

2022 University Research Symposium

Individual Abstracts - Afternoon Session

MUTATIONS IN LAMIN GENE AND HOW IT CAUSES MULTIPLE TISSUE-SPECIFIC DISORDERS

Presenter: Acquah, Bismark
Graduate, Biological Sciences
Mentor: Prof. Alysia Vrailas-Mortimer

Authorship: Bismark Acquah, Alysia Vrailas-Mortimer

Mutations in the LMNA gene result in at least 15 distinct disorders ranging from muscular dystrophies to neurological disorders to lipodystrophies. These disorders are collectively called laminopathies. Lamins are fibrous proteins in type V intermediate filaments, providing structural function and transcriptional regulation in the cell nucleus.

One outstanding question is how mutations in the Lamin genes result in such different disorders, as these proteins play a critical role in nuclear shape and are expressed in most cell types. Interestingly, mutant forms of lamin proteins aggregate, which may be toxic to the cells. Studies on the fruit fly *Drosophila melanogaster* has been instrumental in our understanding of lamin functions. Flies have two lamin genes, LamC and Lam Dm0, that evolved from a single ancestral gene and are homologous to both the LamA/C and LamB genes in humans. Many of the diseasecausing mutations in LMNA are conserved in both LamC and Lam Dm0. Furthermore, while LamC is not expressed in neurons, Lam Dm0 is expressed in both muscle and neurons suggesting that Lam Dm0 in muscles and neurons has both A- and B-type lamin activities.

Therefore, we hypothesize that certain tissues are susceptible to specific lamin mutations due to the inability of tissue specific quality control mechanisms to degrade those mutant forms, leading to protein aggregation and cellular toxicity. We have found that the p38Kb interacts with the CASA complex in flies to regulate the degradation of Lam Dm0. However, we will be testing if different lamin mutations aggregates in muscles and neurons.

APPLICATIONS OF [5+2] CYCLOADDITIONS TOWARD CLEAVABLE TETHERS

Presenter: Angles, Susanna
Undergraduate, Chemistry

Mentor: Prof. Andrew Mitchell

Authorship: Andy Mitchell, John Goodell

Oxidopyrylium-alkene based [5+2] cycloadditions are a convenient intramolecular method of synthesizing complex polycyclic and biologically relevant molecules. Moreover, these molecules can serve as key intermediates, providing a framework upon which additional functionality can be added. Recent unpublished work by the Mitchell group utilized silyloxypyrone substrates that yielded cycloadduct at room temperature. It was found that the presence of both electron withdrawing and electron donating groups on the alkene produced increased reactivity in comparison with the terminal olefin, and the mechanistic implications of altering the functional groups on the tethered alkene are being studied. Additionally, we are interested in the development of a tether which could be easily cleaved following cycloaddition, providing an indirect way to achieve net intermolecular [5+2] cycloadditions. Attempting an intermolecular route would likely result in a complex mixture of compounds due to issues with entropy, stereospecificity, and regioselectivity making the intramolecular variant an attractive alternative towards these cycloadducts.

ASSESSING THE SENSITIVITY OF BIOTIC INTERACTION TO TEMPERATURE INDUCED CLIMATE CHANGE

Presenter: Avella, Philip
Graduate, Biological Sciences

Mentor: Prof. Lise Comte

Authorship: Philip Avella, Lise Comte

The effects of climate change on species and biological communities have been far reaching, and will likely continue to worsen in the coming decades. Freshwater fish are believed to be particularly vulnerable to the direct physiological effects of temperature increases and evidence suggests that they may also be indirectly affected through changes in their predator-prey interactions. Previous studies assessing the vulnerability of freshwater fish often focused on physiological risk only, and we still know little about the potential consequences of altered biotic interactions. My research seeks to fill this knowledge gap by assessing the sensitivity of biotic interactions to climate change in freshwater fish food-webs across the state of Illinois. To do so, the first step is to reconstruct the meta-food-web among for the freshwater fish of Illinois. This is accomplished by compiling information from the scientific literature of stomach or gut content analyses, which allow us to infer feeding interactions that would be otherwise difficult to observe visually. Having the ability to infer local food webs will then aid us in evaluating the potential for direct physiological effects to cascade up or down the food web. This will be accomplished by comparing the critical thermal maxima (CT_{max}), a commonly used measure of upper thermal tolerance limit, between pairs of interacting species as well as across food webs. This research aims to improve our ability to predict future changes in biodiversity in aquatic environments.

SENSORY RESPONSE TO TOUCH OF CAENORHABDITIS ELEGANS AMPHID SHEATH IS DEPENDENT ON THE EXPRESSION OF MEC-12 GENE

Presenter: Awe, 'Tope
Graduate, Biological Sciences

Mentor: Prof. Andrés Vidal-Gadea

Authorship: 'Tope Awe, Jessica Adams, Dayton Obling Hammond, Andrés Vidal-Gadea

Glia are typically considered to be supporting cells for development of neurons and synaptic transmission. The supportive role in sensory and synaptic transmission have been thought to be through the maintenance of the morphology of neurons. However, recent studies are showing that glia can respond to sensory stimuli in a cell-autonomous manner, suggesting them to be active partakers in the modulation and integration of sensory stimuli.

In *C. elegans*, the amphid sheath glia (AMsh) has been shown to respond to hard touch and aversive odorants independent of the putative ASH neuron that senses these stimuli. While the receptor that senses odorants has been identified, the receptor responsible for the detection of the hard touch stimulus in AMsh remains unidentified.

Here we used reverse genetics and calcium ratiometric imaging techniques to show that *mec-12* is required for normal response of AMsh to harsh touch. Global RNAi knockdown of *mec-12* gene resulted in attenuated response of AMsh to touch stimulus on the nose. This result was also observed in *mec-12* mutants, establishing the necessity of *mec-12* in the response of AMsh glial cells to harsh touch stimulation.

WHAT GOES ON AFTER PRISON: A QUALITATIVE ANALYSIS

Presenter: Boron, Davida
Graduate, Criminal Justice Sciences
Mentor: Prof. Charles Bell
Authorship: Davida Boron

My research project will focus on the initiatives and resources or the lack thereof that formerly incarcerated individuals are provided once they are released. Once released, most inmates tend to recidivate due to the lack of resources provided for them for reentry. A part of my project would be looking into the data that surrounds this topic to highlight what initiatives and resources are working and how we could implement them better into our systems. I will conduct ten interviews of the participants to gain more knowledge of their experiences once released. This will gauge what kind of assistance they received once released. What programs or initiatives were beneficial, and document what steps should be taken to combat the negative outcomes. My focus is non-violent offenders because they tend to have shorter sentences and are released more often. My age of participants will range from 18 to about 45 years of age just so that I have participants who are aware of everything going on. My recruitment strategy will have the snowball effect, a recruitment flyer, and resources from my supervisor.

TRAGIC POPULISM OR ESTRANGEMENT?: CONTRASTING VISIONS FOR A REVOLUTIONARY POLITICAL THEATRE

Presenter: Brown, Thomas
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Authorship: Thomas Brown

The Western theatre's historical relationship with Marxist sociopolitical thought throughout the twentieth century is quite rich and varied; while some Marxist theatre practitioners remained confident in the power of rationalism to ignite revolutionary action, others felt the need to solicit other moral energies through drama to bring about social change. If the desired ends of these thinkers were largely the same, why did they opt to take different routes? In my analysis, I position Brecht's Epic Theatre against the realism of the American and Russian stages and argue that the aesthetic differences between them are in fact ideological ones as well. In a bout of genealogy, I try to trace the origins of "socialist realism" from earlier aesthetic and intellectual sources, particularly the bourgeois tragedy. Pulling from the work of these thinkers, as well as more recent scholars such as Georg Lukacs, Walter Benjamin, Raymond Williams, Terry Eagleton, Christopher Lasch, and Ilka Saal, I relabel the theory and drama of the realists "Tragic Populism" and show their commitment to the notion of revolutionary empathy. On the opposite hand, I link Brecht's anti-Aristotelean approach to the residual of positivism in Marx's work. The task of us historically removed from these debates is not to select one thread of thought over the other; rather, we should take it as an opportunity to consider what either one has to offer us in the twenty-first century in our continued search for a revolutionary political theatre.

DETRITAL APATITE THERMOCHRONOLOGY OF THE GRAND TETON MOUNTAIN RANGE

Presenter: Chambers, Connor
Undergraduate, Geography, Geology, and the Environment

Mentor: Prof. Lisa Tranel

Authorship: Connor Chambers, Lisa Tranel

This research is to assess the apatite grains gathered from sediment in the Grand Teton Mountain Range to help answer the question of where the Tetons are eroding by measuring the amount of helium trapped in the crystal grain, with a process called detrital apatite (U-Th/He) thermochronology. We have data from Glacier Gulch, Avalanche Canyon, and Paintbrush Canyon with 17, 15, and 29 samples taken that are within the margin of error. As a part of this project, we will be adding sample data to Avalanche Canyon. Sample processing includes carefully processing sediments through sieving, hand magnet separation, wifely table processing, heavy liquid separation, Franz magnetic separator, and lastly hand picking the individual grains to send them off for analysis. So far, the cooling ages we have gotten back on the previous samples are all around 10-20 million years old, with Glacier Gulch showing a large spike at 20 million years old going out to 100. Avalanche Canyon has high numbers of apatite grains at 10 to 20 million years old then decreasing numbers to 60 million years old. Paintbrush Canyon spikes at 20 million years old with some samples at 10 and 30 Ma but also as far back as 60 million years old. All histograms show a high around the 20 Ma mark and a normal distribution out into the older ages of 60 or 100 Ma. The results we have seen so far show that almost all the cooling occurred 10-20 million years ago but there is some sediment from rocks that cooled much earlier, though it's not the majority. Using other sources of data like the relationship between climate, landscape connectivity and sediment export from mountain ranges, (Harries., et al.) we will be able to better understand erosional processes, weathering processes, and cooling process of the Teton Mountains. Future work can include is more data collection and sample processing from other canyons in the range to further our understanding of the cooling ages of the apatite grains across the range, leading to a better understanding of erosion and landscape evolution overall.

DYNAMICAL SYSTEMS MODELS FOR PLASMA DILUTION

Presenter: Chambers, Dylan
Undergraduate, Physics

Mentor: Prof. Neil Christensen

Authorship: Dylan Chambers, Neil Christensen

Recent experiments provide evidence that diluting the blood plasma restores the plasma environment to a more youthful level at least partially restoring the health of organs and tissues throughout the body. We propose that a dynamical-systems model representing the plasma constituents could support the optimization process and help determine the appropriate dilution level, frequency and any plasma additions to achieve the most favorable outcome. We use a combination of a gradient descent, a simulated annealing and a genetic algorithm to find a population of models that fit the illustrative data. We analyze the population and present distributions of the model parameters and include a collection of plots of the dilution process for illustrative models. We then consider modifications of the dilution in order to illustrate what predictions might be possible had we more data to disambiguate the model. Among the modifications, we consider enhancing some of the plasma constituents while diluting the rest as an illustration of a dilution coupled with an infusion.

ASSESSMENT OF TEMPORAL VARIATIONS IN CHLORIDE CONCENTRATION IN AN AGRICULTURAL TILE-DRAINED AREA IN MCLEAN COUNTY, CENTRAL ILLINOIS

Presenter: Commander, Okiemute
Graduate, Geography, Geology, and the Environment

Mentor: Prof. Eric Peterson

Authorship: Okiemute Commander

Increase in chloride (Cl⁻) concentration in surface water and groundwater from anthropogenic sources including deicing salts, agriculture, septic effluents, and wastewater treatment plants is a growing cause for concern all over the world. In non-urban areas where there is less impervious surface cover, agriculture could account for a larger percentage of Cl⁻ source in water systems. One of the major sources of Cl⁻ in non-urban areas is potash (KCl), an agricultural fertilizer used annually to grow soybean and corn throughout the Midwest especially in Illinois. This study is being conducted in a saturated buffer zone (SBZ) adjacent to an agricultural field in McLean County with wells installed to monitor water chemistry. Samples collected from 34 locations on the site over a six-year period will be analyzed (for major ion concentration), with subgroups compared based upon location and time. Subgroups will be delineated based on location into: deep groundwater (DW), downgradient shallow groundwater (DGSW), upgradient shallow groundwater (UGSW), diversion box (DB), and stream (ST). While the seasons will be divided according to equinoxes and solstices, corresponding with agricultural practices: spring/planting (April - June), summer/growing (July - September), fall/harvesting (October - December), and winter/fallow (January - March). Anion and cation concentrations will be measured using both the Ion Chromatograph (IC) and Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) respectively. Results from these analyses will be used to (1) identify the number(s) of contributory population of Cl⁻ using cumulative probability plots calculated with Cl⁻ and K⁺ values and (2) assess seasonal variations in Cl⁻ concentration among the different subgroups using a two-way ANOVA test. Background concentration for Cl⁻ will be established using cumulative percent probability from the analyzed samples. Inflection points representing "thresholds" of background concentration and other contributing population(s) will be determined using the cumulative probability plots of Cl⁻ and K⁺ in the area. Two-way ANOVAs will be used to test Cl⁻ and K⁺ concentration against time (seasons) as well as location (subgroups). It is expected that there will be at least one or more contributing sources of Cl⁻ and K⁺ in the study area and that Cl⁻ and K⁺ concentration would be higher in the DGSW subgroup during the spring (planting) season and highest in the ST subgroup in the winter (fallow) season.

Keywords: Chloride, Potash, Saturated buffer zone, Background concentration, Thresholds, ANOVA.

[5+2] CYCLOADDITIONS UTILIZING A BORON-NITROGEN BASED TETHER AND DISCOVERY OF A MILD PROTODEBORONATION METHOD

Presenter: Corrie, Seth
Undergraduate, Chemistry

Mentor: Prof. Andrew Mitchell

Authorship: Seth Corrie, Andy Mitchell

The Mitchell group's recent research has centered on the production and optimization of [5+2] cycloadditions utilizing maltol as a substrate. This is often achieved through the use of a tethered olefin attached to maltol at the 2 position. The use of a tether reduces the entropic requirements necessary for a [5+2] cycloaddition. Unfortunately, a tether could limit the utility of [5+2] cycloadditions. One option to overcome this downside is to employ the use of a temporary tether that can be severed after the [5+2] reaction, which are colloquially referred to as "snap tethers" by the Mitchell group. A pyrone possessing an amino diol, that could be used as a tether, was synthesized. The diol can chelate to a vinyl boronic acid through the loss of two water molecules resulting in a caged three-point binding tether that reduces the entropic requirements of a [5+2] cycloaddition. These cycloadducts can have their tethers severed after they have been formed allowing for a greater level of utility in the tether region of the molecule. It was found that this reaction can also be utilized on vinyl pinacol boronates and vinyl MIDA esters. MIDA esters yielded surprisingly high yields often surpassing the yields of boronic acids. By attempting to utilize a single chelating tether with a vinylboronic acid to generate a [5+2] cycloadduct, it was discovered that protodeboronation can result instead of the desired reaction. This was initially viewed as a hurdle to cycloaddition; however, it is a promising reaction for intentional protodeboronation, a reaction that typically requires harsh conditions or metal catalysts. The Mitchell Group has begun to investigate Deanol (dimethylaminoethanol) motifs as it appears that they can cause protodeboronation of boronic acids, pinacol boronates, and MIDA esters. Parallel studies on amide tether cycloadditions have led to the possibility of single-point binding cycloadditions using both a protonated amine and a boronic acid that will allow for tethered cycloadditions that can "snap" apart during a workup.

HAPTIC RENDERING IN A VIRTUAL MANUFACTURING ENVIRONMENT FOR PROCEDURAL KNOWLEDGE ACQUISITION

Presenter: Diffor, Alexander
Undergraduate, Technology

Mentor: Prof. Isaac Chang

Authorship: Jake Weihe, Jordan Osborne

Haptic rendering in a virtual environment refers to a system's ability to allow a user to touch, explore, or manipulate virtual objects through a haptic device. With the technological breakthrough, it is possible nowadays to simulate the feel of surface textures on complex geometries under dynamic conditions. In the context of manufacturing training, haptic rendering could provide the learner stimuli needed for the hands-on experience, especially for acquiring procedural knowledge, e.g., know-how. Nevertheless, researchers also reported the concern of overstimulating the user-in-the-loop with unnecessary sensation and thus distracting him or her from picking up the key components of the intended experience. There is a lack of literature suggesting how certain haptic stimuli in a virtual environment might help to construct the target procedural knowledge.

In this presentation, we will report an ongoing research product studying how proper haptic rendering could enhance an individual's performance and experience in learning manual assembly tasks. A conceptual framework on the hand movement patterns will be described and corresponding haptic stimuli will be suggested. To determine the effectiveness of the proposed haptic rendering scheme, the assembly of a virtual TV stand will be used to measure participants' speed and accuracy for completing the assigned task according to the instruction provided. Statistical analysis of quantitative data will be discussed. A self-reported post-test survey on participants' demographic data and experience will be used to help further explain the experimental findings. We will conclude the presentation with the lessons learned.

THE IMPACT OF NUTRITION ON FECAL ODORS AND INTRASPECIFIC OLFACTORY COMMUNICATION IN GROMPHADORINA PORTENTOSA

Presenter: Donald, Samone
Undergraduate, Biological Sciences
Mentor: Prof. Steven Juliano
Co-Mentor: Prof. Kate Evans
Authorship: Samone Donald, Steven Juliano, Kate Evans

Studies have shown some species of Blattodea (roaches and termites) are capable of distinguishing olfactory cues from fecal matter from conspecifics. This order includes species ranging from gregarious to fully eusocial, and olfactory cues play a large role in aggregation and social communication. This study tests whether fecal olfactory cues influence *Gromphadorina portentosa*, the Madagascar Hissing Cockroach, aggregation preferences, and whether those preferences are related to quality of food consumed, or to familiarity of food consumed by conspecifics. A four-choice behavioral assay in a colony of *G. portentosa* suggests they can identify differences in the scent of fecal matter from conspecifics that have consumed food of greater vs. lesser nutritional value, as well as distinguishing between odors of feces from conspecifics that have consumed familiar vs. unfamiliar foods. Results indicate that *G. portentosa* are attracted to fecal olfactory cues from roaches feeding on a diet of the greatest relative nutritional value, and to fecal olfactory cues from roaches feeding on familiar vs. unfamiliar foods. The study also tested for effects of sex and stage of the producing individual on fecal olfactory preferences. The results did not indicate any significant effect of male vs. female nor of juvenile (3rd instar) vs. adult on preferences. This study suggests further research into the role of gut bacteria associated with the diet is needed to determine the impact they may have on intraspecific communication in among these gregarious Blattodea.

TRANSPORT OF SUSPENDED SEDIMENT AND PHOSPHOROUS IN AN AGRICULTURAL WATERSHED: A CASE STUDY OF THE MONEY CREEK WATERSHED, CENTRAL ILLINOIS

Presenter: Efobo, Oghenevwede
Graduate, Geography, Geology, and the Environment
Mentor: Prof. Eric Peterson

Authorship: Oghenevwede Efobo

Suspended sediment and phosphorus are a threat to surface waterbodies. Excessive supply of suspended sediment to streams can alter water quality, reduce reservoir storage capacity, and degrade ecological functions including the displacement of aquatic habitats. Phosphorus is a limiting nutrient in freshwater. Excessive phosphorus in streams has led to eutrophication, the development of harmful algal blooms and hypoxic conditions that restrict the water for fisheries, recreation, industry, and drinking. For the City of Bloomington, central Illinois, high nutrient loads and sediment concentrations are a major problem in water reservoirs. The primary sources of suspended sediment and phosphorus in the area are from agriculture, which dominates local landuse. High nutrient loads and sediment concentrations are a major problem in water reservoirs in agricultural regions. To aid our understanding of the transport dynamics between suspended sediment and phosphorus over a five-year period (July 2016-May2021), two hypotheses were proposed. They are: (1) the mass of total suspended sediment (TSS) will be linearly related to the mass of total phosphorus (TP) for storm events, and (2) there will be both an annual and a seasonal relationship between the mass of total suspended sediment (TSS) and the mass of total phosphorus (TP). For hypothesis 1, a linear regression analysis will be used to evaluate a potential relationship between the independent variable, TSS load and the dependent variable, TP load. For hypothesis 2, an ANOVA ($\sigma = 0.05$) will be used to identify statistical differences among TSS and TP loads throughout the four seasons and annually. If there is a significant difference, a Tukey Test will be conducted to determine which seasons, or years, the differences in TSS and TP were significant. I expect to see a linear relationship between the mass of TSS and the mass of TP for storm events. Since phosphorus is mainly transported with suspended sediment, TP export would increase with increasing TSS transport during storm events. I also expect to see a seasonal and annual relationship between the mass of TSS and the mass of TP. This is because there are seasonal and annual variations in rainfall patterns that have control on the export of TSS. The findings from this study will add to the existing knowledge and aid decision-makers in the design of management plans for the watershed.

UNDERSTANDING MAGMA FORMATION AT ÞINGMÚLI VOLCANO, ICELAND BASED ON ZIRCON ANALYSES

Presenter: Essex, Cameron
Undergraduate, Geography, Geology, and the Environment
Mentor: Prof. Tenley Banik
Authorship: Cameron Essex, Tenley Bani

Iceland is one of the few places on Earth where a spreading center and mantle hot spot coincide, leading to abundant magmatism and production of silicic rocks. There are two processes thought to be dominantly responsible for generating silicic magmas in Iceland: fractional crystallization and partial melting of pre-existing crust. Þingmúli (Thingmuli) volcano, an extinct volcano in eastern Iceland, is viewed as an archetype for rhyolite generation via fractional crystallization based on whole rock analyses (Carmichael, 1964, 1967; Charretier et al., 2013). We present the first zircon-based oxygen (O) isotope compositions and U-Pb ages for Þingmúli. Whole rock samples (n=8) were collected from mapped Þingmúli silicic units and zircon was separated via standard crushing, sieving, and conventional magnetic and density separation methods, followed by hand-picking under a microscope. Oxygen isotope compositions in zircon grains were then analyzed at UCLA and U-Pb geochronology and trace element compositions were measured using the Stanford-USGS SHRIMP-RG. Zircon U-Pb ratios indicate ages ~9–10 Ma. Zircon $\delta^{18}\text{O}$ in seven samples is restricted to ~3.1–3.9‰, suggesting rhyolite petrogenesis at Þingmúli can be dominantly attributed to fractional crystallization of mantle-derived basaltic magmas, which is in line with previous whole-rock-based findings. The sample with the oldest U-Pb age has a substantially lower $\delta^{18}\text{O}$ weighted mean (~2.1‰), with grains (n=10) having $\delta^{18}\text{O}$ ranging from ~1.8–2.3‰. Titanium—which is a proxy for crystallization temperature in zircon—ranges from ~8–17 ppm and Hf ranges from ~9,000–16,000 ppm across all samples, both of which are typical for Icelandic zircon. However, the oldest, low $\delta^{18}\text{O}$ unit has an average Ti concentration of ~14 ppm, which is 2–4 ppm higher than the other sample averages. While overall these zircon data provide support prior interpretations for rhyolite petrogenesis at Þingmúli, our data also hint at a warmer, early phase of magmatism in which incorporation of low- $\delta^{18}\text{O}$ material was a significant contributor to these zircons' parent melt.

TECHNOLOGY, SOCIAL MEDIA, AND THE GEN Z THEATRE

Presenter: Farias, María Amenábar
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Authorship: Maria Amenábarn Farias

In this presentation I will discuss how a technological revolution has led to a revolution in communication, both inside and outside of the theater, a topic I explored through my production of the play *Good Kids* by Naomi Iizuka. History has proven that the survival of theatre as an art form relies heavily on its ability to adapt to the needs of its current society. As society evolves, the topics theatre focuses on and the storytelling methods it uses must evolve as well. The introduction of new technologies has not only inspired playwrights into incorporating that technology into their stories, but has also inspired directors like myself to use social media and other technological advances as a part of the fabric of the storytelling of a production. Gen Z audiences relate to plays that communicate in the same way they do, plays in which the characters use technology as a communication method and productions that use technology to communicate with the audiences directly. This is why with *Good Kids* our team used social media, projections and interactive dramaturgical devices to not only mirror the use of social media in the play, but to also connect with our Gen Z audience.

DO ANIMALS USE STREAMS AS CORRIDORS?

Presenter: Fever, Lacey
Undergraduate, Geography, Geology, and the Environment

Mentor: Prof. Catherine O'Reilly

Authorship: Lacey Fever, Valerie Kurgan, Michael Brown, Catherine O'Reilly

Wildlife are increasingly found in urban environments. However, it is not clear how wildlife move around the urban landscape. The purpose of our project is to determine whether animals use the town's streams as corridors to move through town. I speculated that animals use the town's streams as a corridor to cross into residents' yards. To test this hypothesis, trail cameras were set up alongside the creeks at Hidden Creek Nature Sanctuary, Anderson Park, and Oakdale elementary in Normal, IL. The cameras were used to collect data between September 2021 and May 2022. The footage was reviewed on a weekly basis and the images were routinely uploaded onto Colorado Parks and Wildlife (CPW) Access database. Information identified by visually inspecting the images was then used to create graphs. The input data consisted of the animals' species, location, direction of movement, time of day, and the animals' behavior. Results from the camera images and our graphs indicated that raccoons and coyotes are often present at Hidden Creek Nature Sanctuary around 3:00am. Raccoons and stray cats were commonly observed near Oakdale elementary around 3:00am. Squirrels and ducks were common at Anderson Park around 12:00pm. The data collected through the trail cameras support our hypothesis; animals do use streams as passageways through town. By inspecting the trail camera footage and noting wildlife location and direction of movement, we observed various native species using the streams to travel through town.

THE SIGNIFICANCE OF THE PARTHENON

Presenter: Fick, William
Undergraduate, History

Mentor: Prof. Kathryn Jasper

Authorship: William Fick

The research conducted for this poster is dedicated to the Parthenon, why it was built, and how it comes to resemble Athenian power in Ancient Greece, the Delian League, and the modern world. Being one of the most iconic structures and temples constructed in all of history, why is the Parthenon so significant when it comes to upholding the institutions of Ancient Athens? The research involves scholarly articles and secondary sources and compares the intricate artwork included on the Parthenon with its overall size, then factors in the speed and quality it was built. Having withstood wars and earthquakes, this poster seeks to understand why the Parthenon is a significant symbol of Athenian institutions even 2,500 years later.

EVOLUTIONARY SYMBOLIC REGRESSION FROM A PROBABILISTIC PERSPECTIVE

Presenter: Furcoiu, Alex
Undergraduate, Physics
Mentor: Prof. R. Grobe
Co-Mentor: Prof. Q. Su

We examine the genetic evolution-based algorithm for symbolic regression from a probabilistic dynamical perspective. This approach permits us to follow the evolution of the search candidate functions from generation to generation as they improve their fitness and finally converge to the best function that matches a given data set. In particular, we use this statistical framework to explore the optimal external parameters that govern a special mutation operator, which can systematically improve the numerical value of constants contained in each candidate formula of the search space [1].

[1] C. Gong, J. Bryan, A. Furcoiu, Q. Su and R. Grobe, Springer Nature Computer Science, submitted.

DATA COLLECTION OF ROCK FALLS THROUGHOUT STARVED ROCK MEASURING POROSITY, GRAIN SIZE, AND CEMENTATION

Presenter: Gaeti, Anthony
Undergraduate, Geography, Geology, and the Environment

Mentor: Prof. Lisa Tranel

Authorship: Anthony Gaeti

The canyons of Starved Rock were carved by meandering creeks flowing into the Illinois River and transporting sediments out of the canyons. Rock falls happening all over the park can also contribute to increased erosion. The St. Peter sandstone can be very brittle and the cement between quartz grains is very weak, making the sandstone fall apart quite easily. In areas of higher foot traffic, this can accelerate erosion processes. Canyons like La Salle have seen higher erosion rates (20.68 mm/ky) while also being one of the more popular canyons in the state park. Conversely, trails that see less foot traffic have significantly lower erosion rates like the Illinois Canyon (9.17mm/ky). Our biggest goal of this project is to possibly find a connection between the case hardening of cement on the surface of rocks and the erodibility of the bedrock. Thin sections are used to measure the area of porosity, grain size, and cementation. The thin sections represent samples collected from rock falls from various parts of Starved Rock. The primary piece of data is cementation. Case hardening samples have higher cementation to prevent the rock from eroding as fast as the weaker rock it protects. This possible result could explain why the areas with less foot traffic could have slower erosion rates. More data of the thin sections need to be taken to make a connection with the possibility of case hardening in the St. Petersburg sandstone.

IDENTIFICATION OF INFLUENCING FACTORS OF AGING IN PLACE LIFESTYLES

Presenter: Galewsky, Isaac
Undergraduate, Family and Consumer Sciences

Mentor: Prof. Sally Xie

Authorship: Isaac Galewsky

This research project will explore and identify the influencing factors of Aging-in-Place lifestyles and focus on the range of applications of smart home automation technology. We believe this topic is worth investigating in order to try and find out what instances the technologies are best applied in and how their application can best help a now aging American population comfortably and sustainably so that they remain independent for as long as they would like to. The research questions are (1) How to design and simulate the living conditions and interior/exterior environments of AIP? (2) What do people consider when they choose the AIP lifestyles? With the rapid pace of technological development, smart environments (SE) have significant potential to help AIP stakeholders (e.g., construction companies and healthcare providers) to explore new ways and keep up with the growth of the aging population in the US and worldwide. In this research project, the student will study and implement Building Information Modeling (BIM) and augmented reality (AR) technologies for the “Missing Middle” in the 21 Century.

MEDIA REPRESENTATION (AND LACK OF) AS A FORM OF SOCIAL INCLUSION/EXCLUSION

Presenter: Gallagher, Brett
Undergraduate, Psychology

Mentor: Prof. Eric Wesselmann

Authorship: Brett Gallagher, Eric Wesslemann

There have been increased discussions both within in U.S. entertainment industry and among cultural commentators about the importance of having diverse representation of characters in media products (e.g., Film and TV shows). Media scholars have focused predominately on the social-psychological effects of positive versus negative depictions of individuals from different identity groups. The prevailing assumption in this literature is that a lack of representation is worse than negative representation, yet this has not been investigated directly. However, this assertion converges with research on interpersonal social exclusion, which demonstrates that negative attention is harmful and to be treated as completely invisible or unworthy of attention in one's personal relationships is even worse. We present data from a preliminary investigation that merges these research areas. Participants first identified an identity category important to their self-concept. Participants were then assigned randomly to one of three groups. One group recalled a time when someone who shared their identity category was represented in media (type of representation purposefully left ambiguous). A second group of participants recalled a time in which a someone who shared their identity category was noticeably absent in media. A third group of participants served as the control condition, writing about an unrelated event (i.e., the last time they ate breakfast). Participants then completed measures of perceived social value, feelings of being ignored and excluded, and of basic psychological need satisfaction (e.g., self-esteem). These measures commonly are impacted by interpersonal social inclusion and exclusion. Analyses are still in progress, but we expect that participants in the noticeably absent condition would feel less valued socially, less psychological need satisfaction, and feel more ignored/excluded than participants in the control condition. Because we left the representation condition ambiguous purposefully, we expect participants' experiences to vary by the type of representation recalled. Participants who recalled an instance of positive representation should report positive scores on the outcome measures compared to both the control and absence conditions. Participants who recalled an instance of negative representation should report negative scores on the outcome measures compared to the control condition, but less negative when compared with the absence condition. We will discuss these results' implications for future studies unpacking the complex connections between media representation and feelings of social inclusion/exclusion.

DECREASING SEED GLUCOSINOLATE CONTENT IN THE OILSEED PLANT PENNYCRESS

Presenter: Gautam, Liza

Graduate, Biological Sciences

Mentor: Prof. John Sedbrook

Authorship: Liza Gautam, Brice Jarvis, Dalton Williams, Kaya Sloman, Alex Hafner, Ashlyn McWilliams, Ryan Bayliss, John Sedbrook

Pennycress (*Thlaspi arvense*) is a Brassica species related to rapeseed and canola that is being domesticated into an oilseed-producing winter cover crop called Covercress to be grown between corn and soybeans in the U.S. Midwest. Pennycress seeds, like in other Brassicaceae, accumulate high levels of glucosinolates - over 100 μmol glucosinolate per gram seed weight. Glucosinolates act as deterrents to herbivory due to their bitter taste and conversion to toxic isothiocyanates by the enzyme, myrosinase. As with the domestication of rapeseed to canola, we aim to decrease pennycress seed glucosinolate content to less than 30 $\mu\text{mol}/\text{gm}$ to make the seed oil and meal suitable for animal and human feed and food uses. To that end, we have targeted loss-of-function mutations in the pennycress MYC3 transcription factor gene, identifying a decrease in seed glucosinolate content to about 75 $\mu\text{mol}/\text{gm}$ without affecting plant growth. We also generated partial loss-of-function mutations in the HAG1 and HAG3 transcription factor genes, which reduced glucosinolates a similar amount as *myc3* knockout. We will present these findings and discuss our efforts in attaining target reductions in pennycress seed glucosinolate content.

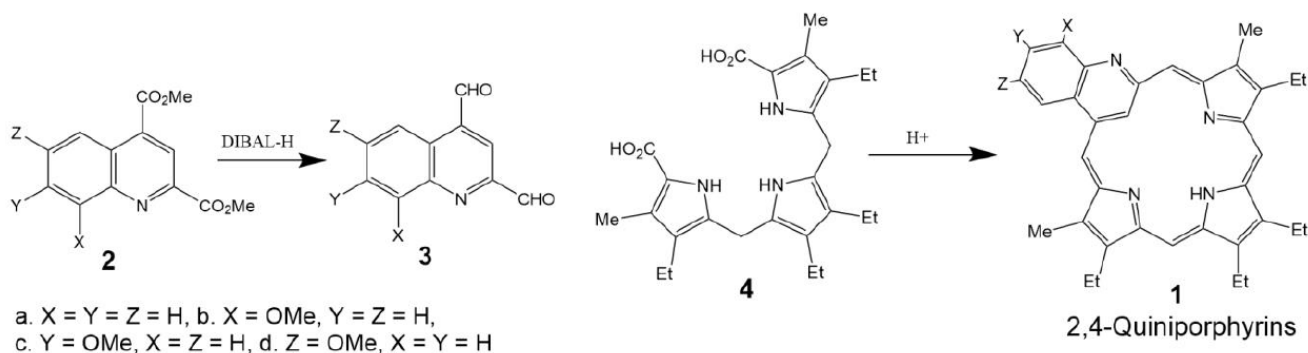
UTILIZATION OF THE "3+1" METHODOLOGY TO SYNTHESIZE 2,4-QUINIPORPHYRINS

Presenter: Graybeal, Alexis
Undergraduate, Chemistry

Mentor: Prof. Timothy Lash

Authorship: Alexis Graybeal, Timothy Lash

Carbaporphyrins are a derivation of a traditional porphyrin in that one or more internal nitrogen atom in the porphyrin are replaced with carbon atoms. Carbaporphyrins and related systems have been well studied, and many retain aromatic character while modifying the electronic absorption spectra. In this project, a series of quinoline subunits have been incorporated into carbaporphyrinoid systems and have been further investigated. Utilization of the quinoline subunit allows the reintroduction of a nitrogen, but at the periphery of the structure. A series of quinoline diesters **2** have been prepared and reduction with diisobutylaluminum hydride at $-70\text{ }^{\circ}\text{C}$ afforded the related dialdehydes **3**. In addition, a tripyrrolic intermediate **4** (tripyrane) has been synthesized so that the new porphyrin analogues can be generated using a "3+1" methodology. Investigations into the properties of these quiniporphyrins **1** are currently in progress.



"WITH PENCIL ON PAPER IT HAS TO BE PERFECT": INTERIOR DESIGN STUDENTS' SKETCH INHIBITION

Presenter: Gwin, Haley
Undergraduate, Family and Consumer Sciences

Mentor: Prof. Elke Altenburger

Authorship: Haley Gwin, Elke Altenburger

Topic

This is a study of instructional strategies, intended to help interior design students overcome sketch inhibition. Many design students are reluctant to engage in sketching. They insist that they cannot work in the studio, and leave sessions when sketching is required. At the end of their design education, many of my peers still lack confidence and skill. Design education continues to struggle to address this problem. (Thurlow et al., 2019).

Context

Sketching supports design thinking, helping to externalize, see, and store thoughts in a different way. It is quick, and supports problem solving (Bilda et al., 2006). Sketching is a way to methodically explore, test, and develop ideas (Leblanc, 2016). Sketching enables designers to investigate multiple paths, while drawing software tends to inspire attention to detail. Overreliance on digital tools encourages premature solutions, developed in a linear process (Cross, 2001). Sketches create a record of the creative process, while digital tools may render that process invisible (Goldschmidt, 2003).

Methods

We developed three interventions: (1) we explained the benefits of sketching more explicitly than in previous semesters, (2) we incentivized producing more sketches, and (3) we engaged students in playful sketch exercises on whiteboard surfaces. We determined a baseline for how (un)comfortable students initially were with sketching. We attended all relevant studio sessions, wrote ethnographic fieldnotes, took photos and maintained a research journal for reflection. Afterwards, we conducted semi-structured interviews with five sketch-inhibited participants and collected short responses to our questions from all enrolled students. The analysis of the transcripts consisted of open and focused coding, followed by the investigation of co-code occurrences and theme development.

Conclusions

The analysis revealed that initially, many students thought that the sole purpose of sketching was to persuade clients of a design solution, which led them to unrealistic expectations of the necessary quality. These students tended to either spend unreasonable amounts of time on sketch assignments or avoid sketching altogether. Students who expanded their understanding of sketching and its usefulness for ideation and collaboration, were able to relax, embrace the design process, and increase their productivity. They reported enjoying the whiteboard activities, because they associated the inherently preliminary nature of the marker sketches with lower stakes, compared to the more intimidating, permanent nature of pencil and paper sketches. Researchers and participants observed that the design students appeared more collaboratively engaged while working on the whiteboards, at previously unprecedented levels.

INTER-METHOD AGREEMENT BETWEEN BODY COMPOSITION TECHNIQUES WITHIN ATHLETIC POPULATIONS

Presenter: Harwick, Aaron
Graduate, Kinesiology & Recreation
Mentor: Prof. Kelly Laurson
Co-Mentor: Prof. Dale Brown
Authorship: Aaron Harwick, Dale Brown, Kelly Laurson, Tyler Kybartas

Accurate assessment of body composition within athletic populations is of great importance, given it is common practice for the results to influence decisions regarding the effectiveness and progression of training and nutrition regimens. Additionally, it is common to see different types of body composition analyzers used at different athletic premises. **PURPOSE:** The purpose of this study was to analyze agreement in body composition assessed by Air Displacement Plethysmography, (ADP), four-electrode, and eight-electrode Bioelectrical Impedance Analysis (BIA) in an athletic population.

METHODS: Sixty-one female athletes competing in basketball, volleyball, and soccer, and twenty-one male athletes competing in basketball, (mean \pm SD) [age 20 ± 1.3 yr., height: 175.4 ± 11.8 cm., mass: 72.3 ± 13.1 kg.] underwent height and weight measures in addition to body composition assessment with the three methods mentioned above. All pre-test procedures for fasting, hydration, and resting were followed by the athletes. Pearson correlation coefficients were used to analyze associations between the three measures. Comparisons of the three methods were made using a One-Way Repeated Measures ANOVA.

RESULTS: The Pearson correlation coefficient suggests the three conditions have a significant, strong association with each other, ranging from ($r=.86$ to $.90$), ($p<0.001$). The ANOVA test indicated significant differences in Percent Body Fat (BF%) between ADP (20.6 ± 6.4), 4-electrode BIA system (21.0 ± 7.2), and 8-electrode BIA system (18.1 ± 7.2), ($p=0.014$). Differences between ADP and 4-electrode BIA were not significant ($p=0.271$). However, there were statistically significant differences between 8-electrode BIA compared to both ADP and 4-electrode BIA (both $p<0.001$).

CONCLUSION: The results may suggest some variance between the three body composition methods, with the eight-electrode BIA system showing 2.5-3.5% lower BF% results, on average compared to ADP and 4-electrode BIA analyzers, which were seen to have better overall agreement with a $<0.5\%$ mean difference. These results suggest practitioners should be cognizant of these differences in methodologies, which could have implications for athlete tracking over time.

RELATIONSHIPS BETWEEN SOCIAL IDENTITY AND ENGAGEMENT IN PERSONAL ACTION TO REDUCE HUMAN IMPACTS ON WILDLIFE

Presenter: Hayes, Alyssa
Undergraduate, Biological Sciences

Mentor: Prof. Rebekka Darner

Authorship: Alyssa Hayes, Rebekka Darner

Some visitors to nature centers and wildlife rehabilitation facilities express unscientific ideas about how to accomplish wildlife protection. Despite attempts to develop mechanistic knowledge about how wildlife rehabilitation occurs through brochures and internet materials, unscientific ideas about how wildlife rehabilitation should occur continues to persist. This is problematic because everyday citizens hold much power in their personal actions or inactions for preventing the need for wildlife rehabilitation. The purpose of this study is to investigate how social identity factors, such as political ideology and science identity, are related to engagement in personal actions that would prevent the need for wildlife rehabilitation. We surveyed visitors to nature centers, wildlife rehabilitation centers, and zoos, as well as through MTurk during February of 2022. We then performed multiple regression analyses to elucidate relationships between social identity factors and personal actions. Findings can potentially improve pre-existing modes of information dispersal, as well as develop new and accessible ways of relaying information to the public.

MEASURING BLOOD PRESSURE WITH RADAR AND MACHINE LEARNING

Presenter: Hazzard, Evan
Undergraduate, Information Technology
Mentor: Prof. Shaoen Wu
Co-Mentor: Prof. Noah Ziems
Authorship: Evan Hazzard, Noah Ziems, Shaoen Wu

Blood pressure is an important metric for diagnosing and monitoring a wide range of medical issues including cardiovascular issues, pulmonary issues, and others. Traditional methods using a sphygmomanometer use a cuff around the patients arm, requiring the patient to be stationary. Moreover, this method of measuring blood pressure provides only periodic and instantaneous readings. Radar, which allows for continuous and unrestricted blood pressure readings, is a promising alternative to traditional methods. However, extracting a blood pressure signal from radar has been a significant limitation. Using machine learning, we solve this problem by deriving accurate blood pressure readings from raw radar data, suggesting radar could be a strong alternative to traditional blood pressure measurement methods.

TRAIT ANXIETY, WORKING MEMORY, AND PROSPECTIVE MEMORY IN COLLEGE STUDENTS; THE EFFECTS OF ANXIETY ON THE NERVOUS SYSTEM

Presenter: Hennes, Madison
Undergraduate, Psychology

Mentor: Prof. Dawn McBride

Authorship: Madison Hennes

Anxiety disorders are one of the most common mental disorders, affecting 18.1 percent of adults in the United States alone. However, there is a lack of research regarding the association between trait anxiety, working memory, and prospective memory as a triad, which is important and must be explored because these cognitive processes are important to everyday tasks. The current study examines the effects of elevated levels of trait anxiety on working memory and prospective memory performance. Participants, 100 college students, will complete the Hospital Anxiety and Depression Scale, to self-report trait anxiety. Then, they will complete two working memory tasks and a long delay prospective memory task to text the researcher after a several hours or a few days. We predict that elevated levels of anxiety will have a negative effect on both working memory and performance in the prospective memory task.

MATUSARAGATÍ SI VIVÉ !

Presenter: Hernandez-Ramos, Catalina
Undergraduate, Creative Technologies

Mentor: Prof. Kristin Carlson

Authorship: Catalina Hernandez-Ramos, Kristin Carlson, Lucy Gill

I am presenting research about the Matusaragatí wetlands in the Darién region of Panama. This environmental research has been crafted into a children's book for education and awareness. The main focus of this research is to give children and adults an insight into their environment through another environment in Panama. The children's book is formatted to teach young children about their senses and emotions as well as inspiration to treasure nature. Our future generations will be stepping into an uninhabitable world that won't be enjoyable as a result of what our past and current generations have been abusing. Particularly in the rainforests of Panama, where preservation of natural areas is political and frequently intersects with the indigenous stewards of the land, which is cancerous to our evolution. Matusaragatí is a wetland that is in need of nourishment, love, and protection. As a Creative Technologies team, we have gathered research on the local histories of the Darién region, and how those histories engage with current people, animals, plants, and environments. We are compiling this information into a children's book in order to raise awareness of the importance of restoring the Matusaragatí wetlands. In previous research, we have gained the understanding that Matusaragatí is dealing with corruption from property title registrations in protected wildlife areas. The consideration of the land as currency is a disease to this wetland and many other parts of Darién and Panama. Deforestation and violation of lagoons, forests may bring revenue in the short term, but have devastating effects on the region as a whole over time. This includes the health of all waterways and oceans surrounding the area, and the accompanying wildlife that residents rely on for their own survival. By listening to the need for awareness, I decided to approach our future generations. I am making a children's book that entails the truth, beauty, and power of wetlands like Matusaragatí to the world. Throughout the book, I provide details of how vital Matusaragatí's life is for all of its inhabitants. Matusaragatí is alive and deserves to be treated as a life that needs protection and love. Together we must not ignore what's happening and still strive to better the situation. As one, we can evolve and create a biodeversity of health and abundance.

STUDENT'S DISCLOSURE OF MENTAL HEALTH IN THE CLASSROOM WITH FACULTY AND PEERS

Presenter: Herr, Aaron
Undergraduate, Psychology
Mentor: Prof. Jeffrey Kahn
Co-Mentor: Prof. Christopher Gjesfjeld
Authorship: Aaron Herr

Mental health and psychological disorders are common occurrences that college students face throughout their time on and off-campus. Current studies look towards the best way for students to disclose their mental health and psychological disorders on campus with faculty and students. One study has shown that students with non-diagnosed mental health disorders preferred sharing their problems with other peers compared to students with diagnosed mental health problems who preferred sharing their problems with faculty (Budenz et al., 2020). Another study has shown that students with mental health disorders perceived disclosure of information to an instructor as a higher risk compared to students who never disclosed information to the instructor (Meluch et al., 2020). These two studies have shown that students with mental health disorders who disclose information to faculty and peers receive different forms of privacy and advice. Because of that, students may have a favorable choice between who they decide to disclose their mental health with. The purpose of this study is to see if students are more likely to disclose their mental health with peers compared to faculty (qualitative) along with to what extent they disclose their mental health with peers compared to faculty (quantitative). This study comprised three hundred Illinois State University students who were recruited via a Qualtrics survey. These students received an online survey that asked them questions about their disclosure of mental health and psychological disorders with classmates and professors. The main variable in this study looked at students' qualitative feelings after disclosing mental health to peers and faculty using a Likert scale with 1 Very Little to 7 To A Great Extent. The ten feelings include: proud, authentic, safe, relieved, ashamed, vulnerable, exhausted, sad, anxious, and angry. An additional variable looked at the context (quantitative data) that the student disclosed their mental health with faculty and peers. The results of the study showed that there is no significance between the degree to which students disclosed mental health and psychological disorders to professors compared to students. The poster will report the results of the quantitative data that is collected from this study. The importance of this study will help future researchers and universities understand new and better ways to help students who are experiencing mental health problems disclose to either faculty or peers.

A COMPARATIVE ANALYSIS OF LEGAL FRAMEWORKS FOR ADDRESSING ENVIRONMENTAL CRIMES IN BANGLADESH, NIGERIA, AND UNITED STATES

Presenter: Hussain, Md Lokman
Graduate, Criminal Justice Sciences

Mentor: Prof. Ashley Farmer

Authorship: Md Lokman Hussain

Environmental crimes developed mostly after the second half of the 20th century. Environmental movements and international environmental treaties played an important role in policy formulations of the environmental harms. Though many of the aspects of environmental justice – or eco justice – are regulatory in nature, criminalization of environmental harms is also significant and ever increasing in implementation. From this backdrop, this paper explores the environmental criminal laws of three different countries that share the legacy of common law tradition in their legal systems. The comparative analysis of their legal frameworks consists of making laws in criminalization of environmental harms, types of environmental crimes, punishments for those crimes, enforcement mechanism for environmental criminal law, role of judiciary in advancing the environmental criminal law through cases, and measures for addressing corporate environmental crimes in particular. The theoretical propositions of green criminology are applied in the analysis. While the study presumes that environmental problems and environmental criminal laws are similar across societies, it is important to map out the areas of differences so that the policies for addressing environmental harms become more informed.

MEASURING THE IMPACT OF THE 2010 EARTHQUAKE IN HAITI ON GDP PER CAPITA USING SYNTHETIC CONTROL METHOD

Presenter: Jean-Louis, Benael
Graduate, Economics

Mentor: Prof. Bibek Adhikari

Authorship: Benael Jean-Louis

On January 12, 2010, Haiti was struck by a magnitude 7.3 earthquake on the Richter scale, killing more than 300,000 people and causing damage estimated at several billion dollars. Yet more than 10 years later, little is known about the causal impact of this shock on the Haitian economy. This paper aims to close this gap to some extent by answering the following question: what is the impact of the 2010 earthquake on Haiti's per capita GDP? To answer this question, I used the Synthetic Control Method (SCM), a research design recently developed in Abadie et al. (2010). This methodology provides a natural approach for evaluating the effects of an exogenous treatment that affects only some units while many other units are unaffected. I collected data for 40 developing countries that constitute the donor pool from which the counterfactual scenario is created. The causal impact is estimated by comparing the GDP per capita of this counterfactual scenario called synthetic unit with the actual GDP per capita of Haiti. The results indicate that the earthquake had a negative impact on Haiti's per capita GDP in the short run as well as in the long run. Particularly, for the 10 years following the earthquake, the magnitude of the impact is estimated at a \$3,811 decrease in Haiti's per capita GDP.

INTERROGATING AND GENETICALLY IMPROVING DROUGHT TOLERANCE IN THE WINTER OILSEED CROP PENNYCRESS

Presenter: Kiam Assato, Carol
Graduate, Biological Sciences

Mentor: Prof. John Sedbrook

Authorship: Carol Kiam Assato, Liza Gautam, Heba Hamdy Abouseadaa, John Sedbrook

Drought damage to crops is a major threat to food security and is becoming a growing problem due to climate change. Amongst all abiotic stresses, drought is believed to be the most impactful on soil biota and crop productivity. According to the National Integrated Drought Information System (NIDIS), in 2020, 40% of the United States was under drought, and it is predicted that this number will continue to rise in the forthcoming years. Pennycress (*Thlaspi arvense* L.) is a member of the Brassicaceae family related to canola and *Arabidopsis* that is being rapidly developed as an oilseed-producing winter cover crop for the U.S. Midwest and other temperate growing regions. As part of our efforts in domesticating this new crop, we are focusing on identifying genetic changes to pennycress that can improve drought tolerance without negatively impacting plant growth and seed yields. Auxin is a phytohormone that plays a vital role in the regulation of plant growth and development in response to abiotic stressors. Auxin responses involve so-called auxin response factor proteins which negatively regulate auxin-response signaling and related gene expression. In *Arabidopsis*, AUXIN RESPONSE FACTOR (ARF) genes been shown to function redundantly in repressing abiotic stress genes; combined loss of function mutations result in improved *Arabidopsis* drought tolerance. Our hypothesis is that putative ARF orthologues function similarly in pennycress without impacting plant health. To test out hypothesis, we have successfully employed CRISPR genome editing to knockout gene function, targeting single genes and gene combinations. We are in the process of performing phenotypic analysis on those. This poster will detail those efforts.

USING AN UNMANNED AERIAL VEHICLE EQUIPPED WITH A MULTISPECTRAL SENSOR TO VISUALLY MAP WATER QUALITY PARAMETERS IN DRINKING WATER RESERVOIRS

Presenter: Komas, Jerome
Graduate, Geography, Geology, and the Environment

Mentor: Prof. Wondwosen Seyoum

Authorship: Jerome Komas, Wondwosen Seyoum, Catherine O'Reilly, Bill Perry

Surface drinking water infrastructure is an integral part of the development and sustainability of societies around the world. However, these surface freshwater resources have been a challenge to monitor due to the vast number of in-situ samples needed to accurately quantify constituents, expenses of equipment, coordination of personnel, and lab cost. Lake Bloomington and Evergreen Lake (Hudson, Illinois) are two vital surface water features that serve as the drinking water reservoirs for the Bloomington area. Both reservoirs are within agricultural watersheds, with watershed inputs typically being high in turbidity and nitrate.

We utilized an Unmanned Aerial Vehicle (UAV) coupled with a five band multispectral image sensor to monitor two important drinking water parameters in the lakes; turbidity and algae. By using the UAV, along with in-situ data collected the same day as the flight, we aim to answer the following questions: 1.) What are the challenges of remotes sensing over a homogeneous setting (such as a lake) and 2.) Is it possible to detect change in the water quality at the surface of the lake using one or more spectral image combinations?

Preliminary results show that at nearly 6 cm pixel size can produce greater than 80% coverage at each sample site and regularly above 90% coverage at 3 m resolution. Through several proprietary algorithms, we were able to explain 70% of the variation of Chl-a in the lakes. Although algorithms were created for Turbidity and TSL, both algorithms were only able to explain less than 20% percent of the variation of the observed samples. This poor correlation has to do in part with the low values and concentrations observed for both Turbidity and TSL respectively.

NANOMETER SCALE MATERIAL GROWTH AND PATTERNING

Presenter: Korveziroska, Amelia
Undergraduate, Physics

Mentor: Prof. M. Mahua Biswas

Authorship: Amelia Korveziroska, Marcos Perez

With the rise in emerging technologies in the field of microelectronics, optoelectronics, sensing and bioengineering exploring different patterning process for inorganic nanomaterial patterns with tunable size and spacing became imperative. In our work we grow nanometer scale inorganic material (such as aluminum oxide (Al_2O_3), titanium oxide (TiO_2), and zinc oxide (ZnO)) patterns using a vapor deposition method called sequential infiltration synthesis (SIS) which utilizes polymer material as a template. SIS enables the control of localized inorganic material growth in polymers which contains active chemical species; which results in nanopatterns of inorganic materials of similar size and spacing as the polymer materials. In our lab we explore new polymers and study the growth mechanism for growing different inorganic materials of different shapes. We evaluate the growth process and the material deposition using scanning electron microscopy and infrared spectroscopy. In this work we show Al_2O_3 nanoparticle growth using SIS and three different polymers as templates, performed at ISU Physics department. We analyze the SIS growth mechanism inside these three different polymers used in the study and resulting nanoparticles shape.

EFFECTS OF THE COVID-19 PANDEMIC ON UNEMPLOYMENT AND WAGES IN THE FOOD SERVICE INDUSTRY

Presenter: Kostrub, Kate
Undergraduate, Economics

Mentor: Prof. Eric Lenz

Authorship: Kate Kostrub

This presentation explores the effects of the government-mandated lockdowns of the COVID-19 pandemic on unemployment and wages in the food industry. Using monthly estimates from the U.S. Bureau of Labor Statistics for unemployment rates and hourly wages from 2011 to 2021, I analyze the changes in each variable before and after March of 2020. I regress the unemployment rates and wages on a binomial lockdown variable to determine a quantifiable relationship. To conclude, I show how wage increases are distributed over wage percentiles in both the food industry and all occupations by comparing the change in average hourly wages from before and at the height of the pandemic.

PURIFICATION OF SECRETED ACID PHOSPHATASE FROM LEISHMANIA TARENTOLAE

Presenter: Lai, Quyen
Undergraduate, Chemistry

Mentor: Prof. Marjorie Jones

Authorship: Quyen Lai

Leishmaniasis is an infectious disease caused by parasitic protozoans of the genus *Leishmania*. A potential target for drug design and treatment development for leishmaniasis is the enzyme Secreted Acid Phosphatase (SAP). This undergraduate research attempted to partially purify SAP from *Leishmania tarentolae* using ion exchange chromatography (Whatman DE51 and CM- Sephadex) and affinity chromatography (Con-A Sepharose 4B). The effectiveness of purification was evaluated via UV/Vis spectroscopy and polyacrylamide gel electrophoresis (PAGE) was used to estimate the molecular weight of SAP. The enzyme activity presented in each column fraction was detected by using p-nitrophenylphosphate (pNPP) as artificial substrate and monitoring product formed at 405 nm. At this time, only a little enzyme activity was retained in the columns. Adjusting the column length, the concentration and the pH of the elution solution might increase the amount of enzyme being retained. Analyzing the column flow-through fractions by PAGE resulted in two protein bands at approximately 28 and 62.5 kDa. However, a Brain Heart Infusion (BHI) medium control must be analyzed to confirm whether these protein bands were of the medium background or of SAP.

FOOD SECURITY AS A MEANS TO ADEQUATE HOUSING

Presenter: LaPorte, Manda
Graduate, Politics and Government

Mentor: Prof. Michael Hendricks

Authorship: Manda LaPorte

Housing is often referred to as a precondition to proper health, and that food security will follow. Global and U.S. organizations like the World Health Organization (WHO), UN-Habitat, Housing and Urban Development (HUD), United States Department of Agriculture (USDA), etc., have revolved their initiatives around the notion that housing will lead to food security and better health. However, we are still combatting alarming statistics for both food insecurity and housing inadequacy locally and globally. While no one is questioning the importance of either, no one is questioning the methodology linked to solving these issues. The purpose of this research is to do just that, provide a starting point for alternative approaches, research, and solutions to accessing these fundamental human rights. The study will utilize HUD's Housing Affordability Data System and Feed America's Insecurity Map and Data to track the relationship between reliable food security programs and adequate housing within rural America. The goal of this research is to answer the question; *does the improvement of household food security positively affect individuals' access to adequate housing? If so, how?*

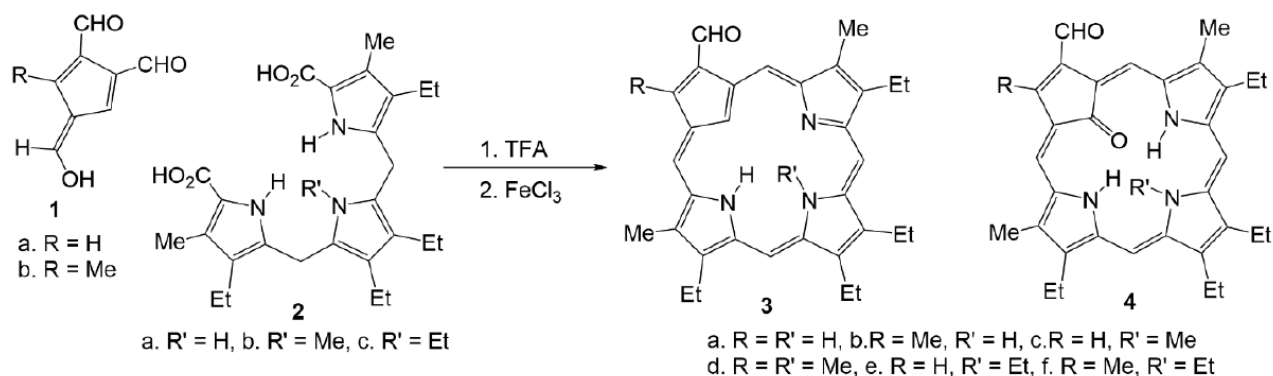
SYNTHESIS AND METALATION OF N-ALKYLCARBAPORPHYRIN ALDEHYDES

Presenter: Le, Kimberly
Undergraduate, Chemistry

Mentor: Prof. Timothy Lash

Authorship: Kimberly Le, Timothy Lash

Carbaporphyrins are porphyrin analogues where one or more of the nitrogens have been replaced with carbon atoms. Previously, trialdehydes **1a** and **1b**, derived from cyclopentadiene or methylcyclopentadiene, have been shown to react with tripyrranes such as **2a** under acidic conditions to give low yields of carbaporphyrin aldehydes **3a** and **3b**. In this study, N-alkyltripyranses **2b** and **2c** were reacted with trialdehydes **1a** and **1b** and following oxidation with ferric chloride, N-alkylcarbaporphyrins 3c-f were isolated in comparatively high yields (20-25%). In addition, minor byproducts **4c-f** corresponding to internally oxidized derivatives were also identified. The presence of an internal alkyl substituent alters the carbaporphyrin nucleus from being a trianionic ligand to a dianionic ligand. Metalation of these porphyrinoids with palladium II and nickel II acetate is currently under investigation.



FREEDOM WITH CONTINGENCIES: OBSTACLES TO LIFE AFTER PRISON

Presenter: Lowe, Megan
Undergraduate, Sociology/Anthropology

Mentor: Prof. Cristina Prestin-Beard

Authorship: Megan Lowe

We all have conceptions of life in prison, but what do inmates experience when they return to society after serving their sentence? Former prisoners face a myriad of obstacles which stand between them and truly returning to life outside of prison.

They lack what they had before incarceration. Familial relations, social networks, job security, and the guarantee of shelter are all liable to have changed in nature or be completely nonexistent after the duration of a prison sentence (Jones, 2021). They can no longer rely on things they had become accustomed to in prison. The structure of prison life can offer crucial support for inmates. In addition, medication and treatment that are provided and regulated in prison can offer stability not easily accessible after reentry into society (Vail, 2017). The world they come back to has changed during the time of their sentence. Technologies have evolved, and released prisoners reenter the world with a criminal record which can make employment difficult to find (Couloute & Kopf, 2018).

The transition back into society for a former prisoner is freedom with contingencies.

THE PRE-FLEDGE EDGE: INVESTIGATING THE EFFECTS OF NATURAL VARIATION IN ECTOPARASITE LOAD IN EUROPEAN STARLING NESTLINGS

Presenter: Lusk, Elliot
Graduate, Biological Sciences

Mentor: Prof. Joseph Casto

Authorship: Elliot Lusk, Noah Price, Joseph Casto

Ectoparasitism in nestling birds can have long-lasting effects on their growth and development by inducing trade-offs. These trade-offs have been detected as decreases in measures of physical development, hematocrit and hemoglobin production, and bacteria killing ability, and increases in blood glucose, interleukin-6, and corticosterone levels. Previous research in our lab has focused on the effects of experimental manipulation of ectoparasite load to study trade-offs but has typically relied on the addition or reduction of the blood-feeding Northern fowl mite (*Ornithonyssus sylviarum*) and has yet to directly examine unmanipulated levels of ectoparasitism. Surveying unmanipulated mite loads in nestling birds may give us a clearer picture of the prevalence and severity of ectoparasitism and its associated trade-offs. In this study, we examined natural Northern fowl mite burdens and their relationship with the growth and development of European starling (*Sturnus vulgaris*) nestlings. Nests were scouted for egg laying across four different nest box colonies over 3 months, and once nestlings hatched, they were followed throughout their early development. At 10 and 20 days of age, nestlings were examined for ectoparasites, assessed for physical growth, and blood was collected to determine parameters of hematological development and corticosterone levels. On day 20, one day prior to when starlings typically leave the nest, the nestlings were sexed and their brains were collected and, 24 hours later, nests were sampled for Northern fowl mite abundance. Mites were present in varying amounts in our nests and nestlings exposed to high mite levels exhibited trade-offs similar to those found previously in response to experimentally enhanced mite loads. Nestlings from high mite nests had lower day 10 and 20 hematocrit and brain weight than those from low mite nests. Female chicks from nests with high mite loads had shorter tarsus and wing length on day 20, and lower mass on day 10 and 20 when compared to male chicks in the same high mite nests. Testing immunological titers, such as the pro-inflammatory cytokine IL-6, may add support for a sex-specific growth-immunity trade-off.

DIVERSITY, EQUITY, AND INCLUSION EFFORTS OF FASHION RETAILERS

Presenter: McCleish, Danielle
Undergraduate, Family and Consumer Sciences

Mentor: Prof. Yoon Jin Ma

Authorship: Danielle McCleish

The purpose of this study is to evaluate various fashion brands on their practices of diversity, equity and inclusion. Diversity, equity and inclusion, or “DEI” practices in fashion brands can be demonstrated through the brands’ overall business practices, marketing and brand representation, company culture and manufacturing and sourcing strategies. Within the last five years, many fashion brands have evaluated their current strategies and updated their business practices to reflect the fast changing and more inclusive world around us.

For the current study, 20 different brands were evaluated. These brands were grouped into four different categories: Luxury Goods, Fast Fashion, Reputably Socially Responsible and Fan Favorites. Luxury brands were chosen based on item value and popularity, including Gucci, Burberry, Stella McCartney, Balenciaga and Louis Vuitton. Fast Fashion brands were chosen based off of the most popular low value but high design volume retailers, and include Shein, H&M, Forever 21, Zara and Uniqlo. The socially responsible brands were chosen based on their reputation of social responsibility, including Patagonia, Girlfriend Collective, Everlane, ABLE, and Outdoor Voices. Finally, the Fan Favorites were selected because they are all everyday retailers found in local shopping malls, and include American Eagle Outfitters, Nike, Victoria’s Secret, Gap Inc., and Urban Outfitters.

The data collection was completed via web search and the data were coded based on how the company fit into the given criteria, the answer to the question being presented, where the information was found and finally the number of clicks to find the information needed to answer the question. First, each brands’ company profile and brand demographics were evaluated through the brands’ mission/vision statement, their product distinction, target audience, number of retail stores, target audience, founding date and location, number of employees and finally their current revenue. Next, DEI were then broken up into three categories with questions respective to each term. In diversity, each brand was evaluated with questions under the subcategories of workplace leadership and workplace culture. In equity, transparency and environmental sustainability were evaluated, while in inclusion, company culture, marketing and brand representation and product line were examined. According to the findings, it was apparent that little to no of the brands met the criteria for all categories. The study shows that while many brands are headed in the right direction in terms of DEI, as an industry we still have a very long way to come.

GLOBALIZING LEFTY: MAKING CLIFFORD ODETS SPEAK TO THE PRESENT

Presenter: Meateanuwat, Sanhawich
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Authorship: Sanhawich Meateanuwat

I directed Clifford Odets's *Waiting for Lefty* at Illinois State University in fall 2021. As international director from Thailand, I found numerous connections between my voice and that of Odets, drawing parallels between this classic American labor play and the political issues and marches occurring in my home country right now. In this presentation, I will discuss ways my production team and I approached this play (written 86 years ago) through the themes of universality, placelessness, and timelessness to emphasize that these issues did not happen only in the past and in the U.S. but are currently happening all over the world. I will also describe ways we used presentational design elements to demonstrate a broken that needs desperately to be fixed. Ultimately, I want to discuss how we showed care and respect to the original story of the down-trodden workers while using theatrical devices (such as globally inspired sound transitions) to create a powerful argument for its global relevance. We sought to revolutionize this classic play with fresh eyes in order to provoke empathy and understanding for those who need it most.

GALAXY MERGER SIMULATIONS

Presenter: Miles, John
Undergraduate, Physics
Mentor: Prof. Matt Caplan
Co-Mentor: Prof. Neil Christensen
Authorship: John Miles, Matt Caplan, Neil Christensen

Galaxy mergers are postulated to be important for the formation of the Milky Way. Scientists have explored the creation of our present galaxy by running large n-body dynamic programs that simulate the evolution of galaxy mergers. By doing this, they have found evidence for a merger in our distant past. In our project, we have used a publicly available n-body simulation python code to observe the effect of tidal forces in galaxy merger events. We vary the mass, body number, galaxy number and inclination as well as the initial positions and velocities. We derive the acceleration from the Plummer model which utilizes the effect of cold dark matter (CDM) in a galaxy. In this talk, we will present the math, our code and some animations of the mergers.

COMBATting CIVIC DISENGAGEMENT: AN ANALYSIS OF YOUTH CIVIC ENGAGEMENT AND EDUCATION TRENDS IN THE UNITED STATES

Presenter: Northern, Grace
Graduate, Politics and Government

Mentor: Prof. Lori Riverstone-Newell

Authorship: Grace Northern

For a democracy to thrive, civic engagement must allow for participation from all of its citizenry. It is widely understood that the more civically engaged an individual is, the more likely they are to vote. Why is it then, that despite higher levels of youth engagement across the United States, there is still a decline in youth voter turnout? This essay seeks to address this paradox, employing a unique data set provided by the Center for Information and Research on Civic Learning and Engagement (CIRCLE). This data set offers insights into youth voter turnout in the United States from 2016-2018, as well as in non-electoral civic engagement activities such as volunteerism, group belonging, and community involvement. Using this data, this paper explores trends in civic engagement and the juxtaposition of high youth civic engagement and low youth voter turnout, and in some cases, vice versa. These results are further explored within the context of civic education standards in selected states. Among other findings, the language used in civic education standards appear to have an effect on youth engagement and voter impact. Finally, this paper advocates for a more diverse and dynamic public school civic engagement curriculum.

WHERE TWO WORLDS MEET: A COMPARATIVE STUDY OF THEORETICAL AND LITERARY INSIGHTS ON AFRICAN FEMALE IMMIGRANT EXPERIENCES IN THE UNITED STATES OF AMERICA

Presenter: Okonma, Jenefas
Graduate, Theatre and Dance

Mentor: Prof. Kee-Yoon Nahm

Authorship: Jenefas Okonma

Volumes abound on the discourse of African migration to the United States of America on the spectrums of both academia and literature. A relatively recent phenomenon of this discourse is voluntary African female migration, and where there is much to be had by way of resources documenting the experiences of female migrants from the far corners of theory-based and literary-based viewpoints, there doesn't exist much that reaches across those ends to present a cohesive outlook on the subject matter. My presentation aims to bridge that gap, as I conduct a comparative study on themes of female African migration discourse that are presented in the scholarly and literary exploration of the subject. Juxtaposing the scholarly works of African migration theorists such as John A. Arthur, Mary Johnson Osirim, Isidore Okpewho and Nkiru Nzegwu with the literary works of playwrights and authors such as Mfoniso Udofia, Chimamanda Ngozi Adichie and Imbue Mbolo, I draw out salient themes of Americanization, maintaining Africanness and race and ethnic relations, presenting both academic insights and experiential models of the discourse.

FACTORS DRIVING NUTRIENTS TREND IN THE ILLINOIS RIVER BASIN

Presenter: Oladuji, Olaoluwa
Graduate, Geography, Geology, and the Environment

Mentor: Prof. Wondwosen Seyoum

Co-Mentor: Prof. Eric Peterson

Authorship: Olaoluwa Oladuji, Wondwosen Seyoum

Water is one of the most useful resources available to mankind, as valuable as this resource is to lives, the demand for high quality potable water increases as populations grows. However, one of the major global challenges is related to water quality issues that come from excess presence of nutrients in water bodies. For example, excess nitrate and phosphorus in waterbodies has led to eutrophication and development of harmful algae bloom. This led to an increase in the hypoxia or dead zones in the Gulf of Mexico. The sources of these nutrients into waterbodies are transported mainly from point and non-point sources. The non-point sources are from agricultural activities through fertilizer application, animal waste, and natural atmospheric deposition of nutrients, while the point sources are from industrial and factory discharge, sewers, and wastewater treatment plants. This study seeks to understand the various factors driving nutrients trends in Illinois River basin with focus on nitrate and total phosphorus. The 2019 biannual report from the Illinois Nutrient Loss Reduction Strategies stated that there was about 13% increase in nitrate and 35% increase in total phosphorus across the statewide basins compared to the previous baseline of 1980-1996. To understand these nutrient trends compared to the previous baseline, this study will present trend analysis of nitrate and total phosphorus in the Illinois River basin using historical data. Recent daily timeseries data and statistical technique will be used to detect trends of nutrients loading in the Illinois river basin. The load of nutrients in the basin will be determined using LOADEST (load estimator). A non-parametric Mann Kendall test and Sen's slope will be used to analyze and detect the magnitude of the increasing nutrients with time. Cross correlation analysis will be adopted to understand the effects of watershed characteristics such as climate, hydrology, and landuse to these trends. The results for this study is expected to show a positive trend compared to the baseline, i.e., increase in nutrients trend in the Illinois River basin. The result for this study can help in water quality management and for the nutrient reduction plan by Environmental Protection Agency and Illinois Nutrient Loss Reduction Strategy program.

MEASURING THE MARKETING EFFECTIVENESS OF A SPECIAL EVENT - A CASE STUDY OF 2022 ADAPTALOOZA

Presenter: Olivares, Jonathan
Graduate, Kinesiology & Recreation

Mentor: Prof. Nicky Wu

Authorship: Jonathan Olivares, Nicky Wu

The world of marketing is evolving with new technology and more sustainable formats. Getting an event's message to the target audience is challenging because there are many weekly events from athletics, festivals, special events, and club meetings in a university setting. The study examines the 2022 Adaptalooza because it matches the university's core values of diversity and inclusion. Adaptalooza promotes these core values by offering adapted recreation activities, including wheelchair basketball, sitting volleyball, adaptive climbing, and virtual reality (VR). The event was given a \$4,000 marketing budget from the Diversity, Equity, Belongingness, and Inclusion (DEBI) grant. With the grant, the event hired a marketing team of ISU students and employed various marketing strategies such as social media marketing, event promotions on digital screens, flyers, post-card invitations, news articles, emails, and announcements. Four social media formats are Instagram, TikTok, Facebook, and Twitter. The event promotion was posted on digital screens at high-traffic areas such as McCormick Hall, Student Fitness Center, residence halls, dining halls, and the Student Bone Center. The event flyers are posted throughout McCormick Hall, residence halls, and other departments. Postcard invitations are delivered to selected faculty and staff whose job responsibilities are aligned with diversity, equity, belongingness, and inclusion. Lastly, emails/announcements are delivered from professors and advisors to students with possible extra credits offered to encourage participation. The purpose of the study is to examine key indicators of the marketing effectiveness in promoting Adaptalooza. The study will examine several social media marketing performance indicators such as post likes, followers, and interaction. Another measure used is the activity-based costing of these marketing tools. The study will analyze the cost-effectiveness of each tool and cross-examine with the data derived from the post-event survey. Lastly, the marketing tools will cross-examine with the event satisfaction questions such as willing's to recommend and return and overall level of satisfaction in the post-event survey. Through this data, one or more marketing tools will be recommended to various university marketing teams and departments to get their message across to members of Illinois State University, including future Adaptalooza and other events.

LEURS-I: A BLACK SHEEP SYNTHETASE

Presenter: Oliver, Ethan
Undergraduate, Biological Sciences

Mentor: Prof. Chris Weitzel

Authorship: Ethan Oliver, Evan Strandquist, Jonathan Brewster, Nick Bretz,
Christopher S. Weitzel

Aminoacyl-tRNA synthetases (aaRSs) are an ancient and ubiquitous set of enzymes vital for protein synthesis. They catalyze the addition of an amino acid (aa) to the 3'-end of their cognate tRNA in a process called aminoacylation or charging. The aa-tRNA conjugate is transported to the ribosome where the aa is incorporated into the growing polypeptide chain. We recently identified a conserved duplication of leucyl-tRNA synthetase (leuRS) within each member of the Sulfolobaceae family in the domain Archaea referred to as leuRS-F and leuRS-I. While leuRS-F was previously found to be essential for *Sulfolobus islandicus* and performs canonical activities associated with leuRS family enzymes. LeuRS-I was found to be deficient in its ability to charge tRNA^{Leu}-UAG yet it activates leucine and binds this tRNA substrate with affinities similar to LeuRS-F. Despite this, leuRS-I is vital for optimal growth and viability of *S. islandicus*. We postulate that leuRS-I may have evolved selectivity toward 1) a specific tRNA^{Leu} isoacceptor, 2) a tRNA substrate other than tRNA^{Leu}, or 3) tRNA substrates harboring endogenous post-transcriptional modifications. First, to confirm that leuRS-I is not a pseudo-gene, a *S. islandicus* strain was engineered expressing a chromosomally encoded leuRS-I bearing a C-terminal hemagglutinin (HA) tag. This tag was used as a handle to probe for the presence of leuRS-I and to preliminarily gauge expression levels as a function of *S. islandicus* growth. Subsequently, the five *S. islandicus* tRNA^{Leu} isoacceptors and a tRNA^{Leu} pseudogene were cloned, transcribed in vitro, and tested for their ability to stimulate leuRS-I activity. Methods for isolating endogenous, total tRNA were also developed. We report here the expression profiles, and the results of aminoacylation assays using each of these tRNA substrates with both leuRS-I and leuRS-F.

THE IMPACT OF REVITALIZATION ON ACCESS TO NATURE: ANALYZING GREENSPACE CHANGE IN SOUTH KENSINGTON, PHILADELPHIA

Presenter: Olson, Alexander
Undergraduate, Geography, Geology, and the Environment

Mentor: Prof. Alec Foster

Authorship: Alexander Olson, Alec Foster

Previous research has shown that greenspaces offer many environmental and social benefits for urban residents. The benefits that urban greenspaces provide improve neighborhood quality of life, and environmental justice concerns arise when they are distributed unevenly across a city's urban fabric. Greenspace access research has primarily focused on formal parks, neglecting informal greenspaces' potential to reduce disparities in access to urban environmental amenities. Our past research yielded insight into the distribution of formal and informal greenspaces (IGS) across the Olde and South Kensington neighborhoods of Philadelphia using high resolution aerial imagery. For this study we analyzed the changes of greenspaces in these neighborhoods over a six-year period, from 2010 to 2016. We documented 351 greenspaces in 2016, totaling almost ten percent of our study area. The vast majority were informal greenspaces, which on average were considerably larger than formal greenspaces. Our results highlight the potential of IGS to increase access to greenspace and address environmental justice concerns. We argue that public resources should support the stabilization of these liminal spaces while allowing local control and management to navigate environmental gentrification threats. Measuring/analyzing greenspace change will show how redevelopment processes impact greenspaces. By using widely accessible tools like Google Earth Pro, we hope to provide a method replicable for community groups and others interested in documenting urban environmental conditions in their neighborhoods. Replicating this study's methods for data acquisition on the distribution and temporal change of greenspaces within the communities of Philadelphia offers the opportunity to address environmental injustices within the city.

CONSTRUCTING HAPTIC GLOVES FOR VIRTUAL REALITY-BASED MOTOR SKILL LEARNING

Presenter: Osborne, Jordan
Undergraduate, Technology

Mentor: Prof. Isaac Chang

Authorship: Alex Diffor, Jake Weihe

With the advancement of visual computing technology and its affordability, job training through virtual reality (VR) environments has become a popular topic these days. The immersive experience allows the learners to develop a mental map of their task's execution and enables them to explore and try alternative solutions. Nevertheless, the induction of reported VR-based learning in most cases relies on computer-generated visual and auditory feedback. Consequently, motor skill acquisition through such VR environments is less favorable unless the enabling technology providing the much-needed haptic feedback is presented.

In this presentation, we will discuss an ongoing project investigating the basics of how the sense of touch affects human learning and determining the feedback mechanism, vibrating pattern, and signal strength for haptic gloves to properly support VR-based motor skill learning. Flex sensors mounted on the gloves are used to detect the user's hand gestures, and the signals are processed through Arduino controllers to allow him or her to interact with virtual objects. Haptic feedback will be provided by vibrating mini motor discs located on the glove's fingertip. The touch sensation is presented through actuating these discs independently or in combination. We will also present an experimental design to measure the effectiveness of haptic feedback for learning motor skills in engineering and technology

EFFECTS OF A NOVEL AMIDE GROUP ON SILYLOXYPYRONE-BASED [5+2] CYCLOADDITIONS

Presenter: Pauley, Kenneth
Undergraduate, Chemistry

Mentor: Prof. Andrew Mitchell

Authorship: Andy Mitchell, John Goodell

Cycloadditions are a foundational reaction toward construction of heterocycles. These ring systems exist in all living beings, and major examples of heterocycles are the four common nucleic acids of DNA that make up the genetic code¹. The Mitchell group studies the reactions of silyloxyprone-based [5+2] cycloadditions and has found contributing factors that influence cyclization. The rate of reaction is heavily influenced by the silyl transfer group with the large t-butyl-diphenylsilyl group accelerating the cycloaddition. Proximity of the olefin containing tether group to the transfer group also was found to influence cyclization with significantly more product observed from maltol-derived substrates. Lastly α,β -unsaturated esters were found to be more reactive than their terminal olefin counterparts². The specific focus of this presentation will be on the effects of the amide-based tethers and their effects on cyclization. The relationship between proximity and steric hindrance of a particular amide group (i.e., t-butyl amine) and the transfer group has given exciting results of cycloadditions proceeding at room temperature. The influence of this novel tether will be deduced from comparing a variety of substitution patterns of the alkene appended to the amide.

Reference List:

- (1) "Nucleic Acid." Genome.gov, <https://www.genome.gov/genetics-glossary/Nucleic-Acid>.
- (2) Jacob J. Bulandr, Jacob P. Grabowski, Chunyin M. Law, Jessica L. Shaw, John R. Goodell, and T. Andrew Mitchell. *The Journal of Organic Chemistry* 2019 84 (16), 10306-10320. DOI: 10.1021/acs.joc.9b01479

SPECULATIVE OBJECTS FOR A SUSTAINABLE FUTURE: ZERO WASTE VIRTUAL FASHION

Presenter: Pereira Gloor, Rochele
Graduate, Creative Technologies

Mentor: Prof. Kristin Carlson

Authorship: Rochelle Pereira Gloor

If any of us analyze the extent of the current climate crisis, we would stop wearing clothes made of plastic and would start wearing clothes made of computer data. Not that plastic is the sole proprietor of environmental and humanitarian devastation, but it is also a byproduct that surpasses cultural identity and sets us in the 4th industrial revolution timeline.

This creative research speculates the future of fashion by drawing speculative objects created with current and promising design software. These virtual and digital artifacts are intended to provoke new ideas about garment production and imagine preferable futures. Understanding how to design products virtually and visualize them before being produced brings new alternatives to the global business models. The tool I utilize is a 3D design software, called Clo, which was implemented for creating “true-to-life” garment simulations in virtual spaces before physical sampling and production, therefore, diminishing the use of natural and human resources. The sustainable fashion design method is zero waste pattern making, a holistic approach that doesn't generate textile residues. Lastly, the speculative design method utilized was STEEP scanning, focused on digital fashion technologies, sustainable practices, and global financial systems. During the first weeks of the research, I got acquainted with the user interface and tools of Clo while following pertaining tutorials and, after that, I followed a free artistic practice within the software. This practice resulted in speculating the boundaries between the continuation of our species and the embodiment of the physical garment, and how to find balance within these. Thus, a possible zero-waste future to work in favor of fashion design software. Foremost, the limitless artistic expression impersonated within this technology transported me to a future place. A place where humans are responsible and the only waste is computer data.

SILICON NANOPARTICLES FOR OPTICAL TWEEZING

Presenter: Perez, Marcos
Undergraduate, Physics

Mentor: Prof. Mahua Biswas

Authorship: Mahua Biswas, Uttam Mann, Marcos Perez

High Refractive Index dielectric (HRI) nanoparticles have arisen as competitive alternatives in nanophotonics research for their low loss compared to plasmonic (gold and silver) particles, and the possibility to generate Mie resonances of both electric and magnetic character, which can yield highly directional light scattering. One of the most celebrated and utilized method in the field of nanophotonics is optical tweezing method which is a contactless manipulation method of microscopic particles. In this regard, magnetic resonance based optical tweezing has not been explored before; hence fabrication and manipulation of Silicon (Si) nanoparticles with wellcontrolled size and shape will provide a novel platform for optical tweezing. In Applied Nanomaterials Lab at Illinois State University, we are using a high temperature fabrication method to obtain perfectly spherical and monodisperse Si nanoparticles of 150-200 nm dimension for tweezing purpose. The fabrication process begins with the high temperature (1500 oC) annealing of silicon monoxide (SiO) to obtain Si nanoparticles embedded in SiO₂ matrix. At the end, the Si nanoparticles are liberated from SiO₂ using hydrofluoric acid (HF) acid. We have imaged the particles using scanning electron microscopy, performed dynamic light scattering measurement to study particle size distribution, UV-VIS spectroscopy and single particles spectroscopy to characterize the scattering of the particles. In the next step, we are planning to perform optical tweezing experiment to trap these nanoparticles using a single beam laser source.

THE PSYCHOLOGY OF COMIC BOOK ADVERTISING GIMMICKS

Presenter: Radtke, Jacob
Undergraduate, Information Technology

Mentor: Prof. Eric Wesselmann

Authorship: Jacob Radtke, Eric Wesselmann

Comic book creators and industry executives, like most entertainment media professionals, have a key goal – to have their product purchased by consumers. As such, they have to make their products attractive so that they stand out among their competitors. Additionally, the growth of the collectors' market in the 1980s and 90s created an additional goal – create books that people will want to buy multiple copies of and preserve and/or re-sell for increased value. Sometimes comic book professionals approached these goals by providing novel story elements, such as having cross-overs between popular characters or by making major changes to characters and storylines (e.g., the unexpected death of a recognized character). Other approaches may involve novel visual elements such as employing 3-D techniques, collector's posters, or variant (and limited) cover art. Occasionally, professionals would employ outrageous gimmicks, such as shooting bullet holes through comics, providing a blank cover to encourage fans to "create your own cover," and even using celebrities' blood in the inking process! In this research, we will categorize different types of advertising tactics/gimmicks that have been used in the comic industry and imbed them within the psychological research on attention and persuasion to explore why these tactics/gimmicks can be effective at increasing product purchasing and collecting, and perhaps why some instead fall flat.

MACHINE LEARNING APPROACH TO FINDING DIFFERENTIAL EQUATIONS

Presenter: Rizo, Luis
Undergraduate, Physics

Mentor: Prof. R. Grobe

Co-Mentor: Prof. Q. Su

We examine machine learning techniques such as genetic evolution-based symbolic regression to construct exact and approximate differential equations and iterative maps for several dynamical systems. This method can recover the logistic map as well as the governing equations of motion for the Lorenz system from noisy chaotic time series. When symbolic regression is applied to numerical trajectories of nonlinear oscillators, it predicts a new iterative map for the orbits.

COULD INVASIVE SPECIES REDUCE THE RISK OF PARASITISM FOR NATIVE SPECIES? TESTING THE DILUTION EFFECT ON AEDES TRISERIATUS AND AEDES ALBOPICTUS

Presenter: Roden, Emerson
Undergraduate, Biological Sciences

Mentor: Prof. Steven Juliano

Authorship: Emerson Roden, Steven Juliano

The **dilution effect hypothesis** postulates that greater biodiversity of potential hosts can reduce parasite prevalence and abundance. **Encounter reduction** could occur if invasive species, or noncompetent hosts, remove parasites from the environment and reduce infections of competent hosts. An alternative mechanism is **host-host competition** which may occur if invasives compete with the native host, reducing its resource acquisition and its ability to support parasites. Alternatively, host-host competition may amplify infection if competition reduces host immune defenses. We tested for the dilution effect, and the possible mechanisms, using the North American tree hole mosquito *Aedes triseriatus* and its protozoan parasite *Ascogregarina barretti*, with *Aedes albopictus* as the invasive species.

We collected contents of 6 water-filled tree holes from a site where *A. triseriatus* and *A. barretti* are abundant. In the lab, we removed resident larvae and halved water and sediment of each tree hole. Both halves received a standard number of 1st instar *A. triseriatus* larvae. One of the halves was a control, while the other received the same number of 1st instar *A. albopictus* larvae. We dissected *A. triseriatus* 4th instar larvae and pupae from each treatment/tree hole.

ANOVA revealed no significant effects of treatment (**control, albopictus**) on infection for both *A. triseriatus* larvae and pupae. These results do not demonstrate dilution. Means for parasite numbers in both larvae and pupae are lower in the **albopictus** treatment than in the **control** treatment. This trend suggests that an experiment using more tree holes may be a useful follow-up to this study.

UNDERSTANDING THE REGULATION OF A NOVEL HOCL-STRESS RESPONSE SYSTEM IN UROPATHOGENIC ESCHERICHIA COLI

Presenter: Roseberry, Brendan
Undergraduate, Biological Sciences

Mentor: Prof. Jan Dahl

Authorship: Brendan Roseberry

Uropathogenic *Escherichia coli* (UPEC) is the most common causative agent of urinary tract infections. They reside harmless as commensals in the gut but turn into serious pathogens upon entry of the urinary tract. UPEC has an unusually high ability to successfully colonize despite the harsh environment of the urinary tract. Neutrophils are phagocytic cells of the innate immune system that engulf foreign pathogens and kill them through the production of reactive oxygen and chlorine species (RO/CS) species. RO/CS damage essential macromolecular structures within pathogens, leading to their death. Previous work in our lab demonstrated that, in comparison to other non-pathogenic *E. coli* strains, UPEC was significantly less susceptible to hypochlorous acid (HOCl), one of the most potent RO/CS produced by neutrophils. Additionally, we found that HOCl-stressed UPEC upregulate a UPEC-specific gene cluster, suggesting it may play a role in UPEC's resistance to RO/CS. Further experimentation elucidated the function of several genes within the operon and their relationship to one another. The expression of one particular gene was found to be essential for UPEC's resistance to HOCl as deletion of this gene rendered UPEC substantially more susceptible to HOCl comparable to non-pathogenic *E. coli*. The goal of this research project was to investigate impact of additional physiologically relevant RO/CS on the expression of these genes. I performed quantitative real-time PCR to quantify changes in the expression of these genes in HOCl-stressed UPEC. My data contributed to our now full picture of signals that activate the expression of these genes and the role they play in UPEC's response to stress from RO/CS. The ability to withstand the chemical stressors of the innate immune system is essential to UPEC's ability to successfully colonize the urinary tract. Understanding the precise mechanism and genes involved in UPEC's response to this stress could uncover potential candidates for drug targets and UPEC-specific treatment options.

USING A TRACER TEST TO ASSESS THE TRANSPORT AND FATE OF NITRATE WITHIN A SATURATED BUFFER ZONE

Presenter: Sahad, Alhassan
Graduate, Geography, Geology, and the Environment
Mentor: Prof. Eric Peterson

Authorship: Wondwosen Seyoum, Catherine O'reilly

The Upper Mississippi Basin (UMB), which includes Illinois, has highly fertile soils and therefore, experiences intensive agricultural practices. While fertile, the soils do not drain well, resulting in the installation of tile-drainage systems. Agricultural practices within the UMB include the application of nitrogen (N)-rich fertilizers. The tile systems coupled with the application of N have led to the excessive export of nitrates (NO_3^-) from the agricultural fields into surface and subsurface waters through subsurface tile drainage systems. Excess NO_3^- contributes to eutrophication and to development of hypoxic zones in aquatic environments. One method that has exhibited success in lowering nitrate (NO_3^-) concentration is the diversion of tile drained waters from the agricultural fields into a saturated buffer zone (SBZ) before the water enters a stream. A SBZ is an area of perennial vegetation between agricultural fields and water ways where a tile-outlets drain. The SBZ serves as a sink where NO_3^- is reduced through natural processes such as plant uptake, denitrification, and dilution with groundwater. Previous works have shown a reduction in the NO_3^- content in the SBZ, but the extent to which this removal occurs cannot be quantified without knowing the residence time of the water through the SBZ. Our goal was to use sodium bromide (NaBr) and sodium chloride (NaCl) as tracers to determine the residence time of the tile waters in a SBZ at the T3 site in Hudson, Illinois and to quantify the amount of reduction or dilution of the NO_3^- in the SBZ using a mixing model. Results from the tracer test show an average groundwater velocity of 0.36 m/day with a standard deviation of 0.18 m/day, using the arrival time of the chloride tracer and 0.61 m/day with a standard deviation of 0.24 m/day using the arrival times from the bromide tracer. The residence time of the NO_3^- is estimated to be between 40 days to 50 days. The average horizontal hydraulic conductivity from the tracer test was calculated to be 6.62×10^{-5} m/s, which conforms with results obtained from slug tests performed on the site (3.03×10^{-5} m/s). The results from the mixing model showed a significant reduction in NO_3^- of about 80% within the period of 40 to 50 days. This research further reinforces the effectiveness of using SBZ as NO_3^- reduction strategy.

THE ROLE OF COMMUNITY RELATIONS IN CREATING A POSITIVE IMAGE: AN EXPLORATORY STUDY OF UNIVERSITY MARKETING AND COMMUNICATIONS

Presenter: Sam-Paintsil, Benjamin
Graduate, Communication

Mentor: Prof. John Baldwin

Authorship: Benjamin Sam-Paintsil

Community relations is a valuable tool to the success of every organization. Even nonprofit organizations like universities may struggle to thrive if there are little or no relations between the organization and its community. However, Bruning et al. (2006) argue that instead of creating mutually beneficial relations, many universities have viewed the community as a “client” and “focused their efforts on fulfilling contractual responsibilities to ensure the flow of federal dollars” (p. 126). Kim et al. (2006) stress that the relationship between a university and its local community should go beyond the point where students simply “get along well with” community members. Therefore, this study aims to explore the activities that a University Marketing and Communications (UMC) office in a mid-Western university in the United States engages in to create a positive image for the school. It also examines the strategies the UMC adopts to manage crises with the university’s local communities.

Using a narrative design, I recruited and interviewed six participants for approximately 30 minutes each, asking about their community relations activities and the strategies their office adopts in managing crises between the university and its local communities. I followed Braun and Clarke’s (2006) six phases of thematic analysis to code the data into themes. The study showed that the UMC engages in four types of activities to create a positive image for their university. These activities include campus-related activities, community-related activities, alumni-related activities, and social intervention activities. Each activity has its own target audience, but the general goal is to engage the local communities.

In managing crises between the university and its local communities, the UMC follows five of the guidelines discussed in Seeger’s (2006) “Best Practice in Crisis Communication” framework: (1) Pre-event planning, (2) Partnerships with the public, (3) Listen to the public’s concerns and understand the audience, (4) Honesty, candor, and openness, and (5) Collaborate and coordinate with credible sources. The UMC also follows two other guidelines that are not captured in Seeger’s framework: (1) Respond in a timely fashion and (2) Address social media complaints as a real-world crisis.

Limitations include that the study was conducted at only one university in the Midwest in the United States. It would be helpful to replicate the study in more than one university in different States. Second, the study examined community relations from the perspective of a university. Future studies should explore university-community relation from community members’ perspective. Finally, the results of this study rely on the experience of only six participants. Future research may recruit more participants.

EL TEATRO CAMPESINO AND SOLIDARITY

Presenter: Samuel, Isabel
Graduate, Theatre and Dance

Mentor: Prof. Bruce Burningham

Authorship: Isabel Samuel

In 1965 Luis Valdez founded El Teatro Campesino as a collective theatre group in order to artistically support the Delano grape boycott and La Huelga led by the United Farm Workers. Through the production of improvisatory actos that could tour around various farms, El Teatro Campesino promoted the idea that Mexican farmworkers must band together in order to fight for humane and livable working conditions. Even after El Teatro Campesino formally separated from the United Farm Workers in order to focus their productions on the full breadth of the Chicano experience, the theatre collective still sought to bring the Chicano community together. It is El Teatro Campesino's origin as a pro-labor theatre collective that proves the importance of solidarity in the Chicano theatre movement.

BIOLOGICAL FUNCTION AND MOLECULAR FEATURES OF KIF3A/KIF3B/KAP AUTOINHIBITION

Presenter: Sawe, Caleb
Graduate, Biological Sciences

Mentor: Prof. Martin Engelke

Authorship: Caleb Sawe, Ayoola Fasawe, Alex Murarus, Jessica Adams, Martin Engelke

Heterodimeric kinesin-2 (KIF3A/KIF3B) motor proteins drive intracellular transport and the formation of cilia, which are found in most eukaryotic cells. Mutations in this motor have been shown to affect cilia formation and have been linked to human disease. However, little is known about how its activity is regulated. Generally, the activity of many kinesin motors is regulated by autoinhibition. To delineate the autoinhibition mechanism of this motor, we express a series of chimeric and truncated constructs in *Kif3a/Kif3b* double-knockout 3T3 cells.

We find that motor constructs in which the stalk and tail domains of KIF3A and KIF3B have been swapped strongly accumulate in the periphery of the cell, indicating loss of autoinhibition. Interestingly, these motor constructs also do not make cilia demonstrating that autoinhibition is indispensable for the KIF3A/KIF3B motor to drive ciliogenesis. Expression of further chimeric motors suggests that one or both tails, as well as the coiled-coiled domains, are critical features for regulating autoinhibition. Finally, we find that a short stretch of amino acids (593-619) in the tail domain of KIF3B is necessary to inhibit motor activity.

Thus, our data suggest that the autoinhibition mechanism of KIF3A/KIF3B may resemble the single tail inhibition mechanism of KIF5; or the intercalation of the coiled-coil regions between the motor domains as seen in KIF17; or both. These findings provide the groundwork for unraveling the molecular basis for KIF3A/KIF3B autoinhibition in cells and how this motor is regulated for intracellular transport and ciliogenesis.

SHORT-TERM FOLLOW-UP OF SWALLOWING SAFETY IN POST-STROKE SURVIVORS

Presenter: Schuck, Morgan
Undergraduate, Communication Sciences and Disorders

Mentor: Prof. Taeok Park

Authorship: Morgan Schuck

Dysphagia is a prevalent disorder among stroke survivors. A common concern for these individuals is aspiration, or the passage of foreign material into the airway. This study was conducted in order to determine the progress of swallow safety through the analysis of videofluoroscopic swallowing exams (VFSE) of three different boluses: 2 mL of thin liquid, 5 mL of thin liquid, and 5 mL of puree. Twelve stroke survivors resulting from unilateral middle cerebral artery infarction, unilateral corona radiata infarction, or unilateral basal ganglia intracerebral hemorrhage participated in this study. VFSE data was collected at Seoul National University Hospital. All participants were in the acute or subacute stage of stroke at their initial evaluation. After conducting their initial evaluation, participants were involved in thirty-minute therapy sessions until their followup evaluation 3-5 weeks later. Penetration-Aspiration (PA) scale scores of the two evaluations were compared between participants to determine if any improvement had occurred. The PA scale was used to score their swallows on a scale of 1 to 8. Lower scores are considered least severe, while higher scores are considered more severe. A score of 1 indicates a normal swallow, 2-5 marks penetration, and 6-8 reveals aspiration. Analysis of these scores shows no significant change in mean PA scale score for any of the volumes or consistencies between the initial and follow-up examinations. Examination of the initial and follow-up evaluations show that only three of the twelve participants showed a decreased PA score. In addition, five of the twelve dysphagia patients showed no change. One participant showed an increased PA score, but it was between two different volumes. However, it was found that puree consistency did result in a slightly lower mean PA score (5 mL Initial: 1.47, Follow-up: 1.62) than thin liquids (5 mL Initial: 2, Follow-up: 2.35). Puree consistency was shown to have the lowest mean PA score of the three. Most participants in this study scored a one or two on the PA scale at the initial evaluation, with one individual showing silent aspiration (PA score of 8) in the follow-up evaluation. This mild presentation could be a factor in why so few participants showed progress. In addition, this study demonstrates that the PA scale can be a tool to quantify the changes of swallowing safety for patients. Future studies should include a larger sample size, various measurements, and to evaluate participants for 1 longer periods of time.

THE INFLUENCE OF THE FACETS OF OPENNESS TO EXPERIENCE ON MUSIC PREFERENCE

Presenter: Setti, Fabio
Graduate, Psychology
Mentor: Prof. Jeffrey Kahn
Authorship: Fabio Setti

Listening to music is a widespread and time-consuming activity for many people (IFPI, 2019). Given this, knowing why people prefer certain kinds of music is psychologically meaningful. Trait openness to experience appears to be a reliable predictor of music preference (Dunn et al., 2012; Rentfrow & Gosling, 2003), yet the ability of facets of openness to experience to predict music preference has yet to be explored. We explored the relation between the singular facets of openness to experience and music preference. Additionally, latent profile analysis (LPA) was used to uncover possible latent classes of music preference according to participants' response patterns.

Procedure

College students (N =478) participated in an online study. Facets of openness to experience were measured consistent with the five-factor model (Costa & McCrea, 1990) and the HEXACO model of personality (Lee & Ashton, 2004). Music preference was measured by the Short Test of Music Preference Revised (STOMP-R; Rentfrow et al., 2011) and participants' liking ratings of 20 musical excerpts selected from Rentfrow and colleagues (2011). Both measures should produce five factors of music preference (sophisticated, unpretentious, intense, contemporary, mellow).

Results

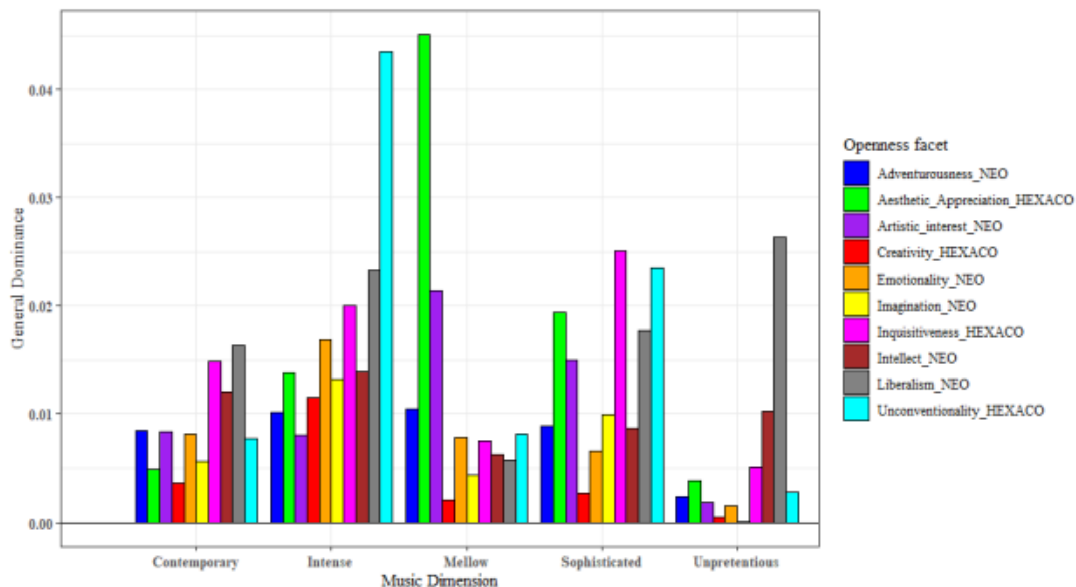
principal axis factoring (PAF) revealed that the STOMP-R did not reproduce the five dimensions of music preference, whereas the five-factors structure of music preference measured by musical excerpts was supported (sophisticated, unpretentious, intense, contemporary, and mellow). Due to multicollinearity among predictors, dominance analysis (Azen and Budescu, 2003) was used to interpret the results (Figure 1). Latent profile analysis (Figure 2) revealed three profiles of music preference among respondents. The 3 profiles were significantly different in mean liking of the 5 music preference; additionally, profile membership was significantly related to ethnicity, (Table 1).

Conclusions and Implications

There is evidence of association between openness facets and music preference. Additionally, it appears that some facets of openness to experience predict music preference better than other. This poster will explicate those results. Moreover, we will discuss the potential advantage of examining the association between personality and latent profiles of music preference as a complement to dimensional measures of music preference.

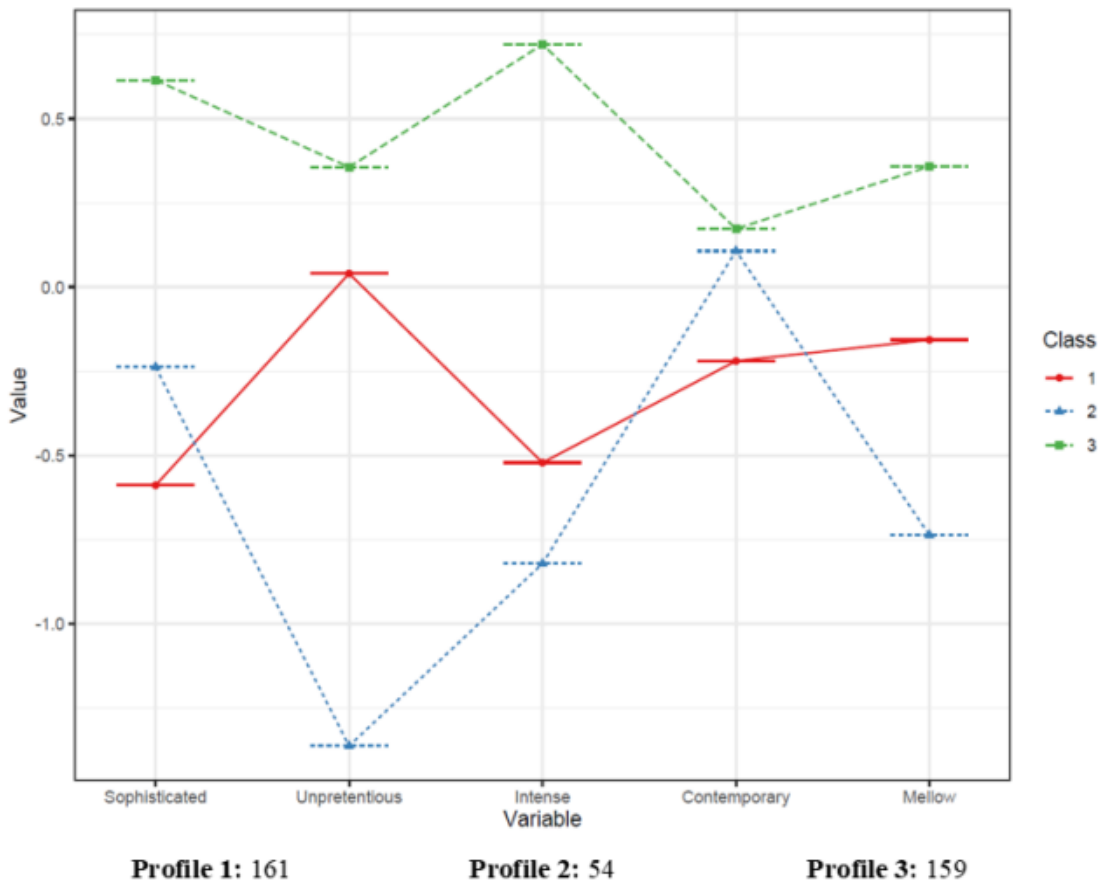
Figure 1

General Dominance Indexes for the 10 Openness Facets Predicting the 5 dimensions of music preference.



note. The x-axis represents the 10 openness to experience facets clustered according to music preference dimensions. The Y-axis represents the general dominance index of each of the openness to experience facets.

Figure 2
Standardized Profiles for a 3 Latent-Profile Solution



Note. Dimensions of music preference are displayed on the X-axis, which is labeled as “Variable”. The Standardized preference ratings for each dimension of music preference are displayed on the Y-axis, which is labeled as “Value”. The estimated number of participants for each profile is displayed right below the graph.

Table 1*Cross Tabulation of Profile Membership and Ethnicity*

Profile	Ethnicity			Total
	White	Hispanic	African American	
1	132 (85.16%)	12 (7.74%)	11 (7.1%)	155
2	20 (40%)	11 (22%)	19 (38%)	50
3	119 (82.64%)	22 (15.28%)	3 (2.08%)	144
Total	271	45	33	349

Note 1. Numbers in parentheses represent the percentage of the ethnicity in each profile.

CHARACTERIZING THE INTERACTION BETWEEN P38KB AND REF(2)P IN PROTEIN HOMEOSTASIS

Presenter: Shosanya, Teni
Undergraduate, Biological Sciences

Mentor: Prof. Alysia Vrailas-Mortimer

Authorship: Teni Shosanya, Alysia Vrailas-Mortimer

As organisms age they accumulate misfolded and damaged protein that can lead to protein aggregation, which can be toxic and lead to a diseased state and eventual death of the cell. We have recently found that the p38 MAP Kinase (p38Kb) plays a major role in regulating protein aggregation in *Drosophila melanogaster* through its interaction with the Chaperone Assisted Selective Autophagy (CASA) complex. The CASA complex is a pathway that helps with the degradation of the misfolded and damaged proteins to prevent protein aggregation. The chaperone proteins in the complex refolds the proteins. The proteins that cannot be refolded are polyubiquitinated and are handed over to a protein called ref(2)p for degradation. We hypothesize that p38Kb binds to ref(2)p to help facilitate the handoff of the target protein for degradation. We have identified several regions in ref(2)p that p38Kb may bind to or phosphorylate. To understand the role that p38Kb plays in regulating the CASA complex and ref(2)p mediated protein degradation, we have made transgenic flies in which these different p38Kb sites are mutated in ref(2)p. The effects of these mutations in ref(2)p were analyzed using a western blot to see if the mutations could change the stability of ref(2)p. We find that certain mutations in ref(2)p affects the detection and stability of the protein. In future studies we will use Co-immunoprecipitation experiments to test if these regions are important for binding between p38Kb and ref(2)p.

THE SIMS FRANCHISE, A RETROSPECTIVE OF RACIAL REPRESENTATION AND SKIN TONES

Presenter: Stipp, Lauren
Undergraduate, Creative Technologies

Mentor: Prof. Sercan Şengün

Authorship: Lauren Stipp, Sercan Şengün

The Sims video game franchise is a staple of life simulation games. Ever since the first game was released on February 4, 2000, the franchise has been extremely popular (Nutt and Railton, 2003). The game started out with presets of clothing and shoes, three skin tones, five personality traits, two ages, and two genders. The first game in the series did not allow for much representation for gamers to express their individuality. As Albrechtslund (2007) puts it: "a successful life in The Sims [is] tied to a certain way of living both in gameplay and game representation." In this work, we trace the changes of identity representation in The Sims franchise over the years, specifically from the lenses of racial representation and skin tones.

INVESTIGATING THE EDITING MECHANISM OF AN ARCHAEAL LEUCYL TRNA SYNTHETASE

Presenter: Strandquist, Evan
Graduate, Chemistry

Mentor: Prof. Chris Weitzel

Authorship: Evan Strandquist, Ethan Oliver, Jonathan Brewster, Christopher S. Weitzel

Aminoacyl-tRNA synthetases (aaRSs) are an ancient class of hyper-specific enzymes that catalyze the esterification of the appropriate amino acid to the 3'-end of their cognate tRNAs, fulfilling a pivotal role in RNA translation. Faithful protein synthesis requires aaRSs to discriminate against chemically similar, non-cognate amino acids. In the case of aaRSs utilizing hydrophobic amino acids, this fidelity involves robust editing mechanisms targeting either misactivated amino acid adenylates (pretransfer editing) and/or mischarged amino acid-tRNAs (post-transfer editing). The archaea *Sulfolobus islandicus* expresses two copies of leucyl-tRNA synthetase (LeuRS) where one, designated LeuRS-I, contains key amino acid substitutions within its connective polypeptide 1 (CP1) editing domain that would be expected to severely disrupt post-transfer editing and introduce substantial variation to the proteome via mistranslation. Another copy, LeuRS-F, contains the canonical active and editing sites. Further investigation of these paralogs supports the hypothesis that LeuRS-F, but not LeuRS-I, is involved in the accurate charging of leucine to tRNA^{Leu} for protein synthesis. To further probe the editing proficiency of LeuRS-F and the potential activity of LeuRS-I, point mutations were introduced at key amino acid residues in the CP1 domain of LeuRS-F that mimic those found in LeuRS-I. These residues include the universal aspartic acid at position 315, threonine at 221, and valine at 308. Aminoacylation assays were performed to probe any changed activity relative to wild-type protein. Pyrophosphate exchange assays were also performed to probe the ability of LeuRS-F, LeuRS-I, and a triple-point mutant LeuRS-F to adenylate non-cognate amino acids. This work shows that key mutations in the editing domain of LeuRSF does not reduce the enzymes fidelity as would be expected. Additionally, pyrophosphate exchange assays involving non-cognate amino acids such as isoleucine, valine, and cysteine may show that these mutations lead to a greater specificity for leucine relative to these non-cognates. These data demonstrate the vigorous editing power of LeuRS-F, suggest a potential non-canonical function of LeuRS-I, and may show the unexpected retention of editing capability of a mutated, class 1a aaRS in this archael model

EFFECTS OF GAIN AND LOSS MOTIVATIONAL INFLUENCES ON PROSPECTIVE MEMORY

Presenter: Symonds, Halle
Undergraduate, Psychology

Mentor: Prof. Dawn McBride

Authorship: Halle Symonds

This study investigated the relationship between prospective memory and motivation using a 3x2 design with gain, loss, and control factors using a lexical decision task with focal and nonfocal task cues. I associated a gain-frame with a numerical gift card entry increase and for remembering to respond to cues and a loss-frame with a numerical gift card entry loss for failing to respond to cues and compared these frames to a no-frame control condition with no contingency linked to performance. I hypothesized that frames with gain and loss intentions will show a higher PM performance than frames without value-added intentions. Additionally, I hypothesized that focal tasks will result in a higher PM performance than nonfocal tasks due to the easier extraction of focal cues. Following the experiment, I found an increase in PM performance for the gain-frame and loss-frame conditions relative to the no-frame conditions. There was also an increase in PM performance for the focal cues as compared to the nonfocal cue performance across all frames. These results have implications for how people may be motivated to do everyday tasks in a real world setting when a potential gain or loss is associated with task completion.

HUMAN IMPACTS ON EROSION RATES IN STARVED ROCK STATE PARK, IL

Presenter: Thielbar, Savannah
Graduate, Geography, Geology, and the Environment

Mentor: Prof. Lisa Tranel

Authorship: Savannah Thielbar

State and national parks are some of the most visited wildlife areas within the United States, allowing the local geology to become more susceptible to human-induced change. As more people visit these parks throughout the year, we see major impacts on wildlife, plant life, and the geological structures present. Multiple concerns arise from these impacts, including how human activity can cause potential for hazardous conditions in the future. This study will determine if human activity influences erosion rates within Starved Rock State Park. From the data we can assess if the impact could create a potential for mass-wasting events within the park. Mass wasting events can pose a substantial risk for humans in areas where geology is influenced by large relief, including cliffs or mountainous terrains. The sandstone cliffs found within Starved Rock State Park preserve human-created carvings allowing us to obtain specific erosion data. Through natural and artificial erosion, the base of the slope is weathering at a much faster rate than the upper portion of the bedrock outcrop. If any part of this stratigraphic unit becomes unstable due to the undercutting from erosion, we could see rock falls or an entire rockslide that could become hazardous for anyone within the general area. Our objectives are to evaluate the effects of human activity on erosion rates within various canyons. From those results we can determine if those erosion rates could produce a weak spot for possible hillslope deformation, as well as investigate whether seasonal changes can accelerate these processes. By obtaining bi-monthly contour data on specific carvings within selected canyons across the park and using cosmogenic nuclide age dating from fluvial sediment within the streams, we can start to determine if erosion rates have accelerated within recent years due to human activity. Focusing on the factors that drive these erosion rates will provide valuable knowledge that can be used as a tool for education and awareness at other state or national parks.

EXPLORING THE CRISIS RESPONSE OF LOCAL NONPROFIT ORGANIZATIONS DURING THE COVID-19 PANDEMIC

Presenter: Thomas, Hunter Graduate,
Communication

Mentor: Prof. John Baldwin

Authorship: Hunter Thomas

By classifying the COVID-19 pandemic as a victim crisis that effects all organizations, this study explores the crisis response of local nonprofit organizations in a small midwestern town and finds that these organizations have held a greater focus on priorities other than reputation repair and maintenance during the COVID-19 pandemic.

When an organization faces a crisis — any phenomenon that challenges their reputation — their response is important to repair or maintain that reputation and thus their ability to profit, operate, or survive. Existing literature provides strategies for responding to a crisis based on its severity, attribution of responsibility, and an organization's past reputation. However, the COVID-19 pandemic is a crisis unlike many organizations have faced before, given its global reach and associated health and safety guidelines that have regularly changed and often led to an organization's inability to engage with stakeholders in-person.

The COVID-19 pandemic is also different than many crises given its classification as a victim crisis — a particular type of crisis for which an organization is not directly responsible. That is, in this study, organizations were not directly responsible for causing the pandemic.

In preparation for crises, organizations often proactively develop crisis response plans. However, no one could have predicted the COVID-19 pandemic. And literature suggests that, even when plans are in place, organizations may not always follow them in the moment. Plausibly, this would especially be the case during a crisis never faced before.

Findings from a constant comparative analysis of eight semi-structured interviews with leaders of local nonprofit organizations suggest that these organizations have held a greater focus on informing, engaging, reflecting on, and collaborating with stakeholders and other organizations during the COVID-19 pandemic rather than reputation repair or maintenance. In turn, local leaders consider the outcomes of their responses to be successful overall.

The implications of this study include useful suggestions for future crisis response planning — for example, for organizations to establish multiple channels of communication with their stakeholders and foster inter-organizational relationships.

AUTOMATED CONSTRUCTION PROGRESS MONITORING FOR BRIDGE INSPECTION

Presenter: Vanka, Venkata Sai Vikas

Graduate, Technology

Mentor: Prof. Sally Xie

Authorship: Venkata Sai Vikas Vanka

The costs of bridge maintenance, repair, and rehabilitation (MRR) are enormous every year. One critical element to consider in deciding measures is the condition ratings of the bridges. Hence, accurately examining and evaluating bridge conditions are crucial to reliable planning for bridge MRR activities and estimating the costs. Currently, bridge engineers use visual inspections and deterministic models like a transition probability matrix (TPM) for this purpose. The TPM forecasts future conditions based on a Markov Chain model, which is a stochastic model for a sequence of events. Each event has a probability calculated from the state obtained in its previous event. However, such a model assumes a constant TPM over the entire life of the element, hence having a memory-less behavior (i.e., the future state depends only on the current state but not further earlier states). Additionally, these models rely on collected inspection data to form the TPM for the condition ratings but neglect influential variables such as age and traffic. The overall objective of this research is to automate the collection and analysis process of the element-level inspection data from the national bridge inventory. We will use the 3D scanned point-cloud datasets of ten bridges from an open-source database and the Simultaneous Localization and Mapping (SLAM) technology to estimate bridge damages. Then we will update the deterioration curves of the bridges that are identified as in accelerated delineation. This proposed system will provide the basis for the transportation agencies, such as the Illinois Department of Transportation when making practical and optimized maintenance, rehabilitation, and repair decisions.

THE NEXT GENERATION OF HANDS-ON LEARNING FOR DISTANCE EDUCATION

Presenter: Weihe, Jake
Undergraduate, Technology

Mentor: Prof. Isaac Chang

Authorship: Jordan Osborne, Alex Diffor, Isaac Chang

Engineering Technology (ET) is a well-established undergraduate technology major. Students of this discipline are equipped with engineering design and analysis skillsets and hands-on abilities to operate and trouble-shooting different equipment in the field. The ET graduates bridge the engineers and operators throughout the product life cycle and help realize the successful delivery of products and services. During the recent pandemic, many universities moved the majority of their courses to the online format. Although the faculty members at ET were able to deliver most of the content remotely via multisensory pedagogies, the muscle memory from physically operating equipment was missing: Some students struggled with comprehending process knowledge when some others felt bored and lost motivation. Being part of the community, we ask ourselves: Can we help improve students' remote learning by offering a sense of touch?

In this presentation, we will present a research project studying the effectiveness of different human-computer interfaces (HCI) on supporting haptic feedback in an immersive virtual environment. Participants of this study will use three different input devices, namely, a VR headset controller, an infrared motion sensor, and a haptic glove to complete the assigned tasks. The individual's learning performance will be measured by his or her speed and accuracy for task completion. Statistical analysis of experimental results will be discussed. A self-reported post-test survey will be used to determine the individual's learning experience and preferences to help explain the experimental findings. We will conclude the presentation with recommendations in the context of distance education.

DRUNK DRIVERS ARE WASPS

Presenter: White, Leila
Undergraduate, Philosophy

Mentor: Prof. Daniel Breyer

Authorship: Leila White

Moral responsibility is one of many philosophical discussions. It is, at large, what will be discussed here. The more accurate focus of this presentation is moral luck or the moral responsibility of accidental agents who lack control of a situation in which they've acted. Is control required of an agent to ascribe moral responsibility to them? To explore this inquiry, we look at two cases of drivers.

The first is the lorry driver who, to no fault of their own as they are completely sober and alert, hit and kills a child while driving. The lorry driver is regarded as an accidental agent without moral responsibility. The second is the drunk driver who, being intoxicated and not alert, hit and kills a child while driving. Both drivers are generally regarded as matters of moral luck since the only difference between them killing and not killing the child would be a matter of luck or chance. For instance, had the child been elsewhere or either driver been given a ride, left their destination earlier/later, decided to stay in bed that morning, etc., they might not have even been there to hit and kill the child.

Three puzzles stem from these two cases of moral luck which will be solved:

- 1) Why is it that the lorry driver still feels agent-regret, or guilt?
- 2) Is this feeling appropriate given the lack of fault and moral responsibility?
- 3) Why do those observing the scenario of the lorry driver say that such accidental agents aren't morally responsible and shouldn't feel guilt, yet, condemn them if they don't feel guilt or 'get over' their guilt too quickly?

In solving these puzzles, I intend to prove that the lorry driver is an instance of true moral luck whilst the drunk driver is not. For this reason, among others, the drunk driver ought to be held morally responsible and the lorry driver should not.

2022 University Research Symposium Group Abstracts - Afternoon Session

UNIVERSITY STUDENTS' TRUST IN SCIENTISTS AND THE CDC WHEN EVALUATING INFORMATION ABOUT THE COVID-19 PANDEMIC

Group Leader: Allen, Tae'lor
Undergraduate, Biological Sciences

Group Member: Kendy Reyes-Cruz, Undergraduate, Biological Sciences

Mentor: Prof. Rebekka Darner

Authorship: Tae'lor Allen, Kendy Reyes-Cruz

COVID-19 is an infectious disease caused by the SARS-Cov-2 virus, which likely emerged through a spillover from a viral reservoir bat population in China in late 2019. Since that time, COVID-19 has caused more than 5.22 million deaths worldwide. The SARS-Cov-2 causes respiratory illness and is especially serious for those with chronic illness, including cardiovascular disease and diabetes. Despite evidence that masking, vaccination, and social distancing prevent illness, such measures are controversial among some ideologies. We embarked on this study to better understand how college/university students evaluate scientific information related to the pandemic in this contentious context. College/university students are of particular interest because they are emerging adults, undergoing substantial identity development as they differentiate their unique identities from that of parents and other influential adults. Through semi-structured clinical interviews, we investigate college/university students' self-reported social-distancing behaviors, opinions about the pandemic, dis/trust in scientists and the Centers for Disease Control and Prevention (CDC), and reasoning patterns when evaluating information related to the pandemic. The first two presenters, student near-peers, conducted the interviews of five college/university students. Interviews were transcribed and qualitatively coded by both presenters and their mentor. Emergent codes included politicization of the pandemic, dis/trust in the CDC, dis/trust of scientists, pandemic-related conflict with family/friends, and issues of identity. A cluster analysis among between codes will reveal associations and patterns among these codes, thereby allowing evidence-based hypotheses to explain how social expectations related to the pandemic influence college/university student identity development.

COMPARISON OF LARGE AND SMALL HOSPITAL'S IN HEALTHCARE ASSOCIATED INFECTIONS IN ILLINOIS

Group Leader: Buhmann, Grace
Undergraduate, Health Sciences

Group Members: Caroline Wieland, Undergraduate, Health Sciences; Joclyn Butler,
Undergraduate, Health Sciences

Mentor: Prof. Quen VanDermay-Kirkham

Authorship: Grace Buhmann, Caroline Wieland, Joclyn Butler

Healthcare associated infections (HAI) within Illinois were studied. Four different infections, including MRSA, blood, urinary tract, and C. difficile infections were chosen to be measured for the study. The data on these infections was compiled by the organization Leapfrog, which reports different ratings from hospitals. The data found will be based on the year of 2020 and will be compared to see which hospitals had the highest rates for each infection. The purpose of this research is to identify the higher rates in each hospital for each infection chosen and determine if hospital size has any impact on these rates.

For each rating, they are based on the actual infections for each year versus the expected infections for each year, which is calculated based on various factors collected by the CDC. If the rating is below one, that means that the hospital had fewer infections than expected for that year. If the rating is above one, that means that hospital had more infections than expected for that year.

The standard for each infection is based on the Standardized Infection Ratio (SIR) formula. The SIR formula is $SIR = \text{Observed} / \text{Predicted}$. The formula takes the actual amount of the infection and divides it by the predicted amount of infections for a specific hospital. Each hospital's data is based on the standard of actuality divided by the predicted number of infections. The standard for this is 1. This study is designed to determine if there is a correlation between size of the hospital and HAI rates.

AUDIOMETRIC HEARING SCREENINGS ACROSS THE LIFESPAN IN AMERICA: POPULATION HEARING-HEALTH SCREENING PROJECT

Group Leader: Clay, Taylor
Undergraduate, Communication Sciences and Disorders

Group Members: Julia Kleinfall, Undergraduate, Communication Sciences and Disorders; Molly Whitcomb, Undergraduate, Communication Sciences and Disorders; Daniel Mast, Graduate, Communication Sciences and Disorders

Mentor: Prof. Antony Joseph

Authorship: Taylor Clay, Julia Kleinfall, Molly Whitcomb, Daniel Mast, Antony Joseph

The primary aim of this project was to determine whether hearing screenings are available to infants, children, adults, and older populations in the US. For the birth-to-five population, universal newborn hearing screenings have been mandated in the US for several decades, and early childhood hearing outreach programs may be accessed by families with children in prekindergarten school. For children age five through 18, audiometric hearing screenings are administered by most school programs, although some states do not mandate hearing testing of school children. For adults age 19 and above, no hearing-health programs were identified that specified delivery of hearing screenings. Hearing is critical for proper development of speech, language, educational, and social skills, thus, access to hearing screenings for the infant and child populations is an important benefit for our citizens. Hearing health is also important for adults because they may be learning in college, working or navigating their career, or in the retirement stages of their lives; therefore, communication and hearing are critical aspects of adults in the US. We searched the literature for scholarly articles and policy reports on hearing screening requirements for each age group. Our findings were categorized and analyzed in order to determine if hearing screenings were mandated for delivery across the lifespan, specifically using the literature to compare the number of scientific reports on hearing screenings in each of the four age groups. From our investigation, it appears that audiometric screening is satisfactory for infants and school children, but is inadequate for adults, both young and old; therefore, access to hearing-health services may be problematic for adult populations. Hearing-health services should be accessible across the lifespan.

IMPROVING THE HEALTH TRAJECTORIES OF FUTURE GENERATIONS

Group Leader: Goytia, Gabrielle
Undergraduate, Kinesiology & Recreation

Group Member: Jaclyn Middendorf, Undergraduate, Health Sciences

Mentor: Prof. Dale Brown

Authorship: Dale Brown, Tyler Kybartas, Rishi Saripalle, Jaclyn Middendorf,
Samantha McDonald, Jordan Wood

Background: Clearly identified in the United States is the prevalence of obesity, not only in adults, but also in children. Obesity in adults is at an all-time high. These changes in obesity over the last 15 years have been dramatic. Thirty percent of adults are now classified as obese with a body mass index (BMI) greater than 30; however, when a BMI of 25 is used, nearly 64% of the U.S. adults are classified as overweight or obese (CDC). The U.S. Healthy People 2030 Report, indicates 2 in 5 adults and 1 in 5 children in the U.S. are obese.

While obesity certainly has a significant impact on one's physical health it also has an economic, social, and psychological toll. More concerning are the co-morbidities or other diseases that accompany obesity. Usually accompanying obesity in adults are the co-morbidities of hypertension, blood lipid abnormalities, impaired glucose tolerance, heart disease, stroke and certain types of cancers and other disorders. Creating what is referred to as metabolic syndrome. These co-morbidities had only been seen in adults; however, recently these co-morbidities have started showing up in obese children. CDC data now shows trends for Type 2 diabetes in children that mirror the childhood obesity pattern from 5 or 10 years ago. This trend re-enforces the notion that as obesity goes so goes the co-morbidities of obesity.

Research by the project's faculty mentor has shown that Bloomington/Normal children have similar obesity rates as those observed nationally. However, what is missing both locally and nationally are statistics on the prevalence of the co-morbidities in childhood and young adults. While there is a strong relationship between adult obesity and its co-morbidities, the extent to which that relationship exists in young adults is not clear nor is it clear as to the extent that the co-morbidities are directly following or related to obesity or other factors. The question then becomes is overweight/obesity really the root of problem or is it, like the other co-morbidities, a symptom of some other underlying problem?

Objective: Therefore, the purpose of this study is to examine the relationship of physical fitness, obesity and the co-morbidities of obesity in young adults. Since the co-morbidities may not be clearly evident additional health indicators, like body mass index, blood lipids, blood glucose, waist circumference, physical fitness scores, etc., will be examined to identify prevalence of comorbidity risk factors in young adults.

SHORTAGE OF ADULT AND GERIATRIC DIDACTIC TRAINING IN DOCTOR OF AUDIOLOGY (AUD) PROGRAMS: POPULATION HEARING-HEALTH SCREENING PROJECT

Group Leader: Kleinfall, Julia
Undergraduate, Communication Sciences and Disorders

Group Members: Molly Whitcomb, Undergraduate, Communication Sciences and Disorders; Taylor Clay, Undergraduate, Communication Sciences and Disorders; Abigayle Larsen, Undergraduate, Communication Sciences and Disorders; Daniel Mast, Communication Sciences and Disorders; Krista Franklin, Graduate, Communication Sciences and Disorders

Mentor: Prof. Antony Joseph

Authorship: Julia Kleinfall, Molly Whitcomb, Taylor Clay, Abigayle Larsen, Daniel Mast, Krista Franklin, Antony Joseph

It is well known in the United States that hearing difficulty increases with age; however, it appears that most of our clinical and research assets are afforded to younger populations. In America, evidence demonstrates that infants and children have far more favorable access to hearing screening services than adults and older populations. Federal and state hearing-health regulation and policy is supportive of young members of American society; whereas adults, who make up the largest proportion of hearing-impaired people, have no documented hearing-health policy, which results in minimal provider awareness, an absence of integration with medical care, and no registry. Using data from the National Health and Nutrition Examination Survey (from 2001-10), Johns Hopkins University estimated that nearly 39-million people in the United States have hearing loss. Overall, less than 1% of infants (birth to 5 years) and children (5-19 years) have mild to moderate hearing loss. By contrast, 6.5% of 40-49-year-olds and 13.3% of 50-59-year-olds have mild to moderate hearing loss. This rate of mild to moderate hearing loss increases to 26.8% for 60-69-year-olds, 54.6% for 70-79-year-olds, and 81.5% for individuals equal to or greater than 80 years. Although screening and diagnostic pediatric audiology require a highly complex level of clinical knowledge, there are far less children than adults and seniors with hearing loss. As such, this project aimed to describe the disparity between adult populations, policy and literature on audiometric hearing screenings, and the extent to which Doctor of Audiology (AuD) programs are delivering courses on topics, such as, adult and geriatric audiology. Our data revealed that substantially more pediatric didactic coursework is required by AuD programs in the United States, which may bolster the disparity of pediatric and adult hearing-health services. We believe it is critical to provide equitable training for AuD students on adult and older adult populations to improve their awareness of this public health problem.

CHARACTERIZING THE ROLE OF P38KB AND GARS IN CHARCOT-MARIE-TOOTH DISEASE

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Mentor: Prof. Alysia Vrailas-Mortimer

Authorship: Piotr Klos, MacKenna Duncan, Megan Cross, Alysia Vrailas-Mortimer

Charcot-Marie-Tooth Disease (CMT) is a progressive neuropathology caused by the deterioration of neuronal function of the peripheral motor and sensory nervous systems. Symptoms include tripping, ankle twisting, and clumsiness. Effects on the sensory system include sensations such as pins and needles and burning pain. There are no preventive therapeutics for CMT, and treatment revolves around managing symptoms. Though mutations in a variety of genes can give rise to CMT, several of the genes are tRNA-synthetases. Newer evidence in *Drosophila melanogaster* (fruit flies) suggests disease-causing mutations in some tRNA-synthetases results in the aggregation of these mutant proteins. We have recently found that the p38 MAPK (p38Kb), which regulates aging and age-dependent locomotor behaviors, regulates the levels of several tRNA-synthetase proteins during aging. Since p38Kb interacts with the Chaperone-Assisted Selective Autophagy (CASA) complex to mediate the degradation of misfolded or nonfunctional proteins, this suggests that during aging, certain tRNA-synthetase proteins become damaged and are normally cleared by p38Kb and the CASA complex. Failure to clear these damaged proteins potentially results in disease symptoms or worsening of symptoms. I hypothesize that p38Kb-mediated regulation of t-RNA synthetase degradation is crucial for maintaining proper neuromuscular function. I will utilize *D. melanogaster* to test interactions between p38Kb and the t-RNA synthetase GARS and how this contributes to CMT-like phenotypes in flies. I will determine if p38Kb can bind to both wild type GARS as well as mutant forms that cause CMT and if p38Kb can mediate the clearance of mutant GARS from the cell. I will then assay if manipulation of p38Kb improves the locomotor dysfunction observed in GARS mutants. Future research with p38Kb can help us better understand its role in CMT, and if my hypothesis is found to be true, this would allow us to explore a new potential molecular therapeutic for the treatment of CMT2D.

KEYWORDS: Charcot-Marie-Tooth Disease; CASA complex; p38Kb; tRNA synthetases; *Drosophila melanogaster*; neuromuscular junction

BIPOC ACADEMICS' EXPERIENCES DISCLOSED VIA #BLACKINTHEIVORY

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#BlackInTheIvory trended on Twitter during June 2020 and highlighted racist experiences reported by Black academics. Such experiences range from micro-aggressions to exclusion and ostracism, all of which are linked to negative consequences (e.g., job stress, dissatisfaction; Duffy et al., 2002). Research on Black, Indigenous and people of color (BIPOC) in academia shows that they are underpaid (Renzulli et al., 2006), receive lower teaching evaluations (Fan et al., 2019), and are less likely to be recognized for their innovations (Hofstra et al., 2020). We examined tweets reflecting the experiences of BIPOC academics who used the hashtag 'Black In The Ivory' to disclose racist incidents. We examined experiences across three domains of academic work: *research, teaching, and service*. Chronic gender differences in experiences across these three domains exist (see Gardner et al., 2018; Schneider & Radhakrishnan, 2018) but there has not been a detailed study focused on BIPOCs' experiences in each of these domains.

We coded tweets using five dimensions specified by Sue et al. (2008) in describing race-based experiences: *incident, perception, reaction, interpretation, and consequence*. We expected BIPOC academics to report race-specific types of harassment (e.g., invasions of personal space, display of threatening symbols, and the experience of being perceived as 'feared'; see Inman et al., 2020). Settles et al.'s (2019) interviews with BIPOC faculty derived three additional categories we used: *tokenism, exclusion, and (in)visibility experiences*.

We gathered #BlackInTheIvory tweets (N = 13,057) using the Meltwater Outside Insight social media analytics application with English-language filters during the 4-week period after the hashtag first appeared in June 2020. We used sentiment extraction packages for R to analyze the mean sentiment of tweets. We content-coded a random 10% subsample of tweets using three BIPOC coders and obtained high internal consistency (> 95% agreement).

Most incidents described occurred in multiple contexts (i.e., teaching, research, and service). Microaggression, more specifically, microinsults, was most frequent (22.4%). Interestingly, the second-most frequent use (14.2%) of #BlackInTheIvory was not to describe personal incidents but to publicize resources that might be helpful to BIPOC academics. Using analyses of bigrams (words that typically co-occur in tweets), we will also present ongoing analyses focused on racism disclosure and reaction

DEVELOPMENT OF AN IN VIVO PLATING ASSAY TO DECIPHER THE IMPORTANCE OF A SULFOLOBUS ISLANDICUS LEUCYL-TRNA SYNTHETASE PARALOG FOR ORGANISMAL VIABILITY

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Mentor: Prof. Chris Weitzel

Authorship: Amy Le, Trang Nguyen, Christopher S. Weitzel

Protein synthesis is an essential process that occurs in all organisms and its accuracy is dependent on the faithful actions of the aminoacyl-tRNA synthetases (aaRSs). These enzymes play the critical role of coordinating tRNAs with their cognate amino acids, which allows for the translation of mRNA codons into proteins. As such, the genes that encode for these proteins are indispensable for cellular viability. Notably, in some organisms, such as all species comprising the Archaeal Sulfolobaceae family, which includes *Sulfolobus islandicus*, there exists duplications of select synthetase genes whose functions are not entirely known. A paralog of Leucyl-tRNA synthetase (LeuRS) in *S. islandicus*, namely LeuRS-I, is the focus of this investigation into the possible noncanonical functions that synthetase-like encoding genes hold. To distinguish phenotypes of a leuRS-I knockout, this strain was used alongside a wildtype strain in a series of plating assays, treated under various conditions meant to simulate environmental stressors. A careful comparison of results has given insight into the role that the duplicate gene plays in the viability of *S. islandicus*.

INVESTIGATING THE EFFECTS OF MODIFIED ELECTRIC FIELD REPRESENTATIONS ON STUDENT INTERPRETATION OF ELECTRIC FIELD DIAGRAMS

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Group Member: Jack Jordan, Undergraduate, Physics

Mentor: Mr. Raymond Zich

Authorship: Naomi Satoh, Jack Jordan

We report on the results of a study of the effect of visual changes to electric field diagrams. Electric fields are often represented with lines of uniform thickness with integrated arrows. Students must infer the strength of the electric field from the spacing of the lines and the direction of the field from the direction of the arrows. Influenced by work with modifications to equipotential diagrams, this project studied the results from modifying electric field indicators. Based on theories of visual affordances alternative electric field diagrams were designed and implemented to increase the visual salience of the strength and direction of the electric field and of the charge sign. Modified symbols and variations in line thickness were used to indicate the direction and magnitude of the electric field. Student performance on assessments using traditional to modified diagrams showed a statistically significant increase of 10% on overall average scores. Student assessment data collection continues to occur.

DETERMINING ION-TRANSPORT MECHANISMS INVOLVED IN BRINE SHRIMP ADAPTATION TO HIGH OSMOLARITY ENVIRONMENTS: A CURE EXPERIENCE

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Mentor: Prof. Craig Gatto

Authorship: Evan Strandquist, Annamarie Hyer, Hannah Brozenec, Mayra Hernandez, Amanda Johnson, Erica Evans, Caroline Maciej, Emily Kreger, Devin Witworth, Jasmine Hatcher-Moorman

Brine shrimp and brine fly larvae are the only animals known to survive in high-salinity inland lakes. Adaptation of these osmoregulators involves mechanisms of water retention together with changes in proteins that transport ions across membranes, to fight enormous osmotic and ionic gradients. However, the ion transport mechanisms that enable adaptation to extreme salinities remain largely unknown. The goal of this Course-based Undergraduate Research Experience (CURE course) was to identify such ion-transporters and uncover their role and cooperation to allow these animals to thrive in an environment where most animals die.

Previous investigations from the Gatto & Artigas laboratories show that one of the high-salinity upregulated transporters is a Na^+, K^+ -ATPase isoform that exports 2 Na^+ in exchange for 1 K^+ , per ATP hydrolyzed, instead of the established 3 Na^+ :2 K^+ :1 ATP stoichiometry observed in every NKA isoform studied to date. The lower ion:ATP ratio allows these NKAs to build a larger Na^+ gradient, which may underlie some of these animals' abilities to adapt to extreme salinities.

Our data generated in this CURE course show that: 1) Brine shrimp adapted to high salinity increase expression of several ion transporters and that pharmacological inhibition of many of them block adaptation to high salinity. In particular, utilizing specific inhibitors of the Na^+, K^+ -ATPase (NKA), Na^+, K^+ , 2 Cl^- Co-transporter (NKCC), the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) Cl^- conductance, and a blocker of the paracellular Na^+ flux, we demonstrated that all of these ion transport pathways are collectively utilized by Brine Shrimp to survive in high salinities.

Educational Impact: This course was designed to: 1) instill the foundations of scientific discovery and inspire undergraduates by offering a discovery-based research experience in the classroom, 2) provide a path for them to develop the necessary skills and attitude for a successful scientific career, and 3) establish a setting where graduate students learn to succeed as scientists and mentors. Thus, this CURE course accomplished a multilevel training experience that reinforced scientific skills at both the undergraduate and graduate levels, while providing training to graduate students as future mentors.

INTERACTIONS BETWEEN YARS AND P38KB AND THE CASA COMPLEX IN CHARCOT-MARIE-TOOTH DISEASE

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Mentor: Prof. Alysia Vrailas-Mortimer

Authorship: Alyssa Virola-Iarussi, Lauren Naeger, Shira Archie, Alysia
Vrailas-Mortimer

Many age-related and degenerative diseases, such as Charcot-Marie-Tooth disease (CMT), are the result of irregular protein aggregations. One mechanism by which protein aggregation is regulated in mammalian systems is the BAG-3 Mediated Selective Autophagy pathway, known as the Chaperone-Assisted Selective Autophagy (CASA complex) in flies. We have recently found that the CMT protein lamin is a target of p38Kb and the CASA complex member, starvin (stv), for degradation during aging. CMT is caused by mutations in over 90 different genes, and we have found that the CMT protein YARS may also be a target of p38Kb and the CASA complex. The YARS mutations play a role in the development and severity of CMT. CMT is a group of inherited disorders that causes axonal degeneration and demyelination of the peripheral motor and sensory neurons. Symptoms include progressive motor impairment, distal muscle weakness, sensory loss, reduced tendon reflexes, and foot deformities. Expression of mutant forms of YARS in drosophila have several hallmarks of the human disease including a progressive deficit in motor performance, evidence of nerve dysfunction, and signs of axonal degeneration. We have found that YARS mutations coupled with p38Kb mutations and overexpression can negatively affect fly locomotive behaviors. Next, we will test if p38Kb and stv regulate the degradation of wildtype and CMT mutant forms of YARS. In addition, we are currently performing further studies to determine the exact binding site between p38Kb and stv.

AN EXPLORATION INTO COMPUTERIZED MEDICATION SAFETY PRACTICES IN ILLINOIS HOSPITALS AND ITS EFFECTS ON IMPROVING PATIENT OUTCOMES AND DECREASING ADVERSE EVENTS

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Group Member: Ryan Kneller, Undergraduate, Health Sciences

Mentor: Prof. Quen VanDermay-Kirkham

Authorship: Jack Wightkin, Ryan Kneller

Medication safety practices are a huge initiative in today's healthcare system. With the integration of electronic entry and tracking systems, there has been a great improvement in medication administration and reconciliation leading to improved patient outcomes and a decrease in adverse events. The use of computerized physician order entry (CPOE) systems helps bring attention to drug-drug interactions and correct doses for each individual patient and their needs. The purpose of this study is to track the compliance of Illinois hospitals with their use of medication safety decision support systems, based on a scoring from the LeapFrog Group hospital safety ratings. The team came up with four quality standards to test for, then collected samples from ten hospitals throughout Illinois. The four quality standards tested include safe medication administration, safe medication ordering, medication reconciliation, and medication documentation for elective outpatient surgery patients. The quality standards tested for each hospital resulted in a score between one (limited achievement) and four (full achievement) for each category standard. After looking at the data, the percentage of facilities that met the benchmark of 3 or higher was found. The findings show both an individual score in each category along with an overall average score on the hospitals reviewed. The team then went on to suggest changes and additions to each facility to be made, based on their compliance with the benchmark standards, that could further improve their medication safety practices. Results from outside studies show that implementing electronic medication support significantly decreases occurrence and severity of errors impacting patient safety. The hospitals that failed to meet the standard score of 3 were offered recommendations to improve operations, based on evidence of computer assisted decision support reducing adverse events in patients.