneath.

TOWARDS COMPUTATIONAL MODELING OF A TRANSVERSE-GUST GENERATOR

Rhylan Huss
Mechanical Engineering, Section 1
Presentation Number: 205
Mentor(s): Ahmed Naguib

The work described explores the interaction of vortices within a low-speed wind tunnel as produced by an array of vortex generators. This vortex generator array (VGA) is used to create a uniform transverse- gust within the facility's test section as part of recent development of a novel low-turbulence gust generator at the Flow Physics and Control Laboratory at Michigan State University. In an effort to complement the experimental and analytical development and optimization of the gust generator design, this study aims to utilize ANSYS FLUENT to model the vortices produced from the VGA, their evolution, and the strength and uniformity of the

gust produced. As a stepping stone towards this goal, and to ascertain the accuracy of the computational approach, a two-dimensional transient study was performed of the Lamb-Oseen vortex, for which an exact analytical solution is known. Studies were performed to ensure mesh and time-step independency and the FLUENT-setup appropriateness for accurate Lamb-Oseen vortex flow calculation. These studies also examined the time horizon over which the calculation aligns with theory and how this time depends on the size of the computational domain compared to the initial size of the vortex core diameter. In addition, the influence of the domain's boundary conditions (no-slip versus constant pressure) was examined.

IN SILICO MODELING OF CARPOMETACARPAL JOINT SUSPENSIONPLASTY

Nathan Buchweitz
Mechanical Engineering, Section 1
Presentation Number: 206
Mentor(s): Tamara Bush

Carpometacarpal joint (base of the thumb) suspensionplasty is a procedure in which bone at the base of the thumb is removed to relieve arthritic pain for older adults. This surgery replaces the bone with a suspension wire and two-button fastening system. The purpose of this study was to provide a theoretical, in silico, framework from which the functional space reached by the thumb with different wire lengths and attachment points could be assessed. Accordingly, a multi-body physical model of the hand was derived in Simulink. Estimates for human phalange, metacarpal, and carpal bone geometries were obtained from literature. Articulations of rigid solid surfaces against each other and connecting joint ranges of motion were simulated to generate a point cloud of the thumb kinematic space. The simulation procedure was carried out once in the absence of a flexible wire connection, and many times thereafter with controlled variation of wire attachment locations and length parameters. A function was derived to mathematically relate these input wire descriptors to measured thumb kinematic area and volume, which was further modified to evaluate theoretical torques at joints throughout the motion space. Data were then individually optimized to provide mechanical recommendations for the best wire configuration. The in-silico hand simulation generated a motion space of 672.4 cm2 in surface area and 1187.9 cm3 in volume consistent with previously established experimental human data sets. Suspensionplasty using this suspension wire system can be modeled virtually with Simulink and allows accurate predictions of surgical fixation system performance.

TURBULENT FLOW KINEMATICS ACROSS SEDIMENT-WATER INTERFACES

Brandon Phan, Guangchen Shen
Mechanical Engineering, Section 1
Presentation Number: 207
Mentor(s): Junlin Yuan

In aquatic environments such as rivers, the exchange of solutes across the interface between the sediment and the overlying water plays a significant role in controlling biogeochemical processes. Important macroscopic exchange parameters such as the residence-time distribution and flow penetration depth are affected by the flow paths below the interface. Our recent work on grain-resolved numerical simulation of turbulent flow around sediment-water interfaces revealed that, even in the absence of bed form, the particle roughness of a flat river bed may lead to significant time-mean wall- normal velocity at the interface and penetration of the mean flow into the sediment. Instantaneous turbulent fluctuations are expected to enhance the exchange. Yet it is not clear to what extent such effects are. For example, how do the actual flow paths differ from the time-mean ones? The goals of this work are to characterize (1) the difference between the mean and instantaneous flow kinematics inside the sediment and (2) the effect of interface roughness texture.

MICROBIOLOGY, IMMUNOLOGY & INFECTIOUS DISEASE

BENCHMARKING COMPUTATIONAL APPROACHES FOR THE IDENTIFICATION OF DIAGNOSTIC SRNA TARGETS

Elliot Majlessi
Microbiology, Immunology and Infectious Disease, Section 1
Presentation Number: 211
Mentor(s): Janani Ravi

Small RNAs (sRNA) are short non-coding RNA molecules that regulate gene expression and play a key role in early diagnosis of infectious diseases. Due to the similarity between pathogens and the variability of common symptoms, early diagnosis is difficult at the clinical level, verifying an imminent need for computational approaches to find early and sensitive diagnostic tests. Currently, there is rising interest surrounding sRNA detection in pathogens and microRNA (miRNA) in hosts, as diagnostic tools which can be attributed to unique biomarkers that become deregulated in host samples (miRNA) and bacterial sRNA once infection occurs. Effective computational approaches must offer fast and precise analysis, a user-friendly environment, and effective quantification of the results. To date, several computational methods and softwares have been developed using sRNA as a diagnostic tool. However, short read lengths, variability across platforms, and inability to identify pathogen-specific diagnostic targets, still pose significant challenges. Therefore, we propose a novel comprehensive computational workflow which will: (i) identify pathogenic sRNA (host miRNA) that is significantly up or down-regulated, (ii) analyze mixed host-pathogen samples, and (iii) determine if the quantification is sufficiently accurate and efficient for diagnosis. We have tested our workflow and will benchmark it against other current pipelines/tools using a recently published dataset, Mycobacterium avium paratuberculosis infecting cow (Bos taurus; GSE129819), and our bovine tuberculosis dataset in nonhuman hosts (unpublished) to identify unique pathogenic sRNA. We hope to present the merits of our novel approach in light of current research and techniques which have already been developed.

DEFINING THE ROLE OF THE INFANT MICROBIOME IN MEDIATING INCREASED AIRWAY HYPER-RESPONSIVENESS (AHR) DRIVEN BY MAST CELLS ASSOCIATED MECHANISMS IN A MOUSE MODEL OF ALLERGIC AIRWAY DISEASE

Monique Christian*
Microbiology, Immunology and Infectious Disease, Section 1
Presentation Number: 212
Mentor(s): Ivon Moyauribe, Jack Harkema, Susan Ewart, Linda Mansfield

The goal of this project is to identify the aspects of the gut microbiome that protect or increase vulnerability to allergic diseases, such as asthma. We hypothesized that during the early stage of life, changes in the gut microbiome of human infants increase the risk of allergic sensitization and allergic diseases. Gut microbiomes were collected from two groups of infants. One group had eczema, identifying them as having potential allergic sensitization and future, and the second group was without eczema, making them less likely to develop asthma. These gut microbiomes were transferred to germ free mice to study their airway allergic responses to house dust mites (HDM). Preliminary data showed that mice with humanized microbiota had greater airway hyperresponsiveness to HDM than mice with an undisturbed microbiota, but the underlying mechanism is unknown. Mast cells are known to influence airway constriction by releasing certain chemicals. Thus, this project examines mast cells in the lungs to determine if they have an impact on lung function when mice are exposed to an allergen. We measured mast cell protease-1 activity (mMCPT-1) in bronchoalveolar lavage samples and are correlating this with the lung function parameters, resistance, and compliance. Literature is being reviewed to identify support for mechanisms linking mast cell activity to lung function. The results of this

project will determine if specific chemicals released from mast cells are associated with airway hyperresponsiveness and the gut microbiome.

ROLE OF LIN28 IN MURINE LEUKEMIA VIRUS REPLICATION

Esther Ogayo*
Microbiology, Immunology and Infectious Disease, Section 1
Presentation Number: 213
Mentor(s): Silas Johnson*

Moloney murine leukemia virus (MoMLV) is an enveloped, positive-sense single-stranded RNA virus belonging to the retroviridae family and is used as a model system to study retroviral replication. LIN28 is an RNA binding protein whose studied roles include triggering Terminal Uridyltransferases (TUTases), TUT4/7, to oligouridylate let-7 RNAs tagging them for degradation. TRIpartite Interaction Motif 25 (TRIM25) is a retroviral restriction factor that targets many steps of the retroviral replication cycle. TRIM25 was also previously identified as a cofactor that stimulates LIN28/TUT4. Because of these interactions with TUT4/7 and TRIM25, we hypothesize that LIN28 may be involved in a novel retroviral restriction pathway that targets retroviral RNAs for TUT4/7 mediated degradation. To test this hypothesis, we first transfected ET-7 cells with LIN28A/B overexpression plasmids and harvested cell lysates every 24 hrs for 5 days post-transfection. We used western blot analysis to confirm the overexpression of LIN28A/B. We then cotransfected ET-7 cells with LIN28A/B overexpression plasmids and pGPP (MoMLV gag-pol-puro expression plasmid) and collected cell lysates every 24 hrs for 3 days post-transfection. Our preliminary results suggest that overexpression of LIN28A/B in ET-7 cells is associated with a reduction in Gag protein levels in cells. This result confirms our hypothesis that LIN28A/B is involved in restricting retroviral replication.

NATURE OF VIRUS ATTACHMENT TO SURFACES IN AN INDOOR ENVIRONMENT

Keaton Connelly*
Microbiology, Immunology and Infectious Disease, Section 1
Presentation Number: 214
Mentor(s): Volodymyr Tarabara

The project centers on the challenge of understanding virus attachment to surfaces in an indoor environment. The main focus is on viruses that are brought to a surface in microdroplets. We hypothesize that the size, ionic strength, and surface tension of microdroplets affect virus adhesion and infectivity. The REU project will produce a literature review on the current state of knowledge on the subject and related experimental methods. The project will inform the ongoing work at MSU on virus adhesion to and resuspension from fomites.

MECHANISMS OF HOST-DERIVED GLUTATHIONE IMPORT AND CATABOLISM IN ANTIBIOTIC RESISTANT STAPHYLOCOCCUS AUREUS

Michael Wischer
Microbiology, Immunology and Infectious Disease, Section 1
Presentation Number: 215
Mentor(s): Neal Hammer, Joshua Lensmire

Staphylococcus aureus is an opportunistic pathogen that causes a wide array of diseases in humans. To proliferate and cause disease, S. aureus must acquire essential nutrients from the host. One essential nutrient, sulfur, is vital for S. aureus to establish infection because it is a critical component of cysteine and methionine, and essential for synthesis of metabolic cofactors such as iron-sulfur clusters. S. aureus acquires glutathione (GSH), a tripeptide containing glutamate, cysteine, and glycine as a sulfur source in vitro. GSH is found in host cells at millimolar levels, and consequently represents an abundant sulfur reservoir for pathogens. Using a genetic approach, we discovered that a putative nickel-peptide

ABC-transporter and γ-glutamyl transpeptidase (Ggt) are required for in vitro proliferation of S. aureus in medium supplemented with GSH in either the reduced or oxidized (GSSG) forms. Consistent with these results, we named the ABC transporter the glutathione import system, or GisABCD. Our findings support the hypothesis that GisABCD imports GSH while Ggt catabolizes the tripeptide. GisA is annotated as an ATPase and contains Walker A/B boxes typically present in this enzyme family. ATP hydrolysis assays will validate GisA as an ATPase. Ggt degrades GSH in Escherichia coli and humans, but GSH or GSSG cleavage by S. aureus Ggt has not been determined. This work seeks to define enzyme kinetics of Ggt using GSH and GSSG as substrates. In total, this investigation increases our understanding of the molecular mechanisms supporting S. aureus acquisition of nutrient sulfur at the host-pathogen interface.

CHARACTERIZING THE MECHANISM BY WHICH CYCLIC-DI-GMP MODULATES THE VIRULENCE OF ERWINIA AMYLOVORA

Jacob Hieber
Microbiology, Immunology and Infectious Disease, Section 2
Presentation Number: 216
Mentor(s): Christopher Waters, Brian Hsueh

The Gram-negative plant pathogen Erwinia amylovora is the causative agent of the plant disease fire blight, primarily affecting apple and pear trees. This disease causes vast economic loss worldwide. E. amylovora disease progression involves a transition between a chronic biofilm state to a systemic acute infection state, utilizing the Type III Secretion System (T3SS). The ubiquitous second messenger molecule cyclic-di-GMP (c-di-GMP) regulates a wide variety of bacterial lifestyles, including biofilm formation, motility, and virulence. It has been shown that increased levels of c-di-GMP downregulates HrpL, the master regulator of T3SS in E. amylovora. Furthermore, c-di-GMP interacts with effectors, such as transcription factors, to regulate downstream pathways in many pathogens with T3SS. However, the molecular mechanism by which c-di-GMP regulates the signaling cascade leading to expression of the T3SS is less understood. I therefore hypothesize that c-di-GMP activates a repressor to downregulate hrpL expression, and thus inhibits T3SS in E. amylovora. Through random transposon mutagenesis, I have identified two genes, a putative transcriptional regulator and a putative two-component system, that repress hrpL under high c-di-GMP levels. Current work is focused on characterizing how E. amylovora utilizes c-di-GMP to control these repressors to modulate gene expression and adapt to environmental signals that initiate infection in apple and pear trees. The regulation of T3SS is highly complex, and the implication that c-di-GMP signaling involving c-di-GMP receptors contributes to controlling the T3SS could help us understand the mechanisms by which E. amylovora initiates infection, and may bring about further advancements in controlling fire blight.

DISCOVERING ANTIBIOTICS IN NEW ZEALAND USING BOTH A METAGENOMIC AND CULTURE BASED APPROACH

Samantha Steurer, Simran Singh, Julia Bazner
Microbiology, Immunology and Infectious Disease, Section 2
Presentation Number: 218
Mentor(s): Jeanette McGuire

According to the World Health Organization, antibiotic resistance is one of the biggest risks to global development and health today. Over the past one hundred years, the use of antibiotics has significantly increased in both the medical and agricultural fields, resulting in an increase in prevalence of antibiotic- resistant bacteria and a need to identify novel antibiotic compounds. The majority of modern antibiotic compounds have been identified using a culture-based approach, however novel compounds are increasingly harder to find. Further, the vast majority of bacteria cannot be cultured to a sufficient degree in the laboratory- substantially limiting the ability to identify antibiotics. We combined a traditional culture-based approach with a

metagenomic approach to help us to further identify potential antibiotics. Soil samples were collected throughout the North Island of New Zealand, we then worked closely with researchers from Victoria University to evaluate potential compounds and compare the two approaches. For the metagenomic approach, we evaluated two common domains typically associated with antibiotics (adenylation domain and ketosynthase alpha domain). We pre-screened for Actinobacteria, and their natural products were extracted and tested for antimicrobial activity based on a zone of inhibition assay. From the culture-based approach, six out of sixty-four small molecules were potential antibiotic compounds. From our metagenomic approach, one of the sixteen samples was suspected to be an antibiotic compound of the ketosynthase alpha domain. There was no indication of adenylation domain antibiotics in any of the samples. These compounds are being evaluated further with Victoria University in Wellington, New Zealand.

INVESTIGATION OF FALSE-NEGATIVE PROPORTION AND OTHER ETIOLOGIES FOR SUSPECTED SARS-COV-2 PATIENTS IN WYOMING

Bailey Bowcutt
Microbiology, Immunology and Infectious Disease, Section 2
Presentation Number: 219
Mentor(s): Noah Hull*

As of July 9, 2020, 1,404 laboratory-confirmed cases of SARS-CoV-2 have occurred in the state of Wyoming. The process of sampling, storage, travel, and testing for SARS-CoV-2 is known to negatively affect the sensitivity of rRT-PCR, the primary testing method for active infections. High false-negative proportions can lead to increased spread of disease and incorrect point estimates of infections. This study compared the current CDC 2019-nCoV rRT-PCR Diagnostic Panel to a new CDC multiplex assay to better understand false-negative proportions. Five-hundred-and-twenty-four SARS-CoV-2 negative and 35 positive specimens were selected for further testing. All subjects were sampled between March 5, 2020 and May 28, 2020. Primary diagnostic testing followed the CDC Emergency Use Authorization for extraction of nucleic acid and the CDC rRT-PCR singleplex assay. Of the 524 negative samples, 10 samples (1.91%) were found to be positive on the CDC multiplex assay, indicating a low false-negative proportion. There was 100% agreement between the assays for the 35 positive samples. Cohen's Kappa rated the strength of agreement between the assays as "strong" (k = 0.87; 95% CI 0.78 to 0.95). One- hundred symptomatic samples that were negative for SARS-CoV-2 were then tested for 15 viral and two bacterial targets on the GenMark ePlex Respiratory Panel. Eleven targets were detected in 10 specimens (11%), with Human Rhinovirus/Enterovirus as the most common (n = 5). Future directions include testing using a broader array of targets to better examine the clinical picture of suspected SARS-CoV-2 patients in Wyoming.

THE EFFECT OF SILVER INFUSED CLOTHING ON BACTERIA VIABILITY

Madalyn Fields*
Microbiology, Immunology and Infectious Disease, Section 2
Presentation Number: 220
Mentor(s): Lance Shultz*

Clothing companies are attempting 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. Two methods of silver infusion were tested, silver nanoparticles woven into the fabric's thread and fabric treated with a coating of silver chloride. Six different antimicrobial shirts and one cotton shirt were analyzed in three different assays to produce a wide range of data to assess the validity of the companies claims. The assays measured zones of inhibition, visual growth, and optical density to determine the antimicrobial ability of the garments. Utilizing this data, only one fabric provided evidence of antimicrobial activity. The other fabrics provided little or

no evidence to support antimicrobial activity. There was also a greater inhibition of gram-positive bacteria when compared to gram-negative bacteria. Since this research primarily focused on the ability of the fabrics to prevent bacterial growth by measuring an endpoint, further research needs to be conducted to determine if the fabrics can slow bacterial growth over time. With the rise of face mask companies promoting this same technology, this research needs to be expanded to test the ability of silver-infused fabrics in disrupting virus viability.

INVESTIGATION OF PLASMID-MEDIATED RESISTANCE IN THE HUMAN GUT MICROBIOME

Ashley Peer
Microbiology, Immunology and Infectious Disease, Section 2
Presentation Number: 221
Mentor(s): Azam Sher, Lixin Zhang, Linda Mansfield

The emergence of antibiotic resistance (ABR) is one of the most prevalent and urgent threats to public health. Horizontal gene transfer (HGT) is considered a major driving force of emergence and spread of ABR among bacteria. Little is known about the role of the human gut microbiome in the development of ABR which is considered a reservoir of antibiotic resistance genes (ARGs). Sharing and acquiring of ARGs via HGT is naturally occurring in the gut microbiome where millions of bacteria are closely located and frequently make contacts to each other. In previous work, HGT has often been studied in the lab settings using lab modified strains which doesn't mimic bacterial strains present in the host gut. To address this gap of knowledge, we have isolated commensal E. coli from the mouse gut and successfully tagged with fluorescent protein and antibiotic resistance genes on its chromosome. We have modeled an in vitro plasmid-mediated conjugation system where we are studying the transfer of ARGs in the commensal mouse gut E. coli from various donor bacterial strains with conjugative plasmids carrying certain antibiotic resistance genes and fluorescent tags. We are using Culturomics, PCR and fluorescent microscopy to isolate, confirm and visualize donor and recipient bacteria respectively. The use of fluorescent-activated cell sorting (FACS) paired with emulsion, paired isolation, and concatenation PCR (epicPCR) will enable the easy identification of transconjugants from donor and recipient. Findings from this study will lead us to mitigate the plasmid-mediated transfer of ARG in the human gut microbiome.

NEUROSCIENCE

VALIDATING DISTINCT TECHNOLOGIES FOR TRACING BRAIN CIRCUITS AND USING THESE DATA TO SHED LIGHT ON EMOTION AND MEMORY

Arjun Balakrishnan
Neuroscience, Section 1
Presentation Number: 225
Mentor(s): Mark Reimers

Mapping the complex connections across the brain of a mouse is a major project of neuroscience today. However several different technologies are used and they have not yet been compared. We compared the connectivity databases from the Allen Institute and the MouseLight database from HHMI Janelia campus. The Allen database contains coarse maps averaged from very many neurons; the MouseLight contains very detailed maps from a few neurons. We found that broadly the maps are consistent with each other, with some important differences in thalamic regions. We propose an explanation for these differences in terms of genes expressed by certain neurons within the source regions. Overall our results provide confidence in the mapping efforts. One important circuit in the mid-brain generates emotional activity. We generated comprehensive maps of these circuits, and note that the functions of the majority of these circuits have not been studied. Emotion plays a large role in memory. We

further show strong variation in how different sections of key memory structures interact with emotional circuits.

TOO STRESSED OUT TO EAT? DO VENTRAL TEGMENTAL AREA NTSR1 NEURONS THAT RESTRAIN FEEDING INCREASE STRESS BEHAVIOR?

Jillian Matasovsky
Neuroscience, Section 1
Presentation Number: 226
Mentor(s): Gina Leinninger

Dopamine (DA) neurons within the ventral tegmental area (VTA) modulate food consumption and locomotor activity, and therefore could be useful targets to support weight loss as needed to address the increasing rates of obesity. We found that a specific subset of DA neurons express neurotensin receptor-1 (NtsR1), and activation of these "VTA NtsR1 neurons" in mice suppresses feeding and promotes locomotor activity: dual behaviors that lead to weight loss. However, stress can also increase locomotion and decrease feeding in mouse models. Thus, the goal of this project was to determine if activation of VTA NtsR1 neurons increases stress behavior, which might aversively produce the weight- reducing effects. To examine this, we used excitatory Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) to selectively activate VTA NtsR1 neurons in mice and then assessed them via three separate tests for stress behavior: nestlet-shredding, marble-burying, and the elevated plus maze test. Activation of VTA NtsR1 neurons did not increase stress behaviors (nestlet shredding, percentage of marbles buried, or percentage of time spent in the closed vs. open arms of the elevated plus maze) above control levels. These results indicate that activation of VTA NtsR1 neurons can support locomotor activity and decreased feeding behaviors that are effective for weight loss in mice without invoking aversive stress responses. Thus, in the future, designing drugs to activate VTA NtsR1 neurons might have promise to safely promote weight loss as needed to reverse the obesity epidemic.

NOVEL BIOMARKERS ASSOCIATED WITH IMPLANTED NEURAL PROSTHESES IDENTIFIED THROUGH RNA SEQUENCING

Nick Heelan
Neuroscience, Section 1
Presentation Number: 227
Mentor(s): Cort Thompson

Neural prosthetics are devices which have the potential to treat numerous neurodegenerative diseases and restore functionality through assistive robotics. Sustainable recording of isolated electrical signals, which is essential for many neuroprosthetics, requires invasive implantation of devices. Currently, signal instability is a significant obstacle in chronic function of implanted neural prosthesis. It is widely accepted that the foreign body response (FBR) of the brain is a major factor in signal instability. The FBR is generally characterized by an encapsulating glial scar and neuronal cell death, as illustrated by studies which evaluate tissue solely through neuronal or glial density. Recent research suggests that using these traditional metrics do not always predict signal quality. The purpose of this study was to identify and explore potential novel biomarkers of device-tissue interaction. In an effort to expand the understanding of the FBR to implanted devices, we used Laser Capture Microscopy (LCM) to sample tissue in the motor cortex of rats at distances 100um and 500um from implanted Michigan style electrodes. RNA extraction and sequencing were performed on this tissue to identify differentially expressed (DE) genes at acute and chronic time-points (1hr, 1 week, 6 weeks). Many of these DE genes have not been reported as metrics of the FBR previously, opening the possibility that they may serve as effective predictors of tissue response and signal quality while also identifying new potential therapeutic targets. We have outlined the most promising DE genes

from our dataset associated with pathways that contribute to FBR and downstream signal fidelity.

THE EFFECT OF SHIFTWORK ON THE CIRCADIAN RHYTHMS IN REPRODUCTIVE TISSUES

Autumn McLane-Svoboda
Neuroscience, Section 1
Presentation Number: 228
Mentor(s): Alexandra Yaw, Hanne Hoffmann

Many careers, including health and protective services, depend on nightshifts, which disrupt the body's internal timekeeping. Coordinated timekeeping in the hypothalamic-pituitary-gonadal (HPG) axis is necessary for reproduction. Light input from the eyes signals the master pacemaker, the suprachiasmatic nucleus (SCN), in the hypothalamus to send signals throughout the brain, which relay information to the pituitary, influencing hormone signaling that control behavior, including wheel running, and gonadal function. Our goal is to determine how shiftwork lighting (light- shift) impacts circadian rhythms in the HPG axis. We hypothesize that light-shift negatively impacts wheel behavior and cellular circadian rhythms. We used validated circadian Per2::luciferase reporter mice, which have a bioluminescent enzyme linked with the Per2 molecular clock gene. Circadian behavior was assessed using running wheels with a light-based shiftwork paradigm. Locomotor analysis were performed by analyzing patterns in the timing of wheel running activity. Adaptation to light-shifts was dependent on direction of shift, with the transition to advances being more disruptive, and overall wheel revolutions decrease throughout light-shifts. Behavioral adaptation to light-shifts in females was less precise during advances. The effect of light-shift on ex vivo HPG axis tissues was assessed through Per2::luciferase waveforms. Data show that the SCN, pituitary, and uterus depend on light-shift direction, while the ovary and epididymis do not. The SCN in both sexes appears to mimic patterns in wheel running activity. Our next step is to understand how reproductive function is altered in these mice. Together, this work provides insight to how shiftwork influences circadian rhythms in reproductive tissues.

MODELING CEREBROSPINAL FLUID FLOW AND WASTE CLEARANCE IN THE BRAIN

Shay Ladd
Neuroscience, Section 1
Presentation Number: 229
Mentor(s): Christina Chan, Neil Wright

The flow of cerebrospinal fluid (CSF) through the brain parenchyma is partially responsible for the clearance of waste products such as beta-amyloid or tau protein, associated with Alzheimer's disease. Reduced flow can lead to accumulation of the harmful species. The predominant flow of CSF is from the ventricles to the recently rediscovered subarachnoid lymph vessels. The mechanics of CSF flow affect how well waste is cleared as well as the locations in which species accumulate. These mechanics have yet to be fully investigated. Experiments in human brains are difficult and costly, and generally rely on observational studies without control of flow parameters. Here, a computational model is used to simulate flow of CSF to improve understanding of the mechanisms involved in waste clearance. The finite element model was first developed in a spherical geometry for validation with a closed form solution. Following validation, a more detailed mesh was developed using MRI scans of human and rat brains. A variety of boundary, initial conditions, and physical parameters (e.g., diffusion coefficients, species production rates) were tested to examine conditions associated with healthy and diseased brains. Determining the parameters that have significant impact on the concentration distribution, as well as the magnitude required to create a change in the distribution, can provide insights in the pathogenesis of Alzheimer's disease, and guide design of subsequent in vitro and in vivo studies. These studies may provide guidance in the development of appropriate treatments.

SEX DIFFERENCES IN THE ACTIVATION OF THE BED NUCLEUS OF THE STRIA TERMINALIS IN JUVENILE MALE AND FEMALE RATS

Haley Velisek
Neuroscience, Section 1
Presentation Number: 230
Mentor(s): Alexa Veenema, Katie Yoest

The bed nucleus of the stria terminalis (BNST) is involved in the regulation of many behaviors including social investigation. Using rodent models, it has been shown that the BNST is involved in social investigation in adults. This effect is sex specific, in part due to sex differences in neurotransmitter release and receptor density within the BNST. However, the role of the BNST in juvenile social investigation is poorly understood. Exploring sex differences in neural circuitry underlying these behaviors can indicate why neuropsychiatric disorders that involve impairment in social function differ between the sexes. We sought to determine if there are sex differences in the activation of the BNST following social investigation in juvenile rats. In order to determine the activation in the BNST we measured the expression of the immediate early gene cFos. Expression of cFos protein reaches peak levels 90 minutes after a cell is activated. By examining cFos levels in juvenile male and female rats that were exposed to a social stimulus or left alone in their home cage we can determine if there are sex and stimulus dependent differences in activation of the BNST. We observed a significant increase in cFos expression in the anterior BNST and a trend toward increased activation of the posterior BNST following social investigation in females but no effect of social investigation on BNST activation in males. This study provides new insights into the neural basis of social investigation by demonstrating social investigation-induced sex-specific activation of the BNST.

USING DEEPLABCUT FOR 3D MARKERLESS POSE ESTIMATION IN HUMAN INFANTS

Samantha Finkbeiner
Neuroscience, Section 2
Presentation Number: 231
Mentor(s): Rebecca Knickmeyer

Infancy is a key period in the development of fear, an essential emotion that involves recognizing and responding to threatening stimuli. Researchers studying the development of fear in infancy rely on both parental reports, which can be highly subjective, and direct assessment of child behavior either in the home or in structured laboratory settings. The objective of the current study is to develop more automated approaches to the assessment of infant behavior, including fear behavior. Specifically, we are testing whether a program called DeepLabCut can effectively track infants' reactions when presented with a series of Halloween masks. DeepLabCut is a relatively new method for 3D markerless pose estimation based on transfer learning with deep neural networks. It allows users to track key features, such as the eyes, nose, shoulders, hands, and feet, as they move through space. Videos were collected by a research team at the University of North Carolina at Chapel Hill studying relationships between infant fear reactivity and the gut microbiome. Our research team at MSU has developed detailed instructions for labeling key features (a prerequisite for training the neural network) and are currently performing a test of inter-rater reliability. After we have established inter-rater reliability, we will test if the duration of an infant's visual attention to the fearful stimulus correlates with the infant's fear reactivity as assessed by an expert human rater. 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.

SEX AND STRESS EFFECTS ON GENE EXPRESSION IN A MODEL OF POST-TRAUMATIC STRESS DISORDER IN RATS

Hayley Kuhn
Neuroscience, Section 2
Presentation Number: 232
Mentor(s): Andrew Eagle

Post-traumatic stress disorder (PTSD) is a psychiatric disorder that stems from exposure to a traumatic stressor and leads to a dysregulated stress response. Women are twice as likely to develop PTSD than men. Women also tend to experience different symptoms from men, which may underlie a differential response to stress. However, the neurobiological mechanism for this sex difference is poorly understood. Single prolonged stress (SPS) is a rodent model that involves multiple stressors and produces behavioral and physiological PTSD-like phenotypes. The glucocorticoid receptor (GR) expression and the bone-derived neurotrophic factor (BDNF) signaling pathway are critical in the stress response. SPS alters GR and elicits BDNF dysfunction in key brain regions that are dysregulated in PTSD, including the hippocampus (HPC), amygdala (Amy), and prefrontal cortex (PFC). We have shown differential alterations in behavior and GR across sexes. These mechanisms therefore may underlie the sex differences we observe in clinical PTSD. To test this hypothesis, male and female rats were exposed to SPS, then BDNF and GR gene expression was measured in the HPC, Amy, and PFC. We found both sex and stress effects on gene expression in these brain regions. This suggests that SPS dysregulates GR and BDNF in a sex-specific manner which may underlie differential behavioral and physiological PTSD phenotypes. Moreover, these findings may explain why we observe sex-specific differences in clinical PTSD.

MAST CELL MEDIATORS AS POTENTIAL ANXIETY MODULATORS

Lexi Singstock
Neuroscience, Section 2
Presentation Number: 233
Mentor(s): Natalia Duque-Wilckens, Alfred Robison, Adam Moeser

Mast cells are distributed throughout tissues and are known for their involvement in peripheral diseases such as allergy, but they can also interact with neurons and glial cells, modulating behavior. The mast cell-deficient KitW−sh/W−sh (sash) mice show increased anxiety-like behaviors compared to wild type (WT) mice, but the underlying mechanisms have not been explored. We tested male and female sash and WT in the elevated plus maze and the sucrose preference test to measure anxiety and hedonic-like behaviors, respectively. In the elevated plus maze test, sash, compared to WT, showed reduced time spent in the open arms, replicating previous findings, and suggesting increased anxiety. The results of the sucrose preference test were surprising: rather than showing a difference in preference, sash mice showed avoidance of sucrose solution, suggesting anxiety-related neophobia rather than anhedonia. Preliminary data suggests that sash behavior in both tests can be rescued by the brain or peripheral engraftment of cultured bone-marrow-derived mast cells from WT, indicating that the role of mast cells on anxiety is associated with circulating mast cell mediators rather than direct cell-cell interaction. We are currently using c-fos immunohistochemistry, a wildly used marker of neuronal activity, to identify potential neuronal substrates underlying mast-cell related behavioral responses. Preliminary data suggest that the absence of mast cells increases c-fos immunoreactivity in the bed nucleus of the stria terminalis, a key area underlying anxiety.

ENHANCING CUE SALIENCE AND CONTEXT-INDUCED REINSTATEMENT IN A MODEL OF COCAINE SEEKING IN MICE

Brooklynn Murray
Neuroscience, Section 2
Presentation Number: 234
Mentor(s): Andrew Eagle

Drug addiction is a serious problem in the US and is characterized by compulsive drug seeking. Drug seeking refers to the craving of drugs that eventually leads to relapse. Dysfunction in brain regions, such as the hippocampus, which is important for memory, and reward regions such as the nucleus accumbens underlie aberrant drug seeking. This has been reliably assessed in rat models of drug self- administration, however it is less well understood in mice. The hippocampus is particularly important for cued and contextual memory. Therefore we explored manipulations of cue salience and contextual reinstatement of drug seeking in a mouse model of cocaine self-administration. In one experiment, we assessed whether enhancing the salience of a cocaine-paired cue would increase cocaine self- administration. We found that adding a more salient cue drove more responding for cocaine and higher cocaine intake. We also tested whether we could produce contextual reinstatement of cocaine seeking in mice. We found that mice robustly reinstated to cocaine after previously extinguishing their cocaine responding in a novel context. These findings suggest that cue salience and context are important in producing robust and reliable and robust drug taking and seeking in mice. Furthermore, these findings will lay the foundation for future studies into the role of the hippocampus in context dependent reinstatement of drug seeking.

IDENTIFYING A NEURAL PATHWAY THAT REGULATES SOCIAL PLAY BEHAVIOR IN JUVENILE MALE AND FEMALE RATS

Valerie Khaykin, Leigha Brown
Neuroscience, Section 2
Presentation Number: 235
Mentor(s): Alexa Veenema, Christina Reppucci

Juvenile social play is an evolutionarily conserved mammalian behavior that is rewarding and highly motivating. Social play is essential for developing normal cognitive, emotional, and social skills, making social play an important behavior for typical mammalian development. Deficits in social skills are shown in autism spectrum disorder (ASD), a disorder characterized by reduced social play behavior. In order to treat ASD, it is crucial to investigate the neural networks that coordinate social play. We recently found that neurons located in the lateral septum (LS) projecting to the ventral tegmental area (VTA) are activated in response to social play in male and female juvenile rats. Here, we aim to determine if this LS→VTA neuronal pathway is necessary for social play expression. To investigate this, we will inhibit the LS→VTA pathway using inhibitory Design Receptors Exclusively Activated by Designer Drugs (DREADDs). Rats will receive control or DREADD injections into the LS, and will be implanted with guide cannulae targeting the VTA. On test days, rats will receive intra-VTA infusions of the DREADD activator clozapine- N-oxide (CNO) or vehicle. When CNO is infused into the VTA, DREADD-expressing neuron terminals originating from the LS will be inhibited, resulting in inhibition of the LS→VTA pathway. We expect that juvenile rats expressing DREADDs will significantly decrease their social play expression under CNO compared to vehicle, and compared to the control group. This study can provide insights into understanding the neural underpinnings of social play deficits by identifying a potentially crucial neural pathway that regulates social play expression.

DEVELOPMENT OF AN AUTOMATED METHOD FOR STATISTICAL ADJUSTMENT OF MRI VOLUMETRIC DATA

Kaylen Doyle
Neuroscience, Section 2
Presentation Number: 236
Mentor(s): Andrew Bender

Structural magnetic resonance imaging (MRI) is a valuable tool for detecting neuroanatomical changes, including regional brain atrophy associated with aging and neurodegenerative diseases such as Alzheimer's disease. Because brain volume is influenced by physical size, regional volumetric estimation needs to be adjusted to account for variation across the population. Currently, researchers perform volumetric adjustment using a variety of common approaches, but there is no standardized implementation of these methods. In order to encourage best practices for volumetric adjustment of structural MRI data, we developed a Python code base that provides 1) multiple established methods of volumetric adjustment, 2) functions to make outlier detection easier, and 3) categorical differences among groups. The three methods for volumetric adjustment include the residual/ANCOVA method, proportion method, and power-proportion method. We implemented additional functions to detect outliers, points with high leverage, and points with high influence on the estimated weights of adjustment. This information can then be used to find and remove potential outliers, in accord with current standards for scientific rigor. We tested this code on volumetric data from the Aging Brain Lab at Wayne State University and the Alzheimer's Disease Neuroimaging Initiative. This code is easy to use and understand, standardizes the procedure, and eliminates the effort involved with manually adjusting regions of the brain for head size. This project represents the first software developed for volumetric adjustment of structural MRI data.

PHYSICAL & MATHEMATICAL SCIENCES

A MACHINE LEARNING APPROACH TO PLAYER DEVELOPMENT: USING JUNIOR LEAGUE STATISTICS TO PREDICT NHL SCORING

Derek Lasker
Physical and Mathematical Sciences, Section 1
Presentation Number: 240
Mentor(s): Albert Cohen

Hockey Analytics is utilized by teams in every league across the world. Statistical methods can be used to evaluate contracts, draft prospects, trades, and player/team evaluation. The area of hockey analytics that is persistently trying to evolve is player success prediction. For our project, we will be using linear regression to estimate player performance over the first 3 seasons of their NHL careers. This study will be limited to forwards who have played in the Canadian Hockey League (CHL), a conglomerate of 3 junior leagues across Canada and the United States.

USING THE POINT FLOW MODEL TO RANK THE WHAC WOMEN'S BASKETBALL CONFERENCE

Marcia Hawkins-Day*
Physical and Mathematical Sciences, Section 1
Presentation Number: 241
Mentor(s): Nate Iverson*

Throughout history, sports teams have used a variety of ways to assess category rankings such as polling/voting, point accumulation, and win-loss records. The research in this presentation focuses on using a method of basketball team ranking based on the flow of points per minute of

play. As a case study, we rank the teams within the WHAC Women's basketball conference for the 2018-19 and 2019-20 regular seasons.

GAMMA STRENGTH FUNCTION FOR CALCULATING NEUTRON CAPTURE REACTIONS

Benjamin Maves
Physical and Mathematical Sciences, Section 1
Presentation Number: 242
Mentor(s): Artemisia Spyrou

Within the field of nuclear astrophysics, one of the main contemporary goals is to understand how elements are synthesized within stars. The creation of heavy elements is of particular interest to nuclear astrophysicists due to the lack of nuclear input due to its inability to be replicated experimentally. Thus, literature on the synthesis of heavy elements is minimal. One of the most common methods of the production of these heavy elements is the rapid-neutron capture process (r-process), which account for about 50% of the production of elements that are heavier than iron. Unfortunately, these reactions are difficult to measure experimentally and thus the identification of certain nuclear properties are required in order to calculate neutron capture reactions. One of the properties that can be used to calculate the neutron capture reaction of each element is the gamma (γ) strength function, which represents the distribution of partial γ-transition widths. Within our work, we aimed to attain the shape of the γ- strength distribution function by observing γ-ray measurements from both the (p, γ) and (γ, γ) reactions of various heavy elements.

CHARACTERIZING THE PHYSIOLOGICAL STATE SELF-EFFICACY EXPERIENCE

Meghan Kinnischtzke*
Physical and Mathematical Sciences, Section 1
Presentation Number: 243
Mentor(s): Laura Wood, Vashti Sawtelle

Student self-efficacy toward academic tasks is a well-researched indicator of persistence and future success, particularly in underrepresented groups in the STEM community (women, people of color, etc.). In this study, we analyze the experiences of transfer students from two-year colleges to Michigan State University. Student subjects belong to a cohort which is designed to give first year students – intending to major in the natural sciences, and from traditionally underrepresented backgrounds – support in academics, research experiences, and the social experience of integrating into the university. These students were interviewed about their experiences at MSU, in which interview questions were designed to prompt discussion about STEM self-efficacy. Using these interviews, we are developing a codebook to identify students' physiological state as it relates to their academic self-efficacy. In addition to the MSU interviewee data, we also draw from outside data and literature in order to make the codebook more widely applicable. The existing codebook identifies verbal indicators of physiological state. The aim of this specific project is to append the existing physiological state codebook so that we can also identify nonverbal indicators of physiological state, specifically through posture and gesture analysis. We will present conclusions about how students nonverbally communicate their emotion/mood state and how this relates to their self-efficacy.

PROBING SPECTROSCOPIC AND MAGNETIC DATA FOR IMPROVED RECYCLING AND SEPARATION OF F-BLOCK ELEMENTS

Nathan Slater*
Physical and Mathematical Sciences, Section 1
Presentation Number: 244
Mentor(s): Selvan Demir, TJ Delano

Environmentally friendly chemical processes, coined 'green chemistry', demand sophisticated methods to recycle and reuse elements in the quest of renewable feedstocks. In contrast to transition metals, effective separation of lanthanide metals is difficult owing to their similar chemical reactivity induced by the poor radial extension of the 4f-orbitals accounting for small differences in ionic radii and Lewis acidity. Current lanthanide separation and purification strategies rely on subtle differences in solubility or thermodynamic properties, however, require the use of large quantities of solvent and harsh reaction conditions. Lanthanide group separation from the actinides is equally crucial as both groups coexist in waste streams emerging from fission and nuclear capture reactions in nuclear reactors. The experimental approach exploits binding affinity of ligands to metals affording different chemical properties such as solubility. However, a deeper understanding of structure-property relationships will lead to more efficient recycling and separation of the lanthanide and actinide ions, while simultaneously resonate with the principles of green chemistry. Hence, we will construct a database that contains magnetic, spectroscopic and structural data of various molecules comprising f-block elements. This database will serve as a platform for rational design of ligand fields to allow for unambiguous identification of lanthanide and actinide ions in solution, therefore aiding in the purification process of the recycling route.

NEUTRON INTERACTIONS IN GRETINA

Charlie Hultquist
Physical and Mathematical Sciences, Section 1
Presentation Number: 245
Mentor(s): Remco Zegers

The Gamma-Ray Energy Tracking In-Beam Nuclear Array (GRETINA) is a high-resolution γ-ray spectrometer produced at Lawrence Berkeley National Laboratory and used at a variety of laboratories, including the National Superconducting Cyclotron Laboratory. GRETINA consists of segmented germanium crystal detectors that are subject to high-energy neutron damage via the destruction of the crystal lattice structure. Recently, GRETINA was used in a (t, 3He + γ) probe of the 86Kr nucleus, where a triton beam was accelerated towards Krypton gas cell, contained within two Kapton foils (C22H10N2O5). t(p, n) 3He events from interactions with Hydrogen in the Kapton foil were isolated to study the interactions of neutrons in GRETINA. As the neutron direction and energy are known on an event-by-event basis, this study allows for the clean characterization of neutron-induced reactions in GRETINA. Neutron-induced peaks and other phenomena were identified in the measured spectra from neutron-γ events in the Germanium crystals. These experimental results are compared to Geant4 simulations to study the efficacy of simulations to replicate neutron interactions in GRETINA. Improved understanding of such interactions will allow for better prediction of neutron background and damage in future GRETINA and GRETA experiments.

HOW THE FORMATION OF MONOLAYER FILMS ON SURFACES IMPACTS THEIR CHARACTERISTICS AND THE WAY THEY ARE STUDIED

Shannon Cartwright
Physical and Mathematical Sciences, Section 1
Presentation Number: 246
Mentor(s): Gary Blanchard

The formation of a single molecular layer to a surface can change surface properties for applications in chemical sensing, separations, and heterogeneous catalysis, for example. This project is focused on reviewing the literature to learn how creating monolayer films, such as Langmuir-Blodgett films, under selected conditions can produce films with unique properties. An important factor is understanding how to study these changes based on the composition of the films being studied. Certain characterization techniques will work better than others. Information found in previous experiments will be insightful as to what procedures will work best depending on the type of film and the characteristics being studied. Looking specifically at the monolayer's organization and binding on the surface will provide information that is needed to evaluate the utility of these films for their intended purposes. Purposely changing specific conditions under which these films were formed, such as the pH, can result in significant structural and mechanical changes in the films. Observing these differences can help to better understand how the process of building these films impacts their final form. Researching previous literature and studies where these things are discussed will be helpful when it comes to designing and carrying out the successful formation of new films.

GRAPH SCATTERING TRANSFORMS

Mason Nakamura*, Sam Smith*, Rebecca Gjini*, Emily Thompson*
Physical and Mathematical Sciences, Section 2
Presentation Number: 247
Mentor(s): Michael Perlmutter, Nathan Brugnone, Sarah McGuire

In the recent history of machine learning, deep, multilayered networks have been shown to outperform traditional models. In particular, Convolutional Neural Networks (CNNs) attain state of the art performance in many machine learning tasks such as image classification. The scattering transform is a mathematical model of these CNNs which allows the use of predefined wavelet filters. We apply the scattering transform to graph-structured data motivated by classification tasks. The scattering transform produces a sequence of coefficients at each layer of the network which can be used to classify different classes of graph data. Specifically, we implement the scattering transform to classify different models of random graphs. We also reproduce and improve upon the results of Gao, Wolf, & Hirn (2019) on social network data. In addition, we explore the use of principal component analysis, applied to the scattering coefficients, as a dimensionality-reduction and visualization tool. Finally, we use Numba, a high-performance compiler, to improve the running time of our implementation.

DATA ANALYSIS TECHNIQUES FOR SCANNING MAJORANA MICROSCOPE

Kaedon Cleland-Host
Physical and Mathematical Sciences, Section 2
Presentation Number: 248
Mentor(s): Stuart Tessmer, Eric Goodwin, Michael Gottschalk

Majorana fermions are being studied as a potential qubit for a next-generation quantum computer. Properties of the Majorana fermion make it less susceptible to certain types of noise that the current leading quantum computing platform suffers from. The Scanning Majorana Microscope is a novel technique developed to verify the existence of Majorana fermions. The microscope uses a sensitive charge-sensing circuit to count individual electrons entering a metallic quantum dot on the tip of a glass scanning probe. Due to a small signal level on the

scale of attofarads (10^-18 F), up to two thousand curves are required for analysis. In the past, the process of data intake and analysis required a lot of manual work to average large sections of curves together. Additionally, it required methods to qualitatively eliminate curves that are statistically significant outliers and draw time-dependent correlations. This project uses Python and C optimized libraries to quickly process and analyze this data in a faster and more quantitative way. Due to the way this data is collected, even and odd-numbered columns need to be separated and shifted before averaging the curves together. This project aims to produce tools that can be used to analyze data produced by this microscope. Once a capacitance peak is isolated from the averages, indicating a single electron entering the quantum dot, Python code is used to fit the peak against a theoretical model. Tools and methods to efficiently process and analyze this data will be presented in this poster.

DESIGN STUDIES FOR A BEAM CONTAMINATION MONITOR

Sean Dziubinski
Physical and Mathematical Sciences, Section 2
Presentation Number: 249
Mentor(s): Steven Lidia

FRIB is going to be a world-class heavy ion linear accelerator and will be at the forefront of discovering new isotopes as well as expanding many fields in the nuclear sciences. However, the high intensity drive beam can damage accelerator components very quickly. To safely operate the machine, beam losses must be kept to a minimum, and part of this is knowing the beam composition. A beam contamination monitor will identify ions in the beam as well as the percentage of each ion species. A typical ion beam at FRIB may consist of one or two charge states of the same ion but could contain a small amount of contaminant ions that are accelerated through the first linac up to the charge stripper. The front end of FRIB selects a charge state of the ion being produced, which has a specific mass-to-charge ratio. The RF cavities and magnets transporting the beam are tuned to a specific or band of mass-to-charge ratios. However, some ions can have the same ratio even when they are not the same element. The undesired ion is contamination, and after the charge stripper the contaminants won't have the same mass-to- charge as the primary ion. The contaminant ions are no longer transported with the primary beam and can then deposit their energy into the beam line, possibly inducing damage. The goal is to eliminate or minimize this energy loss into the beam line, by first quantifying the amount of contaminant ions in the beam.

APPLICATIONS OF RECURRENT NEURAL NETWORKS TO THE ICECUBE-UPGRADE

Brandon Pries
Physical and Mathematical Sciences, Section 2
Presentation Number: 250
Mentor(s): Jessie Micallef, Brian Clark, Claudio Kopper

Neutrinos are some of the most abundant particles in the universe, but also one of the most elusive as their low mass and lack of charge makes them extremely difficult to detect. One instrument being used to study neutrinos is the IceCube South Pole Neutrino Observatory, which currently consists of 5,160 Digital Optical Modules (DOMs) situated on 86 strings over 1.5 km in the depths of the Antarctic ice. The DOMs detect light from neutrino interactions with the ice, recording the time and charge of every signal, called a hit, the DOMs detect. We then use this information to reconstruct properties of the neutrino such as energy and direction. Reconstructing neutrino events is especially difficult at lower energies (between 1-100 GeV) due to the inherent lack of light produced during interactions. One promising new way to reconstruct these events is with neural networks, specifically Recurrent Neural Networks (RNNs). RNNs excel at handling data with a sequential relationship such as time, which makes them a great candidate for event reconstruction. This study highlights some of the preliminary results of applying an RNN to time series data from current detector simulations and

simulations handling the future IceCube- Upgrade — an additional 7 strings (each with 100 new DOMs) to the central area of the detector known as DeepCore.

DATA REDUCTION FOR NEURAL NET RECONSTRUCTION OF NEUTRINOS IN ICECUBE

Emma Hettinger
Physical and Mathematical Sciences, Section 2
Presentation Number: 251
Mentor(s): Jessie Micallef, Claudio Kopper, Brian Clark

The IceCube Neutrino Observatory is a particle detector built into a cubic kilometer of natural Antarctic glacier, located deep beneath the South Pole. It searches for interactions of a nearly massless subatomic particle called the neutrino. The detector consists of a 3D array of 5160 digital optical modules (DOMs) which detect light from relativistic charged particles resulting from neutrino interactions in the ice. The center of the detector, DeepCore, contains a more densely packed region of DOMs, which is optimized for detecting low energy neutrinos. This recorded light signal is used to reconstruct information about the neutrino, like its energy and the direction it came from. One effective method of reconstruction is using a convolutional neural network (CNN). "FLERCNN" (Fast Low Energy Reconstruction CNN) is such a neural network created by J. Micallef which is designed to reconstruct neutrinos with energies from 5 to 100 GeV by using only detectors near the DeepCore sub-detector. My project is to increase the accuracy of FLERCNN by combining information from optical modules located further away from DeepCore so that the network can use the additional information without running into memory and training time limitations. In this presentation I will explain how that was done and the impact it had on training the neural net.

CONTRIBUTION OF ELECTRON-CAPTURES ON THERMALLY EXCITED NUCLEI

Jeremy Rebenstock, Jason-Michael Gabler
Physical and Mathematical Sciences, Section 2
Presentation Number: 252
Mentor(s): Remco Zegers

Nuclear reactions inside massive stars play an important role in their demise as core-collapse supernovae. Electron-captures on nuclei inside the star are particularly important as, during the collapse of the core of the star, they reduce the pressure of the degenerate electron gas in the star and lead to the emission of neutrinos that can escape and carry away energy from the star. Significant questions arise when considering electron captures inside stars: "How does the rate of electron capture reactions depend on the stellar density and pressure?" And "How can one effectively model electron capture reactions for the thousands of nuclei that play a role?" In the present work we address the two aforementioned questions by combining state-of-the-art nuclear structure calculations (using the nuclear shell-model code NuShellX) necessary to estimate the electron-capture rates with electron- capture calculations that account for temperature and density dependence. In particular, the contribution from electron-captures on thermally excited nuclei is presented. This material was based on work supported by the National Science Foundation under Grants No. PHY-1430152 (JINA Center for the Evolution of the Elements), and No. PHY-1913554.

AN ELECTROCHEMICAL INVESTIGATION OF DINITROBENZENE DERIVATIVES AND THEIR POTENTIAL APPLICATIONS IN NONAQUEOUS ORGANIC REDOX FLOW BATTERIES

Isaac Spackman*
Physical and Mathematical Sciences, Section 2
Presentation Number: 253
Mentor(s): Thomas Guarr

Renewable energy sources have many environmental benefits, though intermittent power generation can be a significant barrier to grid-scale application. Redox flow batteries (RFBs) are an emerging technology with the potential to support increased grid-scale application of renewable energy sources through load leveling during periods of low power generation. A main advantage of a RFB is the ability to decouple energy storage from power generation, enabling more flexible energy storage solutions. Organic RFBs may offer a lower cost, more sustainable alternative to current aqueous flow battery technologies, owing to the accessibility of higher cell voltages. Among the remaining issues in organic RFB development are the choice of solvent/electrolyte, solubility of the active materials, and the stability of anolyte and catholyte. While acetonitrile is a common solvent for lab-scale organic electrochemical reactions, its flash point is too low and its toxicity is too high for practical large-scale industrial applications. On the other hand, propylene carbonate (PC) is much less hazardous and less volatile, retains excellent electrochemical properties, and is a good candidate for grid storage applications.The electrochemical behavior of dinitrobenzene derivatives (DNBs) has been primarily studied in acetonitrile, with few reports of their electrochemical properties in PC. DNBs are generally soluble in PC, and have been shown to exhibit reversible electron transfer, making them good candidates for anolytes in a flow battery system. We report herein a study of the electrochemical behavior of several DNBs in PC, in addition to spectroelectrochemical measurements of radical anion stability.

PREPARATION OF A COVALENTLY LINKED ANOLYTE-CATHOLYTE SYSTEM FOR USE IN SYMMETRIC NONAQUEOUS REDOX FLOW BATTERIES

Isabella Purosky*
Physical and Mathematical Sciences, Section 2
Presentation Number: 254
Mentor(s): Thomas Guarr

The transition toward renewable energy resources from fossil fuels has increased the demand for different ways to store renewable energy. Since energy demand does not often align with energy production when using renewable sources, a mechanism for storing energy to be used when energy consumption is higher than production is required. Redox flow batteries offer a potential solution to this problem by creating a means of inexpensive and reliable energy storage. Redox flow batteries typically contain two different compounds such as: an anolyte and a catholyte, along with a membrane separating the anodic and cathodic cell compartments. Although the membrane itself is often the most expensive component of the flow battery, its performance characteristics are far from ideal. Crossover of active materials through the membrane leads to reduced efficiency and loss of battery capacity. To solve some of these problems, a linked donor-acceptor system can act as both the anolyte and catholyte, reducing crossover, and indeed even the need for an ion-selective membrane all together. This experiment was conducted to synthesize, purify, and test a multifunctional organic compound containing both electron donor and acceptor capabilities that is able to undergo ambipolar electron transfer within redox flow batteries. Thin layer chromatography (TLC) was used to track the progress of the reaction and purity. Silica plug chromatography was used for further purification. Various methods of recrystallization and metatheses were investigated in order to increase the purity of samples. Products were characterized by nuclear magnetic resonance (NMR), thin layer chromatography (TLC), and electrochemistry.

CALIBRATING THE SINGLE ATOM MICROSCOPE WITH THE FLUORESCENCE OF INDIVIDUAL IONS

Joseph Noonan
Physical and Mathematical Sciences, Section 3
Presentation Number: 255
Mentor(s): Jaideep Singh

The slow neutron capture process (s-process) that occurs inside stars is the source of many familiar elements like phosphorous and copper that make up our bodies and our technology. However, the s- process occurs much more slowly than other nuclear processes that form heavy elements, like the rapid neutron capture process. The Single Atom Microscope (SAM) is designed to be sensitive enough to detect individual magnesium ions, the products of the slowest step in the s-process, using the light that they give off by fluorescence after being embedded in a krypton sheet. However, it needs to be calibrated with the amount of fluorescence produced by a single ion. To do this, the number of ions embedded in the sheet by an ion beam had to be determined. This was determined by measuring the current of the beam and integrating over time to find the total charge, which could be converted into the number of ions. The beam current was measured by a Faraday cup, but it couldn't be kept in the beam for the entire time, or it would block the beam, so an aperture was used to approximate the beam current by examining how aperture data was correlated with Faraday cup data. The uncertainty and a confidence interval for the number of ions deposited were also calculated. This data can be combined with the total fluorescence given off by the embedded ions to determine the number of photons per ion.

NAVIGATING COMPUTATIONAL THINKING FRAMEWORKS FOR INTRODUCTORY PHYSICS COURSES

Theo Bott
Physical and Mathematical Sciences, Section 3
Presentation Number: 256
Mentor(s): Daniel Weller, Paul Irving, Danny Caballero

Within the last 15 years, computational thinking (CT) has emerged as a focal point of K-12 education. A plethora of studies have outlined the practices involved when students and teachers engage in CT, and these works discuss the topic for a variety of disciplines, academic levels, and research purposes. In this work, we present our process of navigating the field of existing CT practices. We have established a framework that is specific to the computationally-integrated high school physics context, where students use minimally working code to construct models of physical phenomena. From a total of nine previous scholarly works, we have identified fourteen CT practices that are applicable to the introductory physics classroom. This work will provide a foundation for exploring high school students' perceptions of computational thinking.

TOPOLOGY AWARE METHODS FOR POINT SOURCE SEARCHES IN NEUTRINO ASTRONOMY

Nathan Willey
Physical and Mathematical Sciences, Section 3
Presentation Number: 257
Mentor(s): Robert Halliday, Tyce DeYoung

Neutrino observatories such as IceCube and ANTARES detect two topologies of neutrino interactions, tracks and cascades. Neutrino astronomy favors tracks due to their strong pointing resolution and signal density. However, in spite of their large angular uncertainties, Cascades are more likely to come from astronomical events rather than atmospheric interactions. Here, we develop new methods that asymmetrically incorporate both track and cascade events into

astronomical searches. By modifying the signal and background functions of a standard point-source likelihood, we are able to increase and potentially tune the sensitivity of the analysis. We demonstrate that the best amongst these new methods can achieve increases in source detection efficiency by at least 15% for a realistic number of both astrophysical source and atmospheric background neutrinos in an ideal detector.

GUESSING GAMES

Nicholas Layman*
Physical and Mathematical Sciences, Section 3
Presentation Number: 258
Mentor(s): David Clark*

A guessing game is a game played between a questioner and a responder. The responder first chooses two distinct numbers from an agreed upon, finite set N. The questioner then asks questions of the form "How many of your chosen numbers are in the set S⊆N?" to which the responder answers truthfully. The goal for the questioner is to determine the responder's two numbers in as few questions as possible. In our research we introduce and examine strategies for the questioner and their relative efficiencies, advantages, and disadvantages using a geometric approach.

A NEW CANDIDATE TRANSITIONAL MILLISECOND PULSAR: 4FGL J0407.7-5702

Jessie Miller
Physical and Mathematical Sciences, Section 3
Presentation Number: 259
Mentor(s): Samuel Swihart, Jay Strader

Transitional millisecond pulsars (MSPs) are the long sought after evolutionary link between low-mass X- ray binaries (LMXB) and rotation-powered radio millisecond pulsars. These unique objects alternate between one of two states: the LMXB state and the rotation-powered MSP phase. In the LMXB state, an accretion disk enshrouds the neutron star primary, quenching any outgoing pulsed radio emission. During the rotation-powered MSP state, the accretion disk dissipates and the source becomes observable as a radio MSP. Transitional MSPs are still relatively understudied; to date, there are only three confirmed transitional MSPs and merely a handful of transitional MSP candidates. Using gamma- ray data from the Fermi-Large Area Telescope, X-ray data from the Swift Observatory and XMM-Newton telescope, and optical data from the Southern Astrophysical Research Telescope and Gemini Observatory, our research group has identified a new candidate transitional MSP. These multiwavelength follow-up techniques, pioneered by our team, have not only led to the identification of this promising transitional MSP candidate, but also numerous candidate accreting and non-accreting millisecond pulsar binaries. With persistent follow-up analysis, we hope to continue to increase the population of confirmed and candidate transitional MSPs.

LANTHANIDE DATABASE FOR ABUNDANCES IN NEUTRON STAR MERGERS

Pranav Nalamwar
Physical and Mathematical Sciences, Section 3
Presentation Number: 260
Mentor(s): Jaideep Singh, Luke Roberts

Kilonovae are optical transients associated with neutron star mergers (NSMs) and are powered by the radioactive decay of heavy elements created by the rapid neutron capture process (r-process). It is important to note the blue and red emission component from the kilonovae, along with their timescales, are greatly dependent on the abundance of the lanthanides and their various charge states in the merger material. To analyze these mergers and their abundances, we study the event through an Atomic Physics lens. In particular, we investigate how varying

atomic data inputs affect the total abundance of these unique elements. To do this, we use elemental abundances calculated by Skynet, a nuclear reaction network code, and uncover how distinct isotopes evolve over time due to variables such as temperature and electron fraction. Using these calculated elemental abundances, the Saha equation, and NIST ionization data we predict the ionization state populations of lanthanides on timescales similar to the expected time of the kilonova peak. Our report details how a multi-element merger material evolves over time. This work is supported by Michigan State University (MSU), the Honors College of MSU, and the Joint Institute of Nuclear Astrophysics.

INFLUENCE OF ELECTRON CAPTURE RATES ON CORE-COLLAPSE SUPERNOVAE

Sheldon Wasik
Physical and Mathematical Sciences, Section 3
Presentation Number: 261
Mentor(s): Sean Couch

Supernovae are large stars that undergo an explosion at the end of their life. The nuclear process that drive these explosions are complex but can be modeled by todays supercomputers. Of the two types of supernovae, a core collapse is a large star that collapses due to gravity, and then proceeds to explode outward. An important factor that helps drive this explosion is electron capture. Electron capture is a process in which a proton rich nucleus of a neutral atom absorbs an inner electron. The result of this is a neutron and a neutrino, resulting in pressure changes of the surrounding area. In the past, supernova simulations have used approximated electron capture rates for ranges of nuclei. However, in recent studies it has been shown that the simulations are most sensitive to electron capture around nuclei with a neutron number, N, of 50. Therefore, electron capture rates around this region were found in the lab and are shown to be much less than those that are approximated. We used these rates from the lab to produce a neutrino opacity table to compare to the previous one. With STIR (Supernova Turbulence in Reduced dimensionality), we ran a 1-Dimensional simulation of a core collapse supernova for a wide range of progenitors for both the approximated and true electron capture rates while holding every other variable the same. This allows us to show how electron capture around the N=50 region affects a core collapse supernova.

PSYCHOLOGY

MOVEMENT VIGOR IN INDIVIDUALS WITH SCHIZOPHRENIA

Zeeba Ali
Psychology, Section 1
Presentation Number: 265
Mentor(s): Katharine Thakkar

Negative symptoms of schizophrenia like flat affect and loss of pleasure and motivation impact one's ability to form relationships and function in everyday society. The specific underlying mechanisms are unknown, posing an obstacle for treatment development. Negative symptoms are proposed to reflect a core abnormality in reward processing- specifically, a failure to allocate effort to obtain rewards. Although this deficit has been shown in experimental settings, it is unclear whether it reflects a true reward processing deficit, or a more generalized cognitive deficit, meaning a problem in assigning value to a reward. Another angle for studying reward processing is to look at basic movement parameters— we move more vigorously the more we want a reward. Movement vigor is related to dopaminergic activity and the neural circuitry underlying the vigor of saccadic eye movements and has been outlined in non-human primates. Thus, measuring saccade vigor specifically may provide a precise, quantitative measure of motivated behavior that can be interpreted at the level of physiology and is relatively immune to confounds related to general cognitive functioning. We hypothesized reduced saccade vigor

in patients with schizophrenia, particularly those with severe negative symptoms. To investigate this idea, we measured peak velocities and saccade amplitudes of patients and healthy controls during a task where subjects made rapid saccades to visual stimuli. Consistent with our hypothesis, we observed reduced peak velocity, but not saccade amplitude, in patients with schizophrenia. However, no relationship with negative symptoms emerged. These findings may provide insights into mechanisms of schizophrenia.

DIFFERENCES IN ACCESS TO MENTAL HEALTH SERVICES FOR CAUCASIAN AND ARAB AMERICAN ADOLESCENTS IN SOUTHWEST MICHIGAN

Karren Shaalini Gunalan*
Psychology, Section 1
Presentation Number: 266
Mentor(s): Amy Damashek*

Many American minorities suffer from mental health conditions. Despite the mental health challenges that minorities face, past studies have found racial bias in access to mental health services. For example, previous research has found that African American adults receive less messages prompting services from mental health care providers when compared to Caucasian help-seeking adults with similar presenting problems. However, there is a lack of research on provider bias for other minorities. After September 11th, an increase in psychological distress and depression were reported among Arab Americans, suggesting that Arab Americans may be in need of mental health services. However, there is a lack of research on whether provider bias affects access to services for Arab American individuals. The present study examined whether mental health service providers responded differently to hypothetical callers who differed by ethnicity (i.e., Caucasian and Arab American) in Southwest Michigan. Calls to providers (N = 120) were placed after hours and voice recordings portraying a hypothetical Caucasian or Arab American mother seeking services for their hypothetical adolescent child were left on providers' voicemails. The hypothetical Caucasian clients received significantly more voicemails promoting psychological services than the hypothetical Arab American clients. These findings suggest that provider bias may be a barrier to accessing mental health services for Arab Americans in Southwest Michigan.

DIFFERENCES IN ACCESS TO MENTAL HEALTH SERVICES FOR CAUCASIAN AND AFRICAN AMERICAN ADOLESCENTS IN SOUTHWEST MICHIGAN

Kailyn Alderman*
Psychology, Section 1
Presentation Number: 267
Mentor(s): Amy Damashek*

The prevalence of mental health conditions for adolescents continues to increase in the United States. Past research has found that minorities are affected by mental health conditions more frequently and with more severity than are non-minorities. Mental health provider bias has also been found to hinder the accessibility to mental health services for African American adults in recent research; however, less is known about whether provider bias affects access to services for African American adolescents. The present study examined the effects of race on providers' responses to hypothetical parents who were seeking mental health services for their adolescent child. Voice actors portraying a Caucasian and African American mother were hired to record two nearly identical voice messages, varying only in the perceived race and names of the hypothetical clients. Mental health providers (N = 120) received phone calls after business hours, and the recording was left as a voicemail. Callback rates were recorded for each condition and voicemails were coded based on whether the provider promoted or denied services. Overall, the Caucasian condition received significantly more callbacks and messages prompting services from mental health providers than the African American condition. The findings of this study

suggest that African American adolescents experience differential access to mental health care than Caucasian adolescent counterparts in Southwest Michigan.

ABNORMAL PUPIL LIGHT REFLEX RELATES TO NEGATIVE SYMPTOM SEVERITY IN SCHIZOPHRENIA

Jessica Fattal
Psychology, Section 1
Presentation Number: 268
Mentor(s): Katharine Thakkar

The psychophysiology of the negative symptoms of schizophrenia has been largely misunderstood due to the inaccessibility of the underlying circuitry, however more recent studies have found pupillary changes useful as an indicator of cholinergic and noradrenergic activity, granting an opportunity to observe these mechanisms noninvasively. Individuals with schizophrenia have shown reduced pupillary dilation during cognitively demanding tasks, which is related to anhedonia and therefore has been interpreted as reflecting inappropriate effort allocation and reduced informational processing capabilities. Older studies have shown abnormalities in the pupil light reflex in individuals with schizophrenia; however is it unknown whether these abnormalities are related to negative symptoms. We sought to explore this in the current study. To conduct this experiment, we used a hand-held pupillometer to measure pupillary diameter over a five second window during which light was flashed for one second in participants with schizophrenia (SZP) and in demographically matched healthy controls (HC). Dynamics of pupil constriction and subsequent dilation were compared between groups and correlated with scores on the Scale for the Assessment of Positive Symptoms (SAPS), the subscales of the Scale for the Assessment of Negative Symptoms (SANS), a measure of depression and anxiety, and working memory. SZP had altered pupillary light reactions compared to HC, and these reactions were significantly correlated with negative symptoms and working memory. Given that pupil dynamics may provide a window into neuromodulatory function, these findings may shed light on the mechanisms of clinical symptoms, with implications for treatment development.

ASSOCIATIONS BETWEEN ESTRADIOL LEVELS, PHYSICAL DEVELOPMENT, AND DISORDERED EATING SYMPTOMS DURING PUBERTY IN GIRLS

Shruthi Ilango
Psychology, Section 1
Presentation Number: 269
Mentor(s): Natasha Fowler, Kelly Klump

Disordered eating (DE) symptoms (e.g., body dissatisfaction) are rare pre-puberty but markedly increase across pubertal development in girls. Past research has focused primarily on psychosocial contributors to this pubertal emergence, including the physical changes of puberty (e.g., increases in adiposity) and their impact on body dissatisfaction and mood. Hormones that are activated during puberty in girls (e.g., estrogen) may also play a role in increased DE risk. This study examined the independent and interactive effects of physical and hormonal changes of puberty on risk for DE in 998 girls (aged 8-16 years) from the Michigan State University Twin Registry. Participants completed one-time assessments of pubertal development (assessed via the Pubertal Development Scale), total DE score, binge eating, body dissatisfaction, weight preoccupation (assessed via the Minnesota Eating Behavior Survey), and salivary estradiol levels. Mixed linear models main and interactive effects of estradiol, pubertal development, and their interaction on DE symptoms. As expected, the physical changes of puberty were significantly and positively associated with all DE symptoms, while estradiol levels were only significantly associated with body dissatisfaction. There were no significant interactions between the physical changes of puberty and estradiol levels for any DE symptom; however, trend-level interactions were observed for body dissatisfaction. Overall, these findings

suggest that estrogen may have differential effects on cognitive versus behavioral symptoms of DE in girls during puberty.

LISTENERS WITHIN THE SAME CULTURE CAN MATCH SHARED STORIES GENERATED IN RESPONSE TO MUSICAL EXCERPTS

Jewelian Fairchild, Gabby Kindig, Anusha Mamidipaka
Psychology, Section 2
Presentation Number: 270
Mentor(s): J. Devin McAuley

A recent study compared stories that listeners from the US and a remote village in China imagined in response to wordless Western and Chinese music (Margulis, Wong, Simchy-Gross & McAuley, 2019). Imagined stories for each musical excerpt demonstrated a within-culture similarity, often containing common underlying themes, and a between-culture divergence, differing in theme and subject matter. This tendency to have culturally-specific narrative responses to music can be attributed to enculturation, an individual's gradual adaptation to cultural characteristics through exposure. The present study investigates whether people can correctly match consensus stories, which were generated previously in the Margulis et al. study, with the musical excerpt that generated the response. Listeners in the US and a remote village in China heard a subset of Western and Chinese musical excerpts that generated the most similar content across US participants. For each excerpt, listeners were then presented with two stories. One story was the 'correct' story (imagined by a participant in response to the excerpt) and the other was a foil (one of the 'correct' stories imagined in response to a different excerpt). Remarkably, participants from the US correctly matched the stories to both types of excerpts with over 90% accuracy. However, participants from the village in China who had little to no exposure to Western culture performed the task at only 50% accuracy. Overall, certain excerpts seem to communicate specific stories to listeners within a culture, but not across cultures, providing further evidence of the role of enculturation in narrative perceptions of music.

A REVIEW OF CHILDHOOD EMOTIONAL ABUSE: WHAT IT IS AND HOW IT AFFECTS SURVIVORS

Emily Tersigni*
Psychology, Section 2
Presentation Number: 271
Mentor(s): Kathryn Hughesdon*

Sections used for this oral presentation are taken from the literature review of the author's Senior thesis project. This presentation will use be using literature from 2009 to 2019 that was found through a database search of keywords. This oral presentation will go over the criteria for diagnosing emotional abuse during childhood, as well as the mental health and psychosocial effects of emotional child abuse. A comparison of emotional abuse to the effects of sexual and physical abuse on children will also be presented.

#METOO: FAIRNESS IN WORKPLACE INVESTIGATIONS OF HARASSMENT

Addie Nelson
Psychology, Section 2
Presentation Number: 272
Mentor(s): Danielle Gardner, Ann Ryan

Due to the widespread prominence of the #MeToo and Time's Up movements, sexual harassment has become a popular topic among the public. However, the degree to which sexual harassment is systematically and effectively investigated within organizations has received much less attention. For this reason, the present study intends to shed light on workplace

investigations of sexual harassment, through the examination of various aspects that may inform whether investigations are perceived as fair in nature. To investigate this notion, we will conduct a 2 (Investigation focus: confidentiality vs. transparency) X 3 (Investigation role: complaining party vs. responding party vs. witness) between- subjects factorial design to understand how these factors relate to three justice perceptions: informational justice, procedural justice, and interpersonal justice. A sample of 300 adults employed at least part-time will be recruited from Amazon's Mechanical Turk system to complete our online scenario study. Specifically, participants will be instructed to imagine themselves within a workplace sexual harassment investigation as described within a provided scenario; however, the content of the presented scenario will differ depending on the participants' experimental condition. We hypothesize that justice perceptions will differ depending on investigation focus and participants' imagined role within the investigation. The results of this study will give insight as to how people are experiencing sexual harassment investigations in the workplace and what they value in these investigations.

EMOTION REGULATION IN CHILDREN WITH AUTISM SPECTRUM DISORDER: INVESTIGATING OUTCOMES USING A THIN SLICE APPROACH

Claire Henderson
Psychology, Section 2
Presentation Number: 273
Mentor(s): Kristin Rispoli

Children with Autism Spectrum Disorder often have a difficult time regulating their emotions, and parents are ideal intervention agents to support their acquisition of emotion regulation skills. This project will examine changes in parents' support for children's emotion regulation, and children's regulatory skills following participation in the Regulation of Emotional Lability in Autism through Caregiver Supports (RELACS) intervention program. Outcomes were measured using brief, "thin slice" ratings from 37 untrained observers who viewed 2-minute video segments of parents and children interacting in play-based activities. Results will provide additional evidence for the potential efficacy of RELACS when implemented by parents of young children with Autism Spectrum Disorder and information about the reliability and validity of thin slice ratings. In order to further assist children with Autism Spectrum Disorder in regulating their emotions, it is imperative to understand if this intervention is beneficial.

WHY DO I REMEMBER THAT? SLEEP STRENGTHENS MEMORIES FOR INFORMATION THAT WAS NOT INTENTIONALLY REMEMBERED

Erin Sawyer, Kaylie Williams, Abdulrahman Alharthi
Psychology, Section 2
Presentation Number: 274
Mentor(s): Kimberly Fenn, Elle Wernette

Humans encounter an enormous amount of information each day; some is actively remembered whereas some is remembered unintentionally. Previously, we found that sleep consolidated incidentally encoded memories, or unintentionally remembered memories, and that consolidation may depend on memory strength. Here, we investigated the effect of sleep on strong and weak memories after incidental encoding. In Experiment 1, participants completed either a deep or shallow encoding task in which they rated words on abstractness (deep), or number of vowels (shallow) either one or three times. They also completed a surprise recognition memory test after a 12-hour retention interval composed of wake or sleep. Wake participants completed the encoding task in the morning and the test in the evening; Sleep participants completed encoding at night and the test the following morning. We found a main effect of condition such that Sleep participants had better memory for words than Wake, following only deep encoding, regardless of the number of encoding trials (one or three). In Experiment 2, all participants encoded words in the evening, received an 8-hour sleep

opportunity with partial polysomnography to objectively assess sleep, and completed the test in the morning. This experiment is ongoing, but we predict there will be a positive correlation between the amount of time participants spend in SWS and memory performance for words encoded both one and three times. This work has implications for study strategies for college students and suggest that balancing sleep with study time may optimize performance.

POSITIVE AND NEGATIVE FACE THREAT/SUPPORT REGARDING INTERPERSONAL ROMANTIC RELATIONSHIPS AND FITNESS

Johnny McGraw
Category & Time: Psychology, Section 2
Presentation Number: 275
Mentor(s): Elizabeth Dorrance Hall

Negative Face – the basic claim to territories, personal preserves, rights to non-distraction, "I.e. freedom to action and freedom from imposition." Positive Face: "positive consistent self-image or personality (the desire that this self-image be appreciated and approved of)" We are going through and coding interactions between partners in order to find patterns and new information regarding positive and negative face threat and support when dealing with discussions revolving around physical fitness.

TOXICOLOGY / PHARMACOLOGY

TRICHLOROETHYLENE MODULATES HEPATIC AND BLOOD GENE EXPRESSION IN EXPERIMENTAL PRIMARY BILIARY CHOLANGITIS

Bryson Satterwhite*
Toxicology / Pharmacology, Section 1
Presentation Number: 278
Mentor(s): James Luyendyk

Human exposure to Trichloroethylene (TCE) is linked to the development of hepatic autoimmune disease. Surprisingly, in studies seeking to define the TCE mode of action, TCE displayed unanticipated therapeutic action. Specifically, TCE treatment reduced hepatic injury and inflammation in dnTGFBRII mice, which develop hepatic autoimmunity resembling Primary Biliary Cholangitis (PBC). We sought to identify transcriptomic signatures (Illumina RNA sequencing) driven by development of PBC-like autoimmunity in dnTGFBRII mice, in both blood and liver, and tested the hypothesis that TCE treatment altered the expression of active genes. Female 8-week old Wild type and dnTGFBRII mice were treated with TCE (0.5mg/ml) or vehicle (1% ethoxylated castor oil) for 12 or 22 weeks. Active genes were identified statistically and as those genes with $\geq$ a 1.5 fold increase or $\leq$ 0.6 fold reduction for specific comparisons. In dnTGFBRII mice treated with vehicle, 1,572 genes were differentials expressed in the blood and 1,167 in the liver. Among these genes, 113 genes in blood were affected by concurrent TCE exposure, and 55 were affected in the liver. Although a surprisingly small fraction of genes were altered by TCE, induction of genes encoding select chemokine-chemokine receptor pairs was inhibited by TCE exposure. The results indicate that TCE inhibits the induction of specific genes associated with development of experimental PBC. The results suggest potential mechanisms whereby TCE may inhibit development of liver pathology in experimental PBC.

INVESTIGATING THE VASCULAR EFFECTS OF CLOPIDOGREL: A REVIEW OF CURRENT LITERATURE

Dejah Wakefield
Toxicology / Pharmacology, Section 1
Presentation Number: 279
Mentor(s): Adam Lauver, Dawn Kuszynski

Clopidogrel is an antiplatelet drug used to treat acute coronary syndromes (ACS). Clopidogrel, and other P2Y12 antagonists, work by inhibiting the P2Y12 receptor on the surface of platelets. Preventing the activation of P2Y12 decreases platelet aggregation, thereby preserving blood flow in patients at risk for heart attacks. Though effective at treating ACS, there are adverse side effects associated with clopidogrel. The most adverse effect is cerebral microbleeds. This effect cannot be explained by platelet P2Y12 inhibition as even in animals without the receptor, bleeding is prolonged with clopidogrel treatment. As the bleeding mechanism is not well understood, an in-depth look on the drug's impact on the vasculature, beyond platelet inhibition, must be evaluated. We hypothesize that clopidogrel has off- target effects on other purinergic receptors within the vasculature to impair vessel response to changes in pressure and blood flow. Furthermore, clopidogrel efficacy is reduced in patients suffering with type II diabetes (T2D). The metabolism of clopidogrel in patients with T2D was investigated to determine antiplatelet resistance. We hypothesize that patients with T2D have altered expression of cytochrome P450 enzymes, thereby affecting the metabolism of clopidogrel. To investigate these hypotheses, literature searches were performed by utilizing the PubMed database. The literature was assessed for information on clopidogrel's impact on vascular functioning, including possible interactions with other purinergic receptors, and clopidogrel's impact on the vasculature through modulating inflammation.
These searches were done with the goal of creating a targeted hypothesis that provides a mechanism for clopidogrel-induced cerebral microbleeds and clopidogrel resistance in T2D.

DIVERSITY AND UBIQUITY OF PSEUDOMONAS AERUGINOSA SPECIALIZED METABOLITES

Justin Williams*
Toxicology / Pharmacology, Section 1
Presentation Number: 280
Mentor(s): Robert Quinn

Over the course of the summer, I will be working with Dr. Robert Quinn on a project that is focused on the human gut and cystic fibrosis. Cystic fibrosis (CF) is an inherited disorder that causes severe damage to the lungs, digestive system, and other organs in the body. CF affects the cells that produce mucus, sweat, and digestive enzymes. Secondary infections of the lungs by pathogens such as Pseudomonas aeruginosa are a significant complication of cystic fibrosis. P. aeruginosa produces a number of small- molecule virulence factors, including phenazines, quinolones, rhamnolipid, and pyochelin, that contribute to CF lung disease. For this project, we will use tandem mass spectrometry and computational analysis to search for these compounds in public data. Tandem mass spectrometry is a common technique that produces spectral fingerprints (MS/MS spectra) of molecules based on their mass. In the public database GNPS, thousands of datasets are available, and millions and millions of MS/MS spectra that can be searched with an algorithm called MASST. We will search for all known quinolones, phenazines, rhamnolipids, and pyochelin to identify where these compounds are found in nature and describe their diversity and ubiquity in different sample types. A better understanding of which of these metabolites the bacterium produces will help us better understand the biology of P. aeruginosa infections in cystic fibrosis and develop MS/MS methods for their diagnosis.

EFFECT OF TAU ON NEURODEGENERATION IN C. ELEGANS

Manasi Desai
Toxicology / Pharmacology, Section 1
Presentation Number: 281
Mentor(s): Jamie Alan

Alzheimer's Disease (AD) is a disorder associated with memory loss and is characterized by the presence of tau tangles. Tau is a protein that binds and stabilizes microtubules and promotes axonal transport in healthy cells. However, when it becomes phosphorylated (p-tau), it aggregates with other tau proteins, resulting in neurodegeneration. AD is also characterized by a loss of acetylcholine (ACh), a neurotransmitter important in encoding new memories. To understand the role of phosphorylated tau in reduced ACh function, we will use the model organism C. elegans. This model organism has a short lifespan and is optically clear, allowing us to observe changes in the cholinergic neurons over the course of aging.We will compare the lifespan of C. elegans expressing GFP in their cholinergic neurons in worms expressing tau and p-tau. We will also assess healthspan by assessing cholinergic neurons function by assessing motor movement (thrashing). Finally, we will monitor cholinergic neuron structure and integrity over time. We found a decrease in the average number of neurons in the worms expressing tau, suggesting that tau is an important part of cholinergic dysfunction. Future work will entail monitoring worms expressing p-tau, and we hypothesize that cholinergic neurodegeneration will occur more rapidly in them.

BLOCKING FUNCTION OF 5-HT7 RECEPTOR IN ABDOMINAL VESSELS CAUSES VENOUS CONTRACTION

Kiera McRae
Toxicology / Pharmacology, Section 1
Presentation Number: 282
Mentor(s): Stephanie Watts

Vascular contraction controls total peripheral resistance, contributing to regulation of blood pressure. Two 5-hydroxytryptamine (5-HT or serotonin) receptors in rat blood vessels, 5-HT2A and 5- HT7, function in contraction of arteries and veins. A reverse transcription-polymerase chain reaction experiment was done to relatively measure mRNA levels for 5-HT2A and 5-HT7 receptors in male Sprague Dawley rat thoracic aorta (RA), thoracic vena cava (RVC), abdominal aorta (RabA), and abdominal vena cava (RabVC). Results showed higher concentrations of 5-HT2A than 5-HT7 mRNA in abdominal vessels (.743-fold change between RabA and RabVC), RabVC having a higher concentration of 5-HT7 mRNA (6.00-fold change between RabA and RabVC). It was hypothesized since 5-HT has higher affinity for the 5-HT7 than 5-HT2A receptor, blocking the 5-HT7 receptor would result in contraction of the RabVC by function of the 5-HT2A receptor. Isometric contraction to 5-HT, as compared to norepinephrine (NE), was measured in an isolated tissue bath. Maximal contraction to 5-HT increased in RabVC when exposed to 5-HT7 receptor antagonist SB269970 (% max contraction to NE: RabVC=41±6%, RabVC+SB269970=72±5%). SB269970 did not modify 5-HT-induced contraction in RabA.Thus, when the 5-HT7 receptor was blocked in RabVC, the vessel contracted more. The difference in mRNA expression in veins versus arteries translated to a functional difference between receptors: the 5-HT7 receptor masked contraction only in veins. This is important for the implication of selectively modifying venous function through the 5-HT7 receptor. Further experiments aim to block the 5-HT2A receptor for better understanding of how these receptors differ between arteries and veins.

THE ROLE OF HDAC9 INHIBITION IN CEREBRAL HYPOPERFUSION ASSOCIATED COGNITIVE DECLINE AND INFLAMMATION

Martina Yen
Toxicology / Pharmacology, Section 1
Presentation Number: 283
Mentor(s): Theresa Lansdell, Anne Dorrance

Vascular cognitive impairment and dementia (VCID) is the second most common type of dementia after Alzheimer's disease and is an important consequence of chronic cerebral hypoperfusion. Cerebral hypoperfusion is associated with impaired memory, decreased myelin intensity, and increased microglial activation in the area of myelin degradation. These changes are associated with the increased expression of the histone deacetylase 9 (HDAC9) gene, a key player in transcriptional regulation. We hypothesized that sodium valproate (VPA), an HDAC9 inhibitor, protects against microglial activation in the cortex caused by cerebral hypoperfusion. In this study, 16-week-old female Sprague Dawley rats were randomized into four treatment groups: sham-vehicle, sham-VPA, BCAS-vehicle, BCAS-VPA. To model cerebral hypoperfusion, rats underwent either a bilateral carotid artery stenosis (BCAS) or a sham surgery and were treated with either vehicle or VPA. Eight weeks following surgery a novel object recognition test was performed to assess non-spatial memory, and Iba1 immunohistochemistry was used to label and quantify microglia in the cortex and hippocampus. Novel object recognition indicated BCAS rats had impaired nonspatial memory ($p=0.0351$, $n=6$) and that VPA prevented memory impairment ($p=0.0137$, $n=6$). Preliminary data indicate a trend toward increased Iba1+ microglia in the cortex of BCAS rats compared to sham ($p=0.0520$ $n=4$), and treatment with VPA did not change the number of Iba1+ cells ($p= 0.8531$, $n=4$). These results suggest prevention of microglial associated inflammation is not important for maintenance of non-spatial memory following BCAS.

EXPLORING THE PHYSIOLOGICAL ROLES OF UNSATURATED FATTY ACIDS USING C. ELEGANS

Benjamin Kessler
Toxicology / Pharmacology, Section 1
Presentation Number: 284
Mentor(s): Kin Sing Lee, Jamie Alan

Monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs) play a crucial role in a diet, but it is unclear which specific unsaturated fatty acids are required and what the physiological consequences of having different amounts of these molecules and their metabolites in the body are. Specific omega-3 and omega-6 PUFAs have been shown to be beneficial to human diseases, such as cardiovascular disease, inflammatory conditions, and certain cognitive impairments. This study aims to investigate the physiological roles of individual MUFAs and PUFAs. From this study, we will gain the preliminary knowledge for making dietary and treatment suggestions for patients with various disease states and in normal aging. We will use the model organism C. elegans because of its short lifespan, abundance of available genetic tools, and reliable translation to human disease. Preliminary data suggests that specific MUFAs and PUFAs are essential for normal lifespan, physiological functions, and neurodevelopment. This study will expand on this by examining every available genetic knockout of fatty acid desaturase enzyme in the worm. We will conduct lifespan assays in order to observe changes in the median and maximum lifespans of different genetic knockouts compared to the wild type as well as thrashing assays, a measure of physical fitness. We hypothesize that certain unsaturated fatty acids play more important physiologic roles than others and the corresponding downstream metabolites are important lipid signaling molecules. Preliminary results from the lab confirm these hypotheses, as the genetic strains tested thus far show variations in lifespan and fitness.

POLYCYCLIC AROMATIC HYDROCARBON BENZO[A]PYRENE EXPOSURE EXACERBATES SKIN INFLAMMATORY PATHOPHYSIOLOGY IN A MOUSE PSORIATIC MODEL

Josh Klein
Toxicology / Pharmacology, Section 1
Presentation Number: 285
Mentor(s): Neera Tewari-Singh

A rapid increase in the global prevalence of skin inflammatory diseases like psoriasis is, in part, attributed to major ubiquitous environmental pollutants like polycyclic aromatic hydrocarbons (PAHs). Benzo[a]pyrene (BaP) is a major PAH generated mainly from cigarette smoke, wood-burning, automobile exhaust etc. To investigate the effect of BaP exposure on skin inflammation in a mouse psoriatic model, the dorsal skin of naïve C57BL/6 mice was shaved and exposed to 62.5mg of 5% imiquimod (IMQ) cream once daily for five days. To assess the effect of BaP exposure on psoriasis, mice were exposed 64µg BaP in 50µl acetone for five days before IMQ application or for five days together with the IMQ (BaP+IMQ) application. BaP exposure together with IMQ exacerbated psoriatic inflammatory symptoms in the skin sections including the skin bi-fold thickness, epidermal and dermal thickness, hyperkeratosis, dermal fibrosis, neutrophil infiltration, neutrophil degeneration and mast cell degranulation. We are currently analyzing the effect BaP on IMQ-induced alterations in neutrophil infiltration, macrophages, inflammatory cytokines and metabolites. There are suggestions that BaP- induced skin inflammation could be mediated by aryl hydrocarbon receptor (AhR), a xenobiotic sensor. To define the role of AhR in BaP-induced biomarkers of toxicity in psoriatic mouse skin, concomitant treatment with AhR antagonist CH-223191 was given before (BaP+IMQ) treatment. The antagonist treatment abrogated the BaP-caused increase in epidermal and dermal thickness. Its effect on other psoriatic parameters that are exacerbated on exposure to BaP are being analyzed to decipher the role of AhR in BaP-induced and/or exacerbation in skin inflammation.

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ADDENDUM

NAME	CHANGE	CATEGORY
Racheal Nassimbwa	Withdrew	Microbiology, Immunology, & Infectious Disease
Carissa Stockton	Late Addition	Heath Sciences

RELATIONSHOP BETWEEN MENTAL HEALTH AND DISABILITY IN FOOD INSECURE NEIGHBORHOODS

Carissa Stockton (University of Michigan – Flint)
Health Sciences, Section 1
Presentation Number: 175
Mentor(s): Woojong Kim (University of Michigan – Flint)

This study aims to examine the relationship between mental health disorders and disability in a neighborhood struggling with food insecurity. Flint, MI has recently faced a great deal of challenges from food insecurity, water safety, high crime rates, and poverty amongst others. This research looks at how all of these stressors have possibly impacted those with disabilities residing in these highly venerable neighborhoods.

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