Undergraduate Scholarly Showcase 2024 Guide to Afternoon Posters

Contents

AFTERNOON POSTER SESSION

Category A: Sensing, Perception, and Sensor Technology

A-01: Can Female Wolf Spiders Sense Male Infection Status?

Atrium
Lily Garver, Biological Sciences
Project Advisor: Dr. George Uetz

Abstract
Animals may be at risk of pathogen exposure from their mating partners, and it would therefore be advantageous for individuals to be able detect infection and avoid risky mates. Previous studies have shown that female wolf spiders can sense male infection status from chemical cues possibly contained in the hydrocarbons of their abdominal cuticle (CHCs) . The primary goal of this research project was to investigate the potential for females to detect of male CHC chemical cues and avoid them. Juvenile male

and female S. ocreata were collected at the Cincinnati Nature Center and raised under controlled lab conditions to maturity. One subset of males (the "infected" treatment) were exposed to a sub-lethal dose of the bacteria Pseudomonas aeruginosa and then rubbed with filter paper to collect CHCs. A second treatment group had CHCs collected from uninfected males. Females were then placed in an arena with filter paper containing CHCs from one of these treatments (infected males, uninfected males) or a blank filter paper as a control treatment group, then recorded for their number of visits to each stimulus. Although data are incomplete and still being analyzed, results will allow us to determine whether females can detect differences among male treatments.

A-02: Effects of Facial Manipulation on Courtship Interactions in Habronattus Coecatus Jumping Spiders

Atrium

Jenna Breiner, Biological Sciences and Environmental Studies
Project Advisor: Dr. Nathan Morehouse

Abstract
Across a diverse range of taxa, faces play a vital role in social interactions by communicating valuable information such as species identity. In courtship, species recognition can be crucial to avoid hybrid matings, which could result in lowered fitness. Previous studies of facial perception have largely focused on primates and other vertebrate animals, but less is known about how invertebrate animals may view and interact with faces. The Habronattus jumping spider genus is a tractable model system for investigating the function and evolution of facial patterning due to their high visual acuity, excellent color vision, and diversity of species-specific male facial patterns. We hypothesize that male Habronattus faces may play a role in communicating species identity. We predict that manipulation of a male spider's face will result in changes to courtship interactions and mating success. To investigate this, we analyzed the courtship responses of paired male and female H. coecatus, in which male faces were either unmanipulated (i.e., natural) or manipulated to resemble that of a co-occurring species, H. calcaratus. We used the software 'BORIS' to track male courtship effort, female aggression, and mating success. Preliminary results suggest that males with unmanipulated faces may experience higher mating success, but female aggression may be unaffected by male facial patterns. These findings shed light on how invertebrate animals might use facial patterning to inform mating decisions, offering new perspectives on the role and evolution of face signals beyond vertebrate taxa.

A-03: Cataracts in a Predatory Insect May Reduce Hunting Success in Dim Light

Atrium

Auggi Jester, Biological Sciences
Project Advisor: Dr. Elke Buschbeck

Abstract
Cataracts, the leading cause of blindness worldwide, plagues over half of Americans over the age of 80, causing a myriad of vision complications such as difficulty reading, sensitivity to glares, decrease in color vision, and eventually loss of vision entirely. Cataracts are formed by damage to specific light-refracting

proteins found in the lens, and it has been estimated that in humans 20-39% of overall cataract formation may be directly linked to an individual's genetics. Therefore, understanding genetic predisposition towards developing cataracts may prove crucial in understanding how to prevent them entirely. Little to nothing is known about cataracts in arthropods, but previous experiments in our laboratory have shown that the gene lens3 is a prominent contributor to the elaborate lenses of the image-forming eyes of diving beetle (Thermonectus marmoratus) larvae. RNAi knockdown leads to a reduction of expression of lens3 and cataract-like lens deformations in those eyes. Interestingly, although clear morphological deficits could be observed, initial experiments did not show significant behavioral deficits, specifically in a test that assessed the hunting success of these predatory larvae. However, considering human ophthalmology, the initial difficulties associated with cataracts are often reported as difficulty completing tasks at night, such as driving. Therefore, in a follow-up experiment, we retested hunting behavior under dim light conditions. Based on a preliminary analysis, the test groups had significantly greater hunting latencies compared to the control group. To the best of our knowledge this is the first study that illuminates interesting parallels between cataracts in humans and insects.

A-04: Short-term Memory Degradation of Navigation by Path Integration in Fiddler Crabs *[Leptuca pugilator]*

Atrium
Michael Doherty, Biological Sciences
Project Advisor: Dr. John Layne

Abstract
Path integration is a navigation mechanism that allows animals to find their way home using sensory cues through measurement of step distances and directions. This results in one cumulative distance and direction which is referred to as a "home vector". An animal that is known to use path integration as its primary method of navigation is the Atlantic Sand Fiddler Crab [Leptuca pugilator], which use it during low tide foraging excursions around their burrows, and >95% of these last fewer than 5 minutes. We theorized that they do this because at >5 minutes the crabs' vector memory degrades to problematic levels - but this is unknown. Thus, the aim of this experiment was to test how long the home vector is accurately stored in fiddler crab's memory. Crabs were blinded using black paint, had sheet metal attached to the back of their carapace, and were returned to their burrows. When they performed a foraging excursion, they were captured using a magnetic detainer that lifted and held the crab above the sand to prevent input to the crab's path integrator system. After a predetermined amount of time (0.5, 5, or 15 minutes), the crab was released, and their subsequent movement was measured to determine their homing accuracy. Results show that only 5 minutes of detention can cause significantly inaccurate homing, which indicates that the path integration memory operates on a very short time scale and explains the need for crabs to frequently return home, which is to re-set the path integrator.

A-05: The Effects of Light Exposure Therapy on Medical Intensive Care Unit (MICU) Night Shift Nurses

Atrium
Carly Sherman, Nursing

Addison Fagan, Nursing
Mara Deselich, Nursing
Project Advisor: Dr. Caroline Morrison

Abstract
Fatigue is a main consequence of working night shift due to the disruption to normal circadian rhythm, which can result in nursing errors. A literature search was conducted to determine how light exposure during night shift affects the perceived fatigue and mental alertness of night-shift ICU nurses. It was aimed towards peer-reviewed articles within the last seven years from PubMed and CINAHL. Research suggests that the implementation of light therapy on night shift workers improves fatigue and mental alertness, resulting in fewer work errors. The evidence was appraised and compiled to create an educational session outlining the findings. The purpose of this project is to educate on the best practice for light exposure to improve fatigue and mental alertness. Night shift nurses in the Medical ICU at the University of Cincinnati Medical Center received the education session. This teaching involved an educational PowerPoint including types of light therapy, the impacts of light exposure, and impacts of fatigue on errors. Pre-test and post-test will be completed to evaluate if the teaching was effective. Results pending. It is expected that nurses will improve their knowledge regarding the impact of light exposure on improving fatigue, mental alertness, and sleep quality/duration. A limitation of this research is lack of time for our population to implement light therapy practices and collect further data to support or reject our proposed question. This topic contributes to the primary goal of nursing practice to optimize patient safety.

A-06: StartReact: Do You React Faster When Startled?

Atrium

Nasma Jarabah, Health Sciences: Pre-Physical Therapy
Cat Poster, Health Sciences: Pre-Occupational Therapy
Project Advisor: Dr. Nikita Kuznetsov

Abstract
The StartReact phenomenon refers to the rapid involuntary triggering of a prepared movement in response to a loud startling acoustic stimulus (Carlsen, 2019). Previous studies showed StartReact in young adults and individuals with stroke (DeLuca, 2022), with a mean reaction time improvement of 42.22 ms. The underlying mechanism is hypothesized to be recruiting subcortical pathways, and as such, StartReact has the potential to elicit movement in people post-stroke. As a first step to developing stroke interventions using this methodology in UC Health Science, we aimed to validate a novel experimental setup to replicate the findings of improved RTs in healthy young adults. We recruited 26 individuals to test their reaction time in response to auditory and visual stimuli. Participants were aged 18-30 with no underlying impairments. Participants were instructed to flex their elbow as quickly as possible after the rectangle on the screen changed colors. In 15 out of 50 trials, the go signal was accompanied by a loud beep (120 db), compared to 80 db for a regular trial. Reaction times will be identified based on electromyography data from the biceps muscle. Startle reactions manifest through contractions in the face, neck, and upper limb muscles (Schmidt and Lee, 2020). In line with previous literature, we anticipated that simple reaction time would be faster in healthy individuals when

compared to non-startle trials. The results of this study will be used as baseline data for future studies that would target eliciting movements in adults with hemiparesis.

A-07: Fragile X Syndrome: Correlations Between Autism Severity and Sensory Processing Abilities

Atrium

Kara Snyder, Neurobiology
Project Advisor: Dr. Annette Stowasser

Abstract

Fragile X syndrome is a genetic disorder responsible for intellectual disability. Fragile X syndrome is often accompanied with autism spectrum disorder, although the severity of autism varies greatly between patients with Fragile X syndrome. Patients with Fragile X syndrome often experience sensory hypersensitivities. Due to the significant overlap between symptoms of Fragile X syndrome and autism spectrum disorder, along with the fact that many children with Fragile X syndrome also have autism spectrum disorder, Fragile X syndrome can be difficult to recognize and diagnose without proper genetic testing. This project aims to examine the correlations between the severity of autism and sensory processing abilities in children with Fragile X syndrome. The data analyzed in this project was collected by the Fragile X Research and Treatment Center at Cincinnati Children's Hospital Medical Center. By comparing the data to research involving the Fragile X mouse model, this project hypothesizes how the mechanisms behind autism and sensory processing function in children with Fragile X syndrome may be interconnected.

A-08: The Effects of Electrical Stimulation and Perturbation on Anterior-Posterior Postural Sway

Atrium

Olivia Tombragel, Health Sciences: Pre-Physical Therapy
Kati Strub, Health Sciences: Pre-Physical Therapy
Project Advisor: Prof. Rachel Gleason

Abstract

Previous research explores muscle activation during postural control. The ankle strategy is essential for static postural control, and the gastrocnemius is one of the initial muscles recruited. Improvements in postural control have been demonstrated when transcutaneous electrical nerve stimulation (TENS) was applied to the gastrocnemius during static stance. This study investigated the influence of TENS applied to the gastrocnemius on postural sway in response to perturbation. Students from the College of Allied Health Sciences with no known conditions impacting balance were recruited. Electrodes were adhered to the medial and lateral heads of the gastrocnemius on both legs. Total center of pressure (COP) displacement values collected from AMTI force plate were measured under four conditions varying TENS stimulation and perturbations. The t-tests displayed a statistically significant difference ($p=0.009$ and $p=0.003$) in postural sway between trials with TENS compared to those without TENS. Application of TENS impacted postural sway. In conditions without a perturbation, postural sway was increased with application of TENS. The increased sway demonstrated in these trials may be due to activation of the gastrocnemius inducing postural sway in the absence of a perturbation. In conditions with a perturbation, postural sway was decreased with the application of TENS. Anterior-posterior sway caused by the perturbation is dampened by the electrical stimulation of the gastrocnemius.

A-09: Influence of Surface Modification in Nanostars for DNA Detection via Surface-enhanced Raman Spectroscopy

Atrium

Max Coates, Chemistry, History, and German Studies
Project Advisor: Dr. Pietro Strobbia

Abstract
Surface-enhanced Raman spectroscopy (SERS) is a transformative analytical tool, that leverages plasmonic nanomaterials to amplify Raman signals, thus enhancing sensitivity. This advancement empowers researchers to detect a diverse set of biological and chemical analytes at ultra-low concentrations, enabling applications in forensic science, medical diagnostics, and environmental monitoring. At the heart of SERS lie two key mechanisms: chemical enhancement and electromagnetic enhancement. While both contribute to signal amplification, electromagnetic enhancement plays a predominant role, with enhancements reaching magnitudes up to 1010 times. Notably, the proximity of the target analyte to the plasmonic nanomaterial's surface significantly influences this enhancement, ideally falling within a narrow range of 2-10 nm. This study delves into the influence of surface modifications on SERS enhancement using silver-coated gold nanostars (NS) as plasmonic nanomaterials. These bimetallic NS are synthesized via a seed-mediated approach to form gold nanostars then coated in silver. To enhance the adsorption of specific analytes, the NS surface was modified with potassium iodide or spermine. Characterization techniques such as ultraviolet-visible spectroscopy and nanoparticle tracking analysis elucidate the stability, size, and concentration of the modified NS. The crux of the investigation lies in probing how these modifications impact the SERS enhancement for DNA detection. By introducing modified and unmodified NS to DNA samples and analyzing the resulting SERS spectra, we aim to discern the nuanced effects of surface alterations on detection sensitivity and specificity. This endeavor not only advances our understanding of SERS principles but also holds promise for enhancing DNA detection methodologies across diverse domains.

A-10: Expanding the Dynamic Range of Surface-enhanced Raman Scattering (SERS) Biosensors

Atrium

Steve Ifeanyi, Biochemistry
Project Advisor: Dr. Pietro Strobbia

Abstract
Biosensors function by using biological and chemical components to detect a broad range of analytes, such as nucleic acids, antibodies, and small molecules like glucose. Among biosensors, those based on surface-enhanced Raman scattering (SERS) have superior multiplexing capabilities that can detect a broad range of targets simultaneously. However, sensors (including SERS biosensors and lateral flow assays) are often used only for yes/no answers and do not provide important quantification information (e.g., viral load). This limitation is due to the small dynamic range (range of detectable target concentrations), which is of 1-2 orders of magnitude. This project focuses on expanding the dynamic range of SERS biosensors from the current 1 order of magnitude concentration range to 4-5 orders of

magnitude. In this project, we altered the design features and sequences of DNA-based SERS biosensors to see how these modifications affected the sensitivity and limit-of-detection of these sensors compared to a benchmark previously developed sensor. The sensors were then tested over a wide range of concentrations to determine the dissociation constant (KD), dynamic range and limit-of-detection of each sensor. We analyzed the data to determine the optimal mixture of sensors that gives the widest and most linear dynamic range. This optimal mixture was then validated by showing that the optimal mixture of sensors has great linearity over more than 4 orders of magnitude. We demonstrated how altering different features of the DNA-based sensors affects figures-of-merit. We also demonstrated that combining multiple sensor designs can greatly increase the dynamic range and quantification capabilities.

A-11: The Impact of Ultrasound Guided IV Insertion

Atrium
Marina Hernandez, Nursing
Rose Torkornoo, Nursing
Maggie Pascual, Nursing
Project Advisor: Dr. Caroline Morrison

Abstract
Registered Nurses are often challenged when prompted to insert an IV on the first try as evidenced by traditional insertions taking two or more attempts on average. This in turn, delays care and reduces patient satisfaction and positive outcomes. Multiple IV insertions can cause more harm to the patient. A literature search was conducted to answer the following PICO question: In floor nurses, how does ultrasound guided peripheral IV insertions compared with traditionally inserted peripheral IVs affect the failure rates of IV insertion. Our project aims to present the evidence on the clinical impact and benefits of ultrasound-guided peripheral intravenous (IV) insertion compared to traditional techniques. An educational session was created using media powerpoints and video on the success rates, time, efficiency, patient satisfaction, and complications associated with each method. To assess the effectiveness of our teaching, a pre and post test will be administered to determine the knowledge obtained by the audience. Our results are pending, however, we intend to improve nurses' understanding of the value of utilizing ultrasound guided PIVs versus traditionally inserted PIVs. Overall, our study will teach and promote the use of ultrasound guided PIVs to reduce pain associated with IV insertion, increase IV placement success rates, and improve patient outcomes.

A-12: Exploring the Photoreactivity and Photodynamic Behavior of Two Light Sensitive Azide Based Crystals

Atrium
Jonathan Weisfelder, Chemistry
Ben Miller, Chemistry
Project Advisor: Dr. Anna Gudmundsdottir

Abstract

Organic crystals can change light energy into mechanical work by coiling, crawling, bending, fracturing, shattering, etc. These materials and their mechanistic studies are of great focus as continued research could lead to a greater ability to predict ring-related changes forming the photoproduct(s). Herein, we report the photoreactivity and photodynamic properties of (1-azidoethene-1,2-diyl)dibenzene (azide) and 2,3-diphenyl-2H-azarine (azirine). We have studied the photochemistry of the azide in solution and cryogenic matrices as a function of irradiation wavelength. At a wavelength of 254nm at a cryogenic state, the azide forms ylide and ketenimine intermediates whereas at the 325nm wavelength, the azide forms the azirine product as well as the observed ketenimine from the previous trial. Furthermore, the azirine product reacts upon short wavelength irradiation to form the ylide. In contrast, laser flash photolysis was performed on the azide and azirine, showing the formation of a triplet nitrene and an ylide intermediate, respectively. These data indicate that the triplet nitrene is an unstable intermediate and likely performs intersystem crossing (ISC) to form the ketenimine product observed. Interestingly, upon irradiation the shape of an azirine crystal changes significantly from needle-like to spherical bubbles. The proposal for these bubbles is due to void spaces in the crystal lattice which was verified when the irradiation of a methyl substituted azirine as it did not show a bubble structure. This material has been irradiated in different states and isolated to form three different compounds – two in the solution state and one in the solid state.

A-13: Development of Metal Nanoparticles as Catalysts for a Color-Changing Reaction

Atrium

Nikita Gorkovets, Chemistry
Project Advisor: Dr. Peng Zhang

Abstract
Detection of toxins, cancers, and other harmful substances is a key challenge and area of development in modern medicine. The analytes can be detected using a catalytic reaction with a fluorescent dye and appropriate catalysts. In this project, the goal is to optimize the preparation of the catalyst to maximally intensify the color change of the dye, so that the catalyst can be used in subsequent sensor development. The research task is to synthesize a series of metal nanoparticle catalysts and evaluate their efficiency in catalyzing the color-changing reaction. In the future, we plan to integrate these metal nanoparticles into sensing schemes for applications.

A-14: Characterizing Subsurface Sediment Architecture through Geophysical Techniques in the Great Miami River

Atrium

Julie Hobbs, Geology
Project Advisor: Dr. Reza Soltanian

Abstract
This study aimed to characterize the subsurface sediment architecture of a channel bar within the Great Miami River, focusing specifically on understanding the interaction between sediment composition and its electrical conductivity. This work is part of a larger project which seeks to determine if geophysical

methods can be utilized to estimate perfluoroalkyl substance (PFAS) sorption behavior. This research utilized electromagnetic induction (EMI) to quantify the variability in electrical conductivity across the channel bar. Many sedimentological analyses were conducted, including grain size assessment, PARIO particle size analysis, and x-ray fluorescence. The aim was to investigate the sedimentological characteristics that support interpretations of geophysical data. EMI measurements were pivotal in identifying the presence of variable sedimentary facies with a distinct zone of interest identified as a cross-bar channel fill. These measurements revealed that areas with higher organic content and finer sediments were associated with increased electrical conductivity. The results of this investigation provide a foundational basis for subsequent studies into the usage of geophysical methods in understanding subsurface mysteries.

A-15: Directional Cues Used by Sand Fiddler Crabs During Spatial Navigation

Atrium

Corinne DuBose, Biological Sciences
Project Advisor: Dr. John Layne

Abstract
This research investigates the navigation mechanisms of Atlantic sand fiddler crabs as they return to their burrows after foraging. The study aims to discern whether these crabs rely on internal cues (e.g., self-generated visual motion, limb movements, acceleration) or external cues (e.g., visual landmarks, sun, sky polarization) when finding their way home to their burrow. For example, an external cue that animals commonly use is the sun or other physical entity as a recognizable landmark when homing. An internal cue could be the bodily movements of the organism, which can be measured by sensory systems such as proprioception. To address this, we placed rotatable disks amongst fiddler crab burrows. When a crab reached a disk during an excursion, the experimenter pulled a line to turn the disk. This rotated the crab's body, and thus passively changed their orientation relative to home. They were video-recorded and their routes were tracked using custom software (MATLAB). It was found that the crabs' homing direction deviated from their burrow direction by an amount very similar to the amount they were rotated. This suggests a dependence on internal cues for navigation, and not external cues. If external cues had been the dominant cues for the fiddler crabs' navigation mechanism, a bodily rotation wouldn't significantly impact homing direction and they would have returned home without the observed error. This research contributes insights into sensory physiology, comparative biology, and neuroscience, shedding light on the intricacies of navigation behavior.

A-16: Agroforestry at the Ancient Maya City of Calakmul, Mexico

Atrium

Elise Brown, Biological Sciences
Justin Schmidt, Biological Sciences
Project Advisor: Dr. David Lentz

Abstract

The ancient city of Calakmul, once a leading polity of the Classic Maya world, has drawn the attention of scholarly investigation for nearly a century. Despite the long history of academic research, the intricate relationship of the densely populated center with its surrounding tropical forest environment has only recently come into clear focus. How did they provide adequate supplies of food and forest products to expanding populations during an occupation that lasted well over a millennium? These and other questions have been the focus of a recent study conducted by a multidisciplinary team of biologists, geographers and archaeologists. In this poster we will address these questions using the identification of wood remains using a combination of light and Scanning Electron Microscopy.

Category B: Digital Futures

B-01: RustBound: Improving Software Security through the Detection of Function Boundaries with Neural Networks

Atrium
Ryan Evans, Computer Science
Project Advisor: Dr. Boyang Wang

Abstract
Function boundary detection identifies start addresses and end addresses of functions in a binary. It is a critical step in binary analysis and is considered as a challenging task over stripped binaries. The accurate binary analysis of a program plays a vital role in software security, reverse engineering, and malware detection. While existing studies have shown that it is feasible to efficiently and accurately perform function boundary detection over C stripped binaries, it remains unknown whether these methods will perform well over Rust stripped binaries. In this paper, we experimentally evaluate and compare four methods/tools, including two industry reverse engineering tools (Ghirda and IDA Pro) and two neural-network-based methods, in the context of function boundary detection over Rust binaries. We establish a large-scale dataset consisting of 2,471 Rust binaries (with over 8.69 million functions) across five optimization levels and develop two tools to perform analyses automatically. We derive two major findings based on our experimental results. First, one of the two neural-network-based methods, named XDA, can achieve promising results (e.g., 94.8% precision and 85.5% recall over binaries compiled with O0) and outperform other methods/tools in detecting function boundaries over Rust binaries, except over binaries from Oz optimization. Second, although Ghidra and IDA Pro can accurately detect function starts, they are not effective on distinguishing function ends over Rust binaries.

B-02: CrossEM: Deep Learning Side-Channel Attacks across Electromagnetic Probe Locations

Atrium
Mabon Manoj Ninan, Computer Engineering
Project Advisor: Dr. Boyang Wang

Abstract
In this paper, we explore the influence of electromagnetic (EM) probe placement on the outcomes of deep-learning side-channel attacks. Our study involves the acquisition of 2.9 million EM traces (66 GBs)

from nine distinct locations on AVG XMEGA and ARM STM32 microcontrollers during the execution of unmasked AES-128 encryption. Subsequently, we employ Convolutional Neural Networks (CNNs) for training on EM traces, aiming to recover encryption keys. We investigate two scenarios: (1) where training and test data originate from the same probe location, and (2) where they are obtained from different probe locations. Our experimental findings reveal that a CNN can efficiently recover keys with a minimal number of test traces when trained and tested on data from the same probe location. Conversely, when data from different probe locations are utilized for training and testing, the CNN exhibits a significantly increased requirement for test traces to recover keys. In certain instances, the CNN may even fail to recover keys, highlighting the impact of EM probe location discrepancies. We delve into potential strategies to mitigate these discrepancies, focusing particularly on the transformation of data into the frequency domain through preprocessing techniques such as Frequency Domain Data, Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA). Our objective is to enhance the robustness of CNNs against variations in EM probe locations, thereby improving the reliability of deep-learning side-channel attacks across diverse scenarios.

B-03: Application of Machine Learning to Study Characteristics of Heat shock Protein 104 (HSP 104)

Atrium

Anvar Normurodov, Biochemistry
Project Advisor: Dr. George Stan

Abstract
Newly produced proteins or already folded proteins may get damaged and lose their 3D structures that is crucial for their biological function. This can happen because of heat shock, or stress, leading to neurodegeneration and various other diseases. The Heat Shock protein 104 AAA+ is a chaperone protein, so called for its duty to prevent unwanted conformations of proteins, mediates protein quality control via protein degradation or disaggregation. Proteins belonging to the AAA+ family (ATPases associated with diverse cellular activities) play a crucial role in preserving protein stability. The Hsp104 from Saccharomyces cerevisiae (brewers yeast) are members of the AAA+ family that support protein quality control by unfolding aberrant or toxic proteins. Though we have identified the purpose of this enzyme, how this protein performs disaggregation is unclear. In this study we implement a clustering method on molecular dynamics simulations. After having simulated the action of the Hsp104 on its substrate and having obtained the timeline of how the shape of Hsp104 changes, we identified and picked out most representative 3D molecular shapes that are important for understanding the behavior of the system. After identifying biochemically relevant descriptors based on the literature, we apply machine learning algorithms to identify the structural features that best describe the identified conformations. Results from this study can help advance research on treatment for neurodegenerative diseases which proceed by accumulation and aggregation of misfolded proteins.

B-04: Virtual Reality Education for Rehabilitation of Postoperative Orthopedic Patients

Atrium

Anna Judy, Nursing

Alexander Brendle, Nursing
Carson Suer, Nursing
Project Advisor: Dr. Paul Lewis

Abstract
Currently, orthopedic surgery is one of the most common surgeries in the world, and post-operative recovery can be complex. VR has shown increased mobility post-operatively and is also known to reduce pain in 88% of postoperative orthopedic adults. The purpose of this project is to educate nurses by using multiple educational sessions in an intensive care setting on the benefits and functions of VR to promote less pain and increased mobility in postoperative orthopedic adults. For these sessions, we created an infographic and used an education video utilizing evidence-based practice principles. This infographic and video were delivered to Surgical Intensive Care Unit (SICU) registered nurses at the University of Cincinnati Medical Center individually. We conducted a pre-test and post-test survey online on the knowledge and feasibility of VR with an opportunity for in-person feedback following the post-test. Results are pending.

B-05: Incentivizing the Commercial Recycling of Textiles and E-waste

Atrium

Finn Biales, Environmental studies
Project Advisor: Dr. Amy Townsend-Small

Abstract
The US alone produces over 20 million tons of electronic and textile waste combined every year. Over 60% of all textile waste and over 80% of all electronic waste end up in landfills each year. With increases in technological advancements in electronics and a growing demand for latest fashion trends, E-waste and textiles are rapidly filling up landfills. E-waste has even become the fastest growing solid waste stream in the world (World Health Organization). While there are some existing programs in Cincinnati that serve as recycling centers for textiles and E-waste, they are often hard to access or charge the public for their services causing the recycling of these products to be a less viable option. In order to create easier, more mainstream processes for the people of Cincinnati to recycle their unwanted electronics and textiles, this project aims to incentivize commercial recyclers to allow free curbside pickup for textiles as well as offer conveniently located, free to use, e-waste drop off bins for these unwanted items through local and state government partnership with for-profit recycling companies.

B-06: Providing Evidence-based Education to Healthcare Workers on the Modes of Virtual Language Interpretation

Atrium

Ava Martin, Nursing
Isabelle Elliott, Nursing
Eva Buehler, Nursing
Project Advisor: Dr. Paul Lewis

Abstract
When addressing language barriers in a healthcare setting, providing necessary information while ensuring educational comprehension can be difficult, and without the use of modern technology could prove next to impossible. Fortunately, due to technological advancements, many hospitals and other inpatient healthcare facilities have translation methods available 24/7. Still, the question remains - which method of translation - audio-only or a combination of audio and video - is more effective in addressing language barriers in healthcare settings? Through evidence-based practice, we delve into determining which method of translation is not only easiest for patients and families to use but also yields the highest level of understanding. Current literature suggests that translators with audio and visual aspects are preferred by both patients and providers, additionally these translators lead to better patient understanding. This project aims to educate those directly involved in patient care on the effectiveness of translators with audio and video features compared to the use of strictly audio translators. An information PowerPoint presentation and pamphlet were provided for staff at Cincinnati Children's Hospital Medical Center (CCHMC) who play a role in patient care. To assess the impact of the educational effort, a pre- and post-test was administered, evaluating the staff members' understanding as well as gathering their thoughts on how they believe translating services could be improved. Results pending.

B-07
Withdrawn

B-08: Design of an ABS/Nitrous Hybrid Rocket Engine
Atrium
Ethan McCowan, Mechanical Engineering
Project Advisor: Dr. Daniel Cuppoletti

Abstract
The purpose of this project is to study how ABS (acrylonitrile butadience styrene) as a fuel affects the performance parameters of a hybrid rocket engine (HRE). Traditional fuels are difficult and expensive to manufacture, and ABS can be 3D printed and is cheap to procure. ABS's performance in published research papers is comparable to traditionally used fuels. My work has provided a tool for estimating engine performance based on multiple parameters so the engine can be modeled. Current tools do not exist for modeling HRE performance with ABS as fuel, so this would be a useful tool for future research. Future students will take my tools and designs to build and test them to refine the tool with experimental data.

Category C: Mental Health and Human Behavior

C-01: Ethnic Differences in Mental Health Outcomes and Resilience among Sexual and Gender Minority Individuals
Great Hall

Mika Sevilla Morales, Psychology
Project Advisor: Dr. Sarah Whitton

Abstract
In the general population, people of color (POC) usually have lower levels of depression and anxiety than their White counterparts. This is called the racial paradox because POC experience higher levels of discrimination and racism. Sexual gender minorities (SGM) have multiple marginalized identities, this might lead to worsen negative health outcomes, also known as double jeopardy. This study investigates that 1) SGM-AFAB individuals who are POC will report better mental health outcomes than those who identify as White and 2) racial differences in resilience will be explained by racial differences in resilience, due to having earlier exposure to discrimination. A total of 388 SGM-AFAB participants (43.0% African American, 26.8% Latine, 30.92% White) reported on anxiety, depression and resilience levels. ANOVA results were conclusive with hypothesis 1, as POC SGM-AFAB participants had lower scores of depression compared to their White counterparts. Specifically, Black SGMs had significantly lower scores of depression in comparison to White SMGs. Black and Latine participants had lower anxiety scores compared to White participants. Black participants had significantly lower anxiety compared to both Latine and White participants. In partial alignment with hypothesis 2, Black participants had significantly higher resilience scores than Latine and White participants. ANCOVA results indicate that resilience does account for depression levels between Black and White participants. Additionally, resilience does account for anxiety levels between Black and Latine participants, but not Black and White participants. Results indicate how Black SGM individuals may have earlier exposure to resilience to combat negative mental health outcomes.

C-02: Ethnic Differences in Family Support for Sexual and Gender Minority Individuals

Great Hall

Nia Clark, Psychology
Project Advisor: Dr. Sarah Whitton

Abstract
Family support acts as a protective factor against anxiety, depression, and suicidal ideation among sexual and gender minority (SGM) adolescents. However, levels of family support may vary across demographics as some studies suggest ethnic minority parents may be more rejecting of SGM adolescents than White parents. This could be accounted for by the greater religiosity of African American and Latine families than White families, as the conservative values of churches often promote homophobia and negative views of SGM individuals. We propose that:1) SGM POC will report lower levels of family support/ higher levels of family rejection than White SGM; 2) racial differences in family support/rejection will be explained by racial differences in religiosity. A sample of 354 SGM-AFAB participants (47.5% African American, 32.5% White, 20.1% Latine) reported on family support, family rejection, and parents' religiosity. We conducted one-way analyses of variances (ANOVA) to test for racial differences in family support, rejection, and religiosity. We then proceeded to run ANCOVAs to test for differences between race and family support while controlling for religiosity. Results: 1) White SGM reported higher levels of family support compared to SGM POC, specifically Black SGM, but levels of family rejection did not differ between ethnic groups. 2) Overall religiousness scores were higher for Black SGM compared to White SGM. However, parental religiosity did not account for racial differences

in family support or rejection. Findings reinforce the need to examine the non-religious cultural factors when accounting for observed ethnic differences in family support.

C-03: Depressive Symptoms and Stress Among Mothers Participating in an Infant Obesity Prevention Program Targeting Maternal Mental Health

Great Hall
Tae'auna Felton, Psychology
Project Advisor: Dr. Cathy Stough

Abstract
Postpartum depression (PPD) symptoms and parental stress may negatively impact child obesogenic health outcomes, and infant obesity prevention programs may be an ideal avenue for addressing these concerns. The current study examined the potential impact of an infant obesity prevention program, Healthy Eating for My Infant (HEMI), on PPD symptoms and parenting stress, along with associations with parental feeding behaviors and infant weight. Thirty mothers of two-month-old infants were randomized to either a control group or to participate in a 6-week behavioral, education, and social support infant obesity prevention program. Mothers completed the Edinburgh Postnatal Depression Scale (EPDS), Parenting Stress Index (PSI-4), and Infant Feeding Style Questionnaire (IFSQ). Infant weight and length were measured by trained study staff. A mixed analysis of variance examined possible group (i.e., control, treatment) differences in change over time on EPDS and PSI-4 scores. Pearson correlations examined possible relations between scores on the EPDS, PSI-4, IFSQ, and infant Body Mass Index (BMI). There was a significant main effect of EPDS, $F(1, 25) = 6.402$, $p= 0.02$, but not a significant group x time interaction. All other findings were non-significant. PPD symptoms reduced for all mothers in the study over time, but participating in HEMI did not result in greater improvements in PPD symptoms or stress . PPD symptoms and stress were not related to child obesogenic outcomes, suggesting additional factors should be considered in supporting families with promoting their child's health.

C-04: Social Media's Impact on 6th Graders' Elementary School Time and Life Balance

Great Hall
Coumba Bagayoko, Social Work
Project Advisor: Dr. Georgia Anderson

Abstract
This research project aims to explore the influence of social media on the time management of 6th-grade students in elementary schools and the subsequent implications for other aspects of their lives. The overarching goal is to gain comprehensive insights into how social media use among this age group affects academic engagement, participation in extracurricular activities, and overall well-being. The central question guiding this research is: How is social media impacting 6th graders' time in elementary schools, and what are the repercussions on their involvement in other activities outside of the school environment? The research seeks to uncover the intricate dynamics between social media use, academic commitments, and the allocation of time to various aspects of their lives. In this study, the researcher employed a survey method to investigate the impact of social media on the time and life

balance of sixth graders in elementary schools. Visiting each sixth-grade class, the researcher distributed permission slips and provided a concise overview of the survey's purpose and expectations. To encourage participation, students returning the survey were offered the chance to have lunch with the researcher. Ultimately, 9 permission slips were collected, but 2 participants withdrew, resulting in a final sample size of 6. Data collection was facilitated through Google Forms, featuring a set of 10 specific questions probing into students' social media usage habits and exploring potential effects on their academic performance and overall well-being.

C-05: Effects of Uninterrupted Breaks on Indicators of Burnout for Nurses Working 12 Hour Shifts

Great Hall

Tabitha Robinson, Nursing
Georgia Ryan, Nursing
Ryan Steiner, Nursing
Project Advisor: Dr. Mohammed Othman

Abstract
Breaks play a key role in reducing burnout among nurses working 12-hour shifts, but many are not able to utilize their break effectively. Even when a break is taken, patient responsibility is often lingering over the nurse's head. The purpose of this research project is to educate practicing nurses on the effects that a lack of shift breaks has on mental health and overall well-being. The PICOT question we want to answer is "In Nurses who Work a 12-hour Shift, What is the Effect of an Uninterrupted 30-minute Break Compared with Nurses That Don't Get Them on Indicators of Burnout in Two Months?". Our goal is to see more nurses take purposeful breaks during their shifts and recognize the effects of constant stress on feelings burnout. To achieve this goal, we provided surveys to collect data on current break culture on two units in hospital settings, specifically an ER at Kettering Hamilton Hospital and Urology at Bethesda North Hospital. The survey included questions regarding stress level, break times, and experience on breaks. We then provided education on both units regarding the importance and effects of taking breaks. This education included a pretest and posttest, which allowed us to see the retention of the information by the nurses. The outcome of our research will allow us to better understand how breaks and stress levels are correlated for nurses, while also advocating for nurses to take full advantage of their breaks. Key Words: Uninterrupted Break, Nurses, 12-Hour Shift, Burnout

C-06: Suicide Prevention in an In-Patient Setting

Great Hall

Alexander Folds, Nursing
Kathryn Cholak, Nursing
Ava Lopez, Nursing
Project Advisor: Dr. Caroline Morrison

Abstract
Inpatient suicide remains a pressing concern within inpatient healthcare settings, necessitating effective prevention strategies and posing many challenges. This project aims to educate and train nursing staff

on the interventions that should be implemented to prevent suicide in the inpatient population. Our main goal is to discover whether suicidal ideation patients in an inpatient setting, with more vigorous monitoring via sitter, lead to less risk of self-harm attempts during hospitalization. We created an education plan to present to a group of nine medical-surgical nurses at the VA Hospital. It included a presentation on close proximity monitoring, proper communication, effective handoff, and a pretest and post-test to assess their knowledge. The presentation emphasized relevant statistics, appropriate interventions, self-harm risk factors, and staff education specifically for patients with suicidal ideation. We examined the nurses on the pretest questions to gauge initial knowledge, then presented our topic to educate further. Following the presentation, the nurses completed the post-test. Two of the nurses got two out of the four questions right, five got three out of four questions right, and two got every question right on the pretest. Seven nurses got all the questions right on the post-test, and two got three out of the four. The nurses were engaged throughout the presentation and stated they believed these interventions would be helpful in their nursing practice to promote patient safety.

C-07: Shift Length Flexibility: Effects on Nurse Burnout and Quality of Patient Care

Great Hall

Olivia Bentley, Nursing
Sydney Berberick, Nursing
Danielle Cheff, Nursing
Project Advisor: Dr. Paul Lewis

Abstract

The current standard practice for a nurse's schedule is three 12-hour shifts per week. Almost 50% of nurses are dissatisfied with their job when working these hours, and a third are dissatisfied with their work schedule. Additionally, working 12 or more hours can cause burnout, leading to diminished mental capacity, less attentiveness, and an increased risk for errors in patient care and safety. The purpose of this project is to investigate the benefits and shortcomings of alternate schedule options for nurses to prevent these contingencies. The research examines the question of how shift length flexibility has an effect on burnout and the quality of care delivered to patients. An evidence-based methodology was used to gather current literature to form an education plan for the targeted population. An educational powerpoint displaying the evidence was then presented to cancer and blood disease pediatric nurses at Cincinnati Children's Hospital Medical Center. A pre and post-test was administered to allow for the analysis of their knowledge gained after attending the education session. The outcome of this work is aimed at helping to further the empowerment of nurses to form an educated opinion when presented with a variety of scheduling options. Results are pending.

C-08: Childhood Trauma Connected to Mental Illness Diagnosis

Great Hall

Brooklyn Collett, Social Work
Project Advisor: Dr. Gary Dick

Abstract

This research study was conducted to compare trauma children experience to their mental illness diagnosis. Children are often overlooked in their trauma due to the fact they are so young and could move past the traumatic events. This study uses an official questionnaire document titled," The Childhood Trust Event Survey" that consists of twentyseven trauma related questions that can be answered with a simple yes or no response. The results show that there is a big connection between childhood trauma and mental illness. Not everyone who experiences a childhood traumatic event is diagnosed with a mental illness and not everyone who has a mental illness experienced trauma in their youth.

C-09: Evaluating Grief Support Groups at Companions on a Journey and How They Affect School-Aged Kids Through Grief and Balance of Their Personal Lives

Great Hall

Mara Wozniak, Social Work
Project Advisor: Dr. Gary Dick

Abstract
This study expands and broadens the knowledge of grief support groups and the effect they have on kids. Emotions, behaviors, and feelings related to grief were examined and analyzed utilizing observations and a Satisfaction with Group Outcomes Survey that students in the groups filled out. The goal of this study is to educate those who are working and interfacing with grieving students, specifically those who are elementary-aged students. Some examples of professionals who can benefit from this study are teachers, doctors, therapists, and social workers. This study examines the literature related to grief, and educates those about the background of the participants of the study through the literature.

C-10: Program Proposal: Substance-related Psychosis - Assessment and Relapse prevention Key (SPARK)

Great Hall

Abigail Gajus, Neuroscience
Project Advisor: Dr. Annette Stowasser

Abstract
Methamphetamine usage in the United States has surged over the past few decades alongside a steady increase in cases of drug-induced psychosis. According to the Center for
Disease Control, the number of people reporting past-year use of methamphetamine has increased from 684,000 individuals in 2016 to 1,048,000 in 2019. Few resources currently exist for those struggling with stimulant addiction, and individuals who present to hospitals and emergency departments with drug-related psychotic episodes frequently slip through the cracks, unable to receive effective care for their addiction or mental health concerns. Methamphetamine use in particular is associated with a high risk of developing drug-induced psychosis, a condition that occurs in up to 40% of users and can recur with repeated usage. With Americans seeing unprecedented rates of methamphetamine usage, it is urgent to find solutions to mitigate these interlinked public health crises. Mental health issues and addiction often fuel each other, making recovery from one extremely difficult without treating the other. This project

will provide the model for a research-based treatment program designed to identify and treat those experiencing psychosis triggered by substance use. The proposed program uses methods that have been successful in treating mental illness and addiction as coexisting issues, reducing substance usage, readmission rates, and cost burden to the healthcare system. By identifying patients who are presenting with drug-related psychotic symptoms in the emergency setting, those who are at risk for recurring episodes can be referred to a team of professionals to help treat addiction and mental illness simultaneously.

Category D: Advancing Education and Professional Practice

D-01: Engineering Students' Prompting Strategies with ChatGPT to Solve Engineering Design Tasks

Great Hall

Aarohi Shah, Computer Science
Tanishq Jadhav, Computer Science
Dhruv Singh, Computer Science
Project Advisor: Dr. David Reeping

Abstract
This research project delves into students' prompting strategies when utilizing generative AI in the context of addressing engineering design problems. Amidst the growing adoption of generative AI platforms like ChatGPT, there is a growing need to explore how to effectively integrate them into educational settings and instruct students on appropriate usage. The current literature primarily focuses on students' usage preferences of generative AI, scant attention has been paid to analyzing their actual prompting strategies.Conducted within an introductory engineering course at a large Midwest university, our study involved administering a brainstorming assignment for a semi-autonomous robot project to teams of 3-4 students. The assignment involved beginning with a structured brainstorming session, followed by a conversation with ChatGPT. Students were tasked with planning at least 5 prompts for the AI system, engaging in dialogue with ChatGPT for at least 30 minutes, and subsequently integrating the new insights with the ideas from the traditional brainstorming session. Our research question centers on understanding the prompting strategies employed by students when interfacing with ChatGPT for engineering design problem-solving. We collected completed assignments from consenting teams (n = 100 teams, 396 prompts) and analyzed them using an inductive qualitative coding approach to identify recurring patterns in their interactions. Preliminary findings reveal that students predominantly seek information akin to conventional search engine queries, with a subset directly soliciting design solutions or asking the system to make evaluative comparisons. Notably, a proportion of prompts instructed ChatGPT to produce the "best" solution instead of generating multiple possible solutions.

D-02: Identifying Meaningful Language Outcomes for Autistic Preschoolers with an Expert Panel

Great Hall

Brooke Clark, Speech-Language Hearing Sciences

Lauren Murphy, Speech-Language Hearing Sciences
Project Advisor: Dr. Andrea Ford

Abstract
The purpose of this study is to identify meaningful and measurable language outcomes that education teams can target in early childhood classroom routines with autistic preschoolers. To identify this set of outcomes, we are using an electronic Delphi Method. This method involves engaging an expert panel in multiple rounds of gathering information to narrow the field of outcomes and reach a consensus on those deemed most essential. Our panel of 28 experts includes researchers (n=13) and practitioners (n=15) with expertise in early language development, autism, and implementation of evidence-based language practices for autistic children in preschool classroom settings. Each expert also has at least 5 years of experience working directly or conducting research with autistic preschoolers. Our qualitative data analysis of the first round is underway. We plan to present the initial set of outcomes the experts identified, organized by themes. We hypothesize that we will see 35 unique expressive and receptive outcomes, such as using total communication with interaction partner (i.e. peers) and promoting autonomy (i.e. AACs) using their language/communication system.

D-03

Withdrawn

D-04: Promoting Confidence and Developing Skills Through Simulation Practice for New Graduate Nurses

Great Hall

Lauren Dible, Nursing
Mallory Mahoney, Nursing
Gracie Mcswords, Nursing
Project Advisor: Dr. Caroline Morrison

Abstract
New graduate nurses often feel unqualified when faced with trauma in the field, having only limited experience to prepare them. The purpose of this capstone project was to provide education supporting the use of simulation prior to entering the field. A literature search was conducted on best practices on experiential learning through the use of simulation. The research indicated simulation enhances cognitive thinking skills, and self-confidence when treating patients in emergency situations as compared to those who do not partake. A group of undergraduate students, educators and other members of faculty from the University of Cincinnati College of Nursing viewed a PowerPoint showing the data found supporting the use of these simulations as well as a "code blue" educational simulation video. Learning outcomes were assessed by pre and post-tests which were administered to allow for the analysis of their knowledge gained after viewing the PowerPoint and video. Also provided was a handout with step by step instructions of what to do when in a "code blue" situation. The goal of this education is to promote the future use of simulation prior to graduation to better prepare students for crisis situations. Results pending.

D-05: Peripheral IV Inflitration Prevention

Great Hall
Katie Leonard, Nursing
Evelyn Kolks, Nursing
Project Advisor: Dr. Caroline Morrison

Abstract
The purpose of this project is to present synchronous PIV infiltration prevention education to hospital medicine pediatric nurses caring for patients with peripheral intravenous lines in order to improve PIV assessment techniques and reduce incidents of infiltration of peripheral intravenous lines during inpatient admissions. The question being asked is "In hospital medicine pediatric nurses caring for patients with peripheral intravenous lines, how does implementing a PIV assessment education session compared with no PIV assessment education session reduce incidents of infiltration of peripheral intravenous lines during an inpatient admission?" The strategy used was to hold a synchronous education session for pediatric nurses on the selected medical-surgical unit at Cincinnati Children's Hospital Medical Center. The presentation provided an educational PowerPoint that included pictures, video demonstrations, and general outlines of current policies related to PIV infiltration and assessment. A pre and post-test was created for session participants in order to gauge content comprehension as well as if attendees felt holding a synchronous education session is useful and should be continued. The outcome of the presentation will help nurses on the unit to feel more competent and confident with regards to the identification and proper care for patients with PIV infiltrates as well as enhancing PIV assessment techniques. The implication of our project is to enhance outcomes related to infiltrations on the designated unit, and to increase awareness around policy and practice guidelines via synchronous education. This outcome is applicable to pediatric hospital medicine settings.

D-06: Educating Pediatric Nurses on Symptoms of Burnout in Order to Decrease Overall Rates

Great Hall
Gabriella Ortiz, Nursing
Erin Kramer, Nursing
Vanessa Martin, Nursing
Project Advisor: Dr. Paul Lewis

Abstract
According to the American Nurses Association, 62% of nurses experience burnout. Pediatric nurses frequently encounter high levels of burnout due to the demanding nature of their job. Many pediatric nurses report experiencing symptoms of burnout including emotional exhaustion, irritability, and isolation. Recognizing the need for support and intervention, this project aims to provide pediatric nurses at Cincinnati Children's Hospital with education and resources to help prevent burnout. The educational presentation involves presenting a PowerPoint and showcasing a video to a group of pediatric nurses in the complex surgery and transplant unit. This presentation covers topics such as recognizing signs and symptoms of burnout versus stress, vulnerable populations, the impact of sleep

and regular exercise/healthy diet, therapeutic counseling, and the BREATHE stress management plan. To evaluate the effectiveness of the intervention, pre and post-tests are administered to measure knowledge gained and changes in attitudes towards burnout. Results pending.

D-07: Bedside Report Increasing Patient Safety

Great Hall
Abigail Carson, Nursing
Madison Hardin, Nursing
Sydney Davis, Nursing
Project Advisor: Dr. Mohammad Othman

Abstract
A crucial moment to assess the status of a patient occurs during a shift change from one nurse to the next. In these moments, nurses have the ability to halt unsafe interventions before it becomes a sentinel event as well as include the patient in the conversation regarding their care. The purpose of this project was to answer the question of how does receiving handoff report at the bedside compared to receiving handoff outside the patient's room benefit patients' safety and satisfaction? Nurses often feel that a bedside report takes longer than any other report. Nurses also agree with the false notion that they cannot speak freely in front of a patient and their family. Nurses on the Clinical Decision Unit at the University of Cincinnati Medical Center received an educational presentation including a poster of statistics regarding increased patient safety and an informational video demonstrating situational techniques of report proving the efficiency and effectiveness of bedside. While conducting research it was found that bedside report decreases falls, medication errors, and allows for patient communication that needs to be addressed. A pre and post test were administered to assess the knowledge gained during the educational session. Results pending.

D-08: Educating Nurses on Sleep Deprivation and Sleep-Promoting Interventions to Improve Hospitalized Patient Outcomes

Great Hall
Carmela Mae Ugaban , Nursing
Samantha Lemar, Nursing
Lauren Autry, Nursing
Project Advisor: Dr. Caroline Morrison

Abstract
Nearly all hospitalized patients (76%) experience disrupted sleep. Disrupted sleep and consequent sleep deprivation may contribute to impaired recovery, prolonged length of stay, reduced subjective well-being, and poor patient perception of hospitalized care. A literature search was conducted on PubMed, Cinahl, MEDLINE, and EBSCO to investigate this issue. Studies show that sleep deprivation and respective sleep-improving interventions remain unaddressed problems among hospitalized patients. The primary aim of this project is to raise awareness and educate nurses about the pervasive issue of disrupted sleep in hospital settings, and the importance of implementing sleep-promoting interventions

to optimize sleep conditions. A group of medical surgical registered nurses at the University of Cincinnati Medical Center will receive an educational PowerPoint with additional informational material at hand. A pre and post-test will be administered to allow for the analysis of knowledge gained after viewing the educational PowerPoint. Results pending. The outcome of this project will help increase nurse awareness and change attitudes towards patients' sleep. By raising awareness of sleep deprivation and incorporating sleep hygiene into everyday practice, patient sleep in hospital settings will improve, thus improving patient outcomes.

D-09: Encouragement of Position Changes Throughout the Duration of Labor to Promote Cervical Changes in the Labor Process

Great Hall
Olivia Oliverio, Nursing
Morga Orzechowski , Nursing
Emma Phelps, Nursing
Project Advisor: Dr. Mohammad Othman

Abstract
Cesarean sections without medical indication are on the rise. Patients are 50% less likely to have a cesarean section with utilization of frequent position changes, such as a peanut ball. Some nurses are not aware of research surrounding labor position changes to reduce this statistic. The purpose of this project is to implement a practice change by educating nurses about evidence-based research on the benefits of positional changes during active labor to increase cervical changes and reduce cesarean sections. We created an education session for nurses on the labor and delivery unit to present our research findings and demonstrate specific positional changes to implement for laboring women. This includes reviewing literature and giving a handout with positions for the nurses to implement for their patients. The nurses will take a pre-test to evaluate their current understanding, and our aim is their post-test outcome will be an increase in knowledge. Using a pre-test and post-test format, we hope our audience gains a greater understanding of the need and advantages of implementing position changes in active labor. The results are pending. The outcome of this work will help labor and delivery nurses know specific positions that may lead to faster cervical changes in laboring women which reduces the need for cesarean sections. Reducing cesarean sections will further reduce stress and labor trauma. While implementation is difficult due to long standing hospital traditional practice, it begins with individual education of the nurses, which is our goal.

D-10: Hand Hygiene

Great Hall
Allie Tong, Nursing
Evelyn Wildey, Nursing
Meghan Lairdieson, Nursing
Project Advisor: Dr. Mohammad Othman

Abstract

Hand hygiene is a crucial strategy that healthcare workers implement to prevent contamination and spread of infection. Although best practice has evolved over time, current research has argued whether alcohol-based hand rubs are more clinically practical compared to medical-grade hand soap. The purpose of our project was to educate healthcare workers on the importance of incorporating correct hand hygiene techniques into patient care, specifically in a clinical setting. Our strategy to achieve our goal is to initially review existing literature to understand the current practice in place. Following, we would evaluate the quality of the studies compared to the studies that support our objective. After reviewing both sides of the literature, we would synthesize data to further implement and educate healthcare workers on the best practice of hand hygiene according to our research. We will implement posters, pamphlets, and verbal explanations of our findings to the healthcare staff on a neuro/trauma unit in order to achieve a decrease in hospital-acquired infections caused by hand hygiene concerns. Results of the project are pending. This project is expected to aid nurses working on neuro/trauma units to utilize the most accurate and efficient clinical techniques in preventing transmission of infection among patients. The outcome of this new practice will allow us to observe how effective our education plan and teachings were. This will be done by gathering data after our education plan process is completed. The data will be the healthcare workers demonstrating proper hand hygiene techniques.

D-11: Enhancing Continuity of Quality Care Through Bedside Shift Report

Great Hall
Caitlyn Edwards, Nursing
Steven Murdock, Nursing
Chloe Davis , Nursing
Project Advisor: Dr. Mohammad Othman

Abstract
Bedside shift reports substantially enhance patient-centered care by involving patients in their own care plan, promoting transparency, improving communication among healthcare providers, and ensuring a smoother transition between shifts. The purpose of our educational project is to identify how bedside reports in comparison to non-bedside reports can improve the quality of care for inpatients. The strategy used started with collection of scholarly evidence in support of bedside shift report. Utilizing this data, an educational slide show was configured with matching pre-test questions and post-test questions. The pre-test, slideshow and post-test questionnaires were then sent via email to registered nurses working in an inpatient pediatric endocrinology and pulmonology unit, and an inpatient adult oncology unit. The data was recorded from the pre and post test questionnaires to evaluate the outcome and results. The outcome of this project concluded that through education on the benefits of this practice, registered nurses were able to identify positive effects of bedside shift reports and in turn displayed increased readiness to participate in this practice.

D-12: Reducing Emergency Department Wait Times

Great Hall
Audrey Farlow, Nursing
Laurel Desrosiers, Nursing

Lydia Holland, Nursing
Project Advisor: Dr. Paul Lewis

Abstract
The purpose of this project was to conduct a literature review of research on different workflow models used in Emergency Departments and to determine which model best improves a patient's overall time in department. Our guiding research question was "In the Emergency Department, how does utilizing components of a workflow model such as the "Super/Fast Track" or "Vertical/Horizontal" workflow model, compared to not utilizing a workflow model, affect low-acuity patients' overall time in the department within a two-day implementation period?". From our literature review, we determined the Vertical Flow Model to have sufficient evidence and developed a presentation to educate the nursing staff in the ED about the literature findings. A pre-survey will be conducted to determine knowledge and comfortability of Vertical Flow Models, nursing role, and intent to implement the proposed model. Methods used to educate will be PowerPoint and a distributed infographic. A post-survey will be conducted to determine if our teaching objectives were met. Results showed an increase in understanding from the pre-test to the post-test in all areas of understanding the vertical flow model, the nurse's role, and how to implement it into practice.

D-13: Educating Pediatric Nursing Students on Coping Strategies When Dealing with The Loss of a Child Patient

Great Hall

Claire MacGowan, Nursing
Anna Eschemeyer, Nursing
Rachel Berling , Nursing
Project Advisor: Dr. Mohammad Othman

Abstract
Almost 75% of pediatric nurses will experience the loss of a child patient within their first year of working. No specific training is provided to nursing students coping with the loss of a patient. The purpose of this project was to provide information to students on positive coping strategies they can use with the focus on the benefits of group debrief sessions as well as individualized personal strategies. We conducted a literature search that consisted of current evidence published within the last seven years and created a PowerPoint educational session to present to a pediatric nursing class. This content outlined the purpose of our research, how the research applies to students, the various types of coping strategies, resources available, and the strategies that proved to be most beneficial when coping with the death of a patient. The pre and post-tests will assess the knowledge of students before and after our presentation. Ultimately, they will assess their confidence level when seeking support, identifying healthy coping strategies, and their understanding of bereavement. Results of this project are pending. The outcome of the education will help future nurses have a better understanding on how to cope with the loss of a patient. Students will be able to identify effective coping strategies such as group debriefing and understand the benefits utilizing this strategy will grant them rather than less effective strategies that only involve the individual alone.

D-14: How the Implementation of Crisis Prevention Intervention Training May Worsen a Student's Experience in a Regular School Setting

Great Hall

Ella Johnson, Social Work
Project Advisor: Dr. Georgia Anderson

Abstract
This study was conducted to measure the relationship between the implementation of Crisis Prevention Intervention (CPI) Training and student's experience in a regular school setting. There are differing opinions that suggest the implementation of CPI training would not appear different in varying settings, nor would the student's experience be altered. In this study, clients from Wasserman Day Treatment were surveyed about their experience in a regular school setting and how staff handled their crises. This study shows that staff in regular school settings did not handle client's crises in the expected terms outlined in CPI trainings and actually worsened the client's experience at school. The implementation of CPI training varies between school based and mental health based settings causing school based settings to not always be best fit for individuals struggling behaviorally.

D-15: An Evaluation of an Educational Intervention to Reduce Peripheral IV Infiltration in Pediatric Medicine

Great Hall

Kaylee Hopper, Nursing
Catherine Broering, Nursing
Evelyn Kolks, Nursing
Project Advisor: Dr. Caroline Morrison

Abstract
The purpose of this project is to present in-person peripheral IV infiltration (PIV) prevention education to hospital medicine pediatric nurses caring for patients with peripheral IV lines to improve PIV assessment techniques and reduce instances of infiltration during inpatient admissions. The question being asked is "In hospital medicine pediatric nurses caring for patients with peripheral intravenous lines, how does implementing a PIV assessment education session compared with no PIV assessment education session reduce incidents of infiltration of peripheral intravenous lines during an inpatient admission?" The strategy used was to hold a synchronous education session for pediatric nurses on the selected medical-surgical unit at Cincinnati Children's Hospital Medical Center. The presentation provided an educational PowerPoint that included pictures, video demonstrations, and general outlines of current policies related to PIV infiltration and assessment. A pre and post-test was created for session participants in order to gauge content comprehension as well as if attendees felt holding a synchronous education session is useful and should be continued. The outcome of the presentation will help nurses on the unit to feel more competent and confident with regards to the identification and proper care for patients with PIV infiltrates as well as enhancing PIV assessment techniques. The implication of our project is to enhance outcomes related to infiltrations on the designated unit, and to increase

awareness around policy and practice guidelines via synchronous education. This outcome is applicable to pediatric hospital medicine settings.

D-16: Training Helps Prepare Cardiac Nurses to Implement Targeted Temperature Management on Cardiac Arrest Patients

Great Hall
Abigail Brandenburg, Nursing
Emma Rackley, Nursing
Peyton Maxwell, Nursing
Project Advisor: Dr. Paul Lewis

Abstract
Targeted temperature management (TTM) is a recent method used to increase positive neurological outcomes post-cardiac arrest. Because of the importance for healthcare providers to understand and implement this method correctly, we developed a research-informed educational training for nurses in a Cardiac Intensive Care Unit. Our presentation clarified the neurological benefits of using TTM following a cardiac arrest and demonstrated the technology used to perform the method. We evaluated participant learning with a pre- and post-test on how and when to use TTM along with the general understanding of what TTM is. Our presentation will relay the results of our training program in terms of participant learning and overall value for healthcare providers.

Category E: Medical Frontiers

E-01: Sub-second Release of Catecholamines from Dendritic Cells

Great Hall
Maren Howorka, Neurobiology
Project Advisor: Dr. Ashley Ross

Abstract
The neuroimmune system is complex and is regulated by small chemical messengers released from resident immune and neuronal cells. Catecholamines like dopamine and norepinephrine are important chemical messengers responsible for initiating and propagating messages between neurons and immune cells; however, the mechanism and dynamics of this signaling is relatively unknown. The presence of the intracellular machinery to synthesize and interact with catecholamines in dendritic cells has been known for over a decade; however, direct measurement of catecholamine secretion in real time from immune cells has not been possible. Here, we have discovered that Bone Marrow derived dendritic cells are capable of releasing catecholamines on a sub second time scale. We have used a revolutionary technique, often used in the neuroscience field, called fast-scan cyclic voltammetry (FSCV) to measure sub second fluctuations of catecholamines from isolated dendritic cells. This work provides direct evidence that dendritic cells are capable of releasing catecholamines, potentially as a feedback communicator to resident sympathetic neurons in host immune organs. These results also prove that

immune cells can signal on the same time scale as neurons. This work will hopefully open the door to enable more sophisticated studies at the neuron-immune synapse in the future.

E-02: Over-expressing a Gene Involved in Cholesterol Metabolism Correlates with Increased Radiation Resistance in Tumor Cells

Great Hall

Rae Kovatich, Biochemistry and Neurobiology
Project Advisor: Dr. Mathieu Sertorio

Abstract
Head and Neck Squamous Cell Carcinoma (HNSCC) has a high incidence of post-radiation therapy relapse. This is a major contributing factor to poor treatment outcomes in almost 50% of patients. The focus of our research is to understand and utilize the radiation resistance mechanisms of HNSCC cells to improve that outcome. By analyzing tumors pre-radiation, relapse was correlated with increased expression of genes involved in cholesterol metabolism. Sterol regulatory element-binding protein 2 (SREBP2) is a protein that activates genes involved in cholesterol metabolism, commonly referred to as cholesterogenic genes. We hypothesized that SREBP2 activation promotes HNSCC radioresistance, so inhibiting SREBP2 will increase cell radiation sensitivity. To test this, we cloned the cDNA sequence corresponding to the activated form of SREBP2 (nSREBP2) and used the virus pLV-Eif1a-IRES-Puro, a lentivirus similar to HIV, as the plasmid backbone. After ensuring the virus contained successfully cloned DNA, it was introduced to tumor cell lines Cal27 (human) and Moc1 (mouse) and treated with the antibiotic puromycin in a process called selection. Selection confirmed nSREBP2 was overexpressed, and that host cells had increased cholesterogenic gene expression. When exposed to radiation, an increased survival rate for cells with over-expressed nSREBP2 was observed in comparison to normal cells. These results confirm that nSREBP2 protects against radiation, and are the basis for ongoing experimentation to test if inhibiting SREBP2 activation in HNSCC tumor cells makes radiation therapy more effective.

E-03: Cell Type Specific Inhibition of a Candidate MicroRNA and its Role in Regulation of Seizure Networks in a Mouse Model of Epilepsy

Great Hall

Rachana Kode, Neuroscience
Project Advisor: Dr. Durgesh Tiwari

Abstract
Epilepsy is a disorder characterized by seizures caused by abnormal neuronal hyperexcitability. Current medications provide limited protection and do not work in one-third of patients; therefore, novel therapies focused on multiple targets could provide better outcomes. Recent evidence suggests microRNAs (miRNAs) as critical regulators of gene expression in epilepsy. Previous lab studies have shown that an antagomir mediated inhibition of miR-324-5p reduces seizure susceptibility in epilepsy mouse models. The following study utilized an adeno-associated virus (AAV)-miRNA-sponge strategy to determine the effect of cell-type specific inhibition of miR-324-5p on seizure susceptibility in a kainic acid (KA) epilepsy mouse model. Methods: MiR-sponges specific to neurons (AAV9-Syn-mCherry-

mir324-5p), microglia (AAV5-GFAP-mCherry-miR-324-5p), and scrambled controls were injected via a bilateral intrahippocampal injection at dorsal and ventral hippocampus (4 sites) in 6-8 week old C57BL/6 mice. Four weeks post treatment, these mice were tested for KA induced seizure susceptibility. EEG data was analyzed for seizures and EEG waveforms. Brain tissue was analyzed for cell type-specific expression using mCherry and immunostaining was performed to determine cell loss. Results: Cell type-specific expression in the hippocampus was established through mCherry expression. Significant reduction ($p<0.05$) in seizure susceptibility was observed in AAV9-Syn-mCherry-miR-324-5p, while there was no significant difference ($p>0.05$) observed for AAV5-GFAP-mCherry-miR-324-5p. No significant difference ($p>0.05$) was observed in EEG waveforms and immunohistochemistry (analysis ongoing). Conclusion: These results demonstrate that the cell-type specific inhibition of miRNAs can help in regulating seizure susceptibility in epilepsy mice models and can be used as potential future therapeutics.

E-04: The Impact of Ciliary Neurotrophic Factor Receptor α Gene Therapy in Amyotrophic Lateral Sclerosis (ALS) Mice Model

Great Hall
Haley Durr, Biochemistry
Project Advisor: Dr. John MacLennan

Abstract
Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative motor neuron disease with onset in adulthood, and currently no effective treatment. Key motor function loss includes moving, swallowing, and breathing. Due to delayed diagnosis, patients are not able to enter treatment until well after symptoms onset. Ciliary Neurotrophic Factor (CNTF) is a potent neurotrophic factor able to maintain axons of motor neurons and promote their growth and regrowth after loss. Instead of focusing on CNTF, this research focuses on a CNTF receptor mechanism which inhibits ALS and helps maintain motor neuron axons systemically. Our treatment uses adeno-associated virus (AAV) gene therapy to enhance expression of the critical CNTF receptor component, CNTFRα , decreasing risk of side effects while inhibiting ALS. In almost all cases of human ALS, there are defects in TDP-43 subcellular location. TDP-43^Q331K mice are a genetic model of ALS with such defects. Like human ALS, they display adult-onset motor function loss as well as slow disease progression. These mice were treated with the CNTFRα AAV after onset of symptoms and monitored for motor function decline with tremor, hindlimb clasp, rotarod, and grip strength tests. This testing revealed long term, highly significant therapeutic effects of the CNTFRα AAV treatment. This research demonstrates that the local administration of CNTFRα AAV inhibits ALS in these model mice and identifies it as a promising potential treatment for human ALS.

E-05: Analysis of Transfer-RNA Modifications in Metastatic Melanoma

Great Hall
Ella Quinlisk, Biochemistry
Project Advisor: Dr. Patrick Limbach

Abstract

Melanoma is a highly fatal skin cancer because of its ability to spread and multiply easily to vital organs. This process is known as metastasis. Metastasis is a well-researched subject, however, most of this research has focused on DNA and proteins leaving out an important mediator, RNA. Transfer RNA (tRNA) is a vital part of the protein synthesis process. tRNA serves as a transporter of amino acids to the ribosome during translation. However, the significance of naturally occurring modifications in tRNA, particularly within the anticodon region, can directly influence protein quantity and quality, factors that can be linked to disease progression. Mannosyl-queuosine (manQ) is a glycosylation of the modified guanosine, queuosine (Q). Previous research has indicated that while the overall levels of manQ remain the same between primary and metastatic melanoma cells, there appears to be a disparity in the abundance of tRNA^Asp containing manQ, with higher levels observed in primary cells. This project focuses on the modification status of manQ on tRNA^Asp. After isolation of tRNA^Asp through gel electrophoresis and purification, we performed LC-MS/MS to directly assess the status of the modification. Studies such as these shed light on the potential biological roles tRNA plays in the development of metastasis. In summary, this project attempts to advance the knowledge of tRNA modifications and their relevance in cancer biology, specifically in metastatic melanoma.

E-06: Fighting Cancer with Novel Antibiotics

Great Hall

Yatra Patel, Medical Sciences
Luke Ustick, Health Sciences
Project Advisor: Dr. Vicky Gomez-Stallons

Abstract

Despite current therapies, tumor relapse and therapy resistance present as significant obstacles to successful management of cancer. Cancer stem cells (CSCs) play a crucial role in the development and recurrence of cancer. CSCs are a subpopulation within tumors capable of self-renewal and differentiation into various cell types within tumors. Furthermore, CSCs are thought to drive tumor recurrence after treatment. Even if the majority of tumor cells are eliminated by therapy, CSCs can survive and repopulate the tumor, leading to cancer relapse. However, identifying and effectively targeting CSCs remains a significant challenge. Recent studies have shown that specific antibiotics can effectively inhibit various types of CSCs (breast, ovarian, prostate, lung, pancreatic, melanoma, and glioblastoma cancers). Due to the impact of antibiotics on CSC function, targeting CSCs is a promising strategy for improving outcomes in cancer patients by preventing recurrence and enhancing treatment efficacy. Our preliminary studies have identified several extracts from bacterial antibiotic producers that can inhibit multiple CSC-derived tumorsphere types (breast, lung, and prostate) in cultured human cancer cell lines. Tumorsphere formation is a widely accepted technique used to quantitate CSC activity and a reliable method to screen for novel anti-CSC agents. Our objective for this Spring semester is to analyze the gene expression patterns of CSC-associated markers and their impact on tumorsphere quantity and dimensions within cultured A549 human lung cancer cells, compared to healthy lung cells. These studies will provide a baseline for assessing changes in gene expression patterns and tumorsphere morphology following treatment with bacterial extracts.

E-07: 3D Printing and Digital Surgical Planning for Endoscopic Mitral Valve Repair and Replacement

Great Hall

Shivum Chokshi, Medical Sciences
Project Advisor: Dr. Prashanth Ravi

Abstract

This project aims to investigate the clinical outcomes and feasibility of 3D printed anatomical models and digital surgical planning that assist in the preoperative surgical planning of endoscopic mitral valve repair and replacement in 5 patients. Due to the complex nature of the minimally invasive procedure, the choice of the entry point in the chest for the surgery has a critical bearing on the outcome. Using advanced computer-aided design and 3D printing, the working port placement was pre-planned before the surgery. Additionally, angular measurements of the valve planes and skin measurement of the entry point were provided to the cardiothoracic surgeon as part of the digital surgical plan. The electronic medical record of the 5 patients will be reviewed to assess the clinical outcomes including any intraoperative, short term, and long-term complications. The project will add new knowledge to the literature on the clinical utility of endoscopic mitral valve repair and replacement using 3D printing and digital surgical planning. Furthermore, in terms of the development of my own discipline and personal growth, through performing this project, I will gain an improved understanding of the possible integrations of engineering with medicine as well as the steps involved in analyzing patient medical records which will assist in my aspirations of becoming a future physician.

E-08: Structurally Tunable Lipid Nanoparticles as Therapeutic Nanocarriers for Applications in Transdermal Delivery

Great Hall

Meghan Mozzone, Biochemistry
Sydney Dobler, Chemistry
Kaylyn Mitchell, Biological Sciences
Project Advisor: Dr. Briana Simms

Abstract

Here, we demonstrate the applicability of structurally tunable lipid nanoparticles and their nanoaggregates as therapeutic nanocarriers. These nanocarriers are comprised of a hydrophobic acyl chain chemically coupled to a hydrophilic dendron polyamidoamine (PAMAM) -resembling the molecular architecture of a standard lipid molecule. We have synthesized a library of these materials varying the dendrimer size, surface group, and acyl tail length to fully evaluate how the structural features of the dendrimer-lipid hybrid macromolecule influence the properties of the self-assembled nanoparticle in solution. Dynamic light scattering was used to understand the size and surface charge density of the self-assembled nanoparticles. Electron microscopy was used to visualize the morphology of the nanoparticles. Thermogravimetric analysis and differential scanning calorimetry provided insight into the bilayer morphology and structure. All of these principles were studied together to provide a holistic understanding of what structural features of lipid nanoparticles are critical to obtain the desired properties for a nanocarrier to improve therapeutic delivery efforts.

E-09: Engineering Skin Microbiome for the Prevention of Skin Cancer by Manipulating Horizontal Gene Transfer and Developing an on-site Therapeutic Delivery System

Great Hall

Tohonne Konare, Health Sciences: Pre-Medicine
Project Advisor: Dr. Nitin Kamble

Abstract
Humans exist in an environment today that exposes them to all different sorts of harmful stimuli such as pollution, toxins, and ultraviolet radiation (UV-R). In the short run, these stimuli can cause reactive oxygen species (ROS), DNA damage, and even metabolic changes. Over time, photoaging, skin cancer, and in extreme cases, death is all result of exposure to UV radiation, without proper precautionary mechanisms. The current market treatments are various kinds of sunscreens. However, they can have detrimental health and environmental effects. DESCRIPTION OF PROJECT: The main goal of our project was to identify and implement a sustainable solution to the native skin microbiome to address various skin conditions. This solution was identified in marine ecosystems by means of Mycosporin-like amino acids (MAAs). MAAs are secondary water-soluble metabolites that are both photostable and can serve as antioxidants. KEY FINDINGS: A commensal bacterial host, Staphylococcus epidermidis (S. epi) was engineered to express enzyme machinery responsible for synthesizing MAAs by using genetic engineering techniques and synthetic biology toolkit. With the help of Transposons, we anticipate engineering S. epi into an on-site, and on-demand therapeutic delivery system, to formulate an effective preventative method for skin cancer, while eliminating the shortcomings of traditional sunscreens. In the future, we anticipate further engineering our platform for horizontal gene transfer (HGT) using transposon to respond to various environmental cues such as U.V radiation, heavy metal ion, and environmental pollutants such as poly aromatic hydrocarbons for addressing various skin damages and skin conditions, making it versatile novel platform.

E-10: Navigating the Neuroimmune Landscape in a Homeostatic and Inflammatory Condition

Great Hall

Mia Natale, Biological Sciences
Project Advisor: Dr. Marc Rothenberg

Abstract
Eosinophilic esophagitis is an allergic disease of the esophagus, which causes symptoms such as inflammation and pain. Previous research has shown that the nervous system plays a role in the perception of pain, but there is limited research regarding the role of the nervous system in allergic diseases. Our goal was to gain an understanding of how nerve patterns in the esophagus differ between allergic and healthy models, as well as the relationship between nerves and allergic response immune cells. We used immunofluorescent imaging techniques to quantify innervation of various nerve types and mast cells in eosinophilic esophagitis mouse esophagus samples and eosinophilic esophagitis human esophagus samples, in comparison to their respective controls. We found increased myelinated nerve density in active eosinophilic esophagitis patients compared with healthy controls ($p=0.042$).

Interestingly, myelinated nerves were only elevated in active eosinophilic esophagitis patients who had received steroid treatment (p=0.014). In mice, allergen exposure increased pain receptor nerve density (p<0.0001), but had no impact on myelinated nerves. Our results also suggest that increased mast cell density may be observed alongside increased nerve density in patients with eosinophilic esophagitis. Taken together, our findings indicate allergic inflammation is associated with changes in nerve density in the esophagus in both mice and humans. They also suggest that there may be an interaction between nerves and the proliferation of mast cells in patients with eosinophilic esophagitis. Our findings provide early insight into neuroimmune mechanisms that may be operational in eosinophilic esophagitis.

E-11: Investigating the Role of GAS6, a Molecule Associated with Resistance to Chemotherapy

Great Hall

Anushkaa Parwade, Biological Sciences
Project Advisor: Dr. David Plas

Abstract

Glioblastoma multiforme (GBM) is a highly aggressive type of invasive brain tumor resulting in a median survival rate of just 18 months. The progression of GBM involves the activation of specific cellular pathways, one of which is the AXL pathway. AXL is a receptor that, when activated by the molecule GAS6, has been shown to promote resistance to a wide range of cancer therapies. When GAS6 attaches to AXL, it triggers the activation of signaling events that ultimately lead to resistance against therapies. This project aimed to investigate the role of GAS6 in therapy resistance by removing (knocking-out) GAS6 from GBM cells. The findings from this experiment hold promise for advancing our understanding of how the activation of the pathway contributes to drug resistance in GBM. Such insights could potentially pave the way for the development of therapeutic strategies to fight treatment resistance and improve outcomes for patients with glioblastoma multiforme.

E-12: A Large-scale Preparation of an Engineered Antibody-like Protein for Monitoring the Cycle of a Versatile Cell Signaling Molecule

Great Hall

Pablo Reed-Prieto, Biochemistry and Biological Sciences
Project Advisor: Dr. In-Kwon Kim

Abstract

ADP-ribosylation (ADPR) is a reversible post-translational modification that is enzymatically added to proteins and serves as an important signaling molecule that controls cellular processes including DNA damage response, gene expression, and cell death. Previous studies have demonstrated the therapeutic benefit of controlling ADPR metabolism, especially to kill certain cancer cells. In order to study the addition and removal of ADPR by various enzymes, it is necessary to specifically monitor the ADP-ribosylation states of target proteins. eAf1521-Fc is an engineered ADPR-binding protein, in which a macrodomain (Af1521) is attached to an antibody fragment, allowing for specific detection of ADPR. I aimed to purify this engineered antibody-like protein for subsequent use in experiments monitoring ADPR addition and removal. A plasmid containing the gene construct for the eAf1521-Fc protein was

introduced into E. coli strains and the overproduction of the protein was confirmed. The E. coli Rosetta strain was selected and grown on a large scale. The Rosetta cells were harvested and ruptured, and proteins were then separated from cellular debris by centrifugation. The eAf1521-Fc protein was purified from this solution by various chromatographic methods in near homogeneity. The ability to specifically identify the presence of ADPR on target proteins allows for further study of the mechanisms and functions of enzymes involved in ADPR metabolism.

E-13: Investigation of Fatty Acid Desaturases as Potential Drug Targets in Naegleria Amoeba

Great Hall

Nick Nowacinski, biological sciences
Project Advisor: Dr. Yoshi Odaka

Abstract

Naegleria are amoebae that thrive in warm environments. Naegleria can be either pathogenic and disease-inducing, the only identified species being N. fowleri (brain-eating amoeba), or non-pathogenic and non-disease inducing, such as N. gruberi. N. fowleri causes an infection to the host known as primary amoebic meningoencephalitis (PAM), which destroys brain tissue and causes brain swelling, having over a 97% fatality rate. The development of a drug that could kill Naegleria could provide an adequate treatment for PAM, but it is essential to first understand what genes may trigger cell death. Given that lipids (e.g., fatty acids) constitute half of the brain's dry mass, and previous studies by others have shown that fatty acid oxidation is the preferred metabolic pathway for cellular respiration in Naegleria, we assessed the expression of transcripts for fatty acid desaturase and the viabilities of N. gruberi when treated with desaturase inhibitors in this study. N. gruberi (NEG-M strain) was maintained aseptically in a liquid medium (2% Bacto casitone, 10% fetal bovine serum, and 2.5% yeast extract, 100U/mL penicillin-streptomycin) in a petri dish. To examine delta-5 desaturase, delta-6 desaturase, and delta-9 desaturase as potential drug targets, the expression of these genes was examined by reverse-transcription of total RNA and then quantitative PCR. Cell viabilities for amoebae treated with desaturase inhibitors, including A939572 (stearoyl-CoA desaturase 1 (SCD1) inhibitor), T-3364366 (thienopyrimidinone delta-5 desaturase (D5D) inhibitor), CP-24879 hydrochloride (Delta 5/Delta 6 inhibitor), sesamin, and PluriSin 1, were then evaluated. In the future, we will investigate the inhibitory mechanisms of cellular processes

E-14: Sleep in Mosquitoes is Essential for Disease Transmission

Great Hall

Jasmine Kennedy, Biological Sciences
Project Advisor: Dr. Joshua Benoit

Abstract

Sleep is crucial for the biological functioning of most animal systems, including insects. In insects, sleep is important for energy conservation and immunity. Using behavioral and/or electrophysiological correlates, sleep has been established in different insects such as fruit flies. However, in disease vectors like mosquitoes, there is little or no study characterizing sleep-like states and epidemiological

importance. In our studies, we characterized sleep-like states using body posture analysis and behavioral correlates in three mosquito species involved in transmitting pathogens: Aedes aegypti, Culex pipiens, and Anopheles stephensi; we found postural differences between sleep-like and active states, where their hind legs and abdomen are lowered during the sleep-like state. Using an infrared activity monitor, we evaluated the rest-activity rhythms of these mosquito species during a 12h/12h light-dark cycle. Ae. aegypti showed decreased sleep during the day relative to the night, Cx. pipiens had increased activity during the transition periods and An. stephensi exhibited decreased sleep during the night, matching field observations. We also investigated the influence of sleep deprivation on sleep rebound, host landing, and blood-feeding propensity in Ae. Aegypti; it was found that nighttime sleep deprivation using vibration stimuli induced sleep rebound, suppressed host landing, and blood-feeding propensity in the subsequent light phase. Lastly, we quantified the potential differences in sleep amount between sexes and among 17 strains of Aedes aegypti. Our results show that females tend to sleep more than males during both light and dark phases. Altogether, the results show the importance of sleep in mosquitoes for disease transmission.

E-15: The Usefulness of Cerebral Visual Impairment Questionnaires in Diagnoses

Great Hall
Taylor Brown, Neuroscience
Project Advisor: Dr. Karen Harpster

Abstract
Cerebral visual impairment(CVI) onsets when a child has a brain injury to the visual pathways in the brain. It is one of the leading disorders in children who have vision problems but it is still a disorder that many do not know about. In order for doctors to help see if their patients may have CVI they can use a questionnaire which is a well known way to use. The question at hand is are these questionnaires useful in diagnosing children with CVI? We would be using the CCHMC Epic system to compare children's score on the questionnaire that they use, TEACH and Previas if they were diagnosed by ophthalmologist and doctors. The outcome of the work will help doctors to diagnosis children better and earlier for CVI so they are able to get early intervention to improve their vision with Occupational Therapists. If children can get early intervention then this could help there visual communication in the adulthood.

Category F: Healing and Strengthening

F-01: HIV and AIDS: The Experience of People Living with HIV/AIDS in Case Management

Great Hall
Maggie Herrle, Social Work
Project Advisor: Dr. Georgia Anderson

Abstract
Using qualitative research and semi-structured interviews, I seek to explore the experience of people living with HIV/AIDS in case management. The research topic has been informed by my internship experience at a non-profit social services agency that works directly with this population. From my

research, I hope to improve case management at this agency to most effectively serve the clients and discover themes among participants' responses.

F-02: Acute Effects of Exercise on Cognitive Performance

Great Hall
Mason Pledger-Shine, Health Sciences: Pre-Physical Therapy
Asya Donmez, Health Sciences
Grant Robinson, Health Sciences
Project Advisor: Dr. Susan Kotowski

Abstract
Physical activity has been shown to boost cognitive performance by increasing neural activity. Previous studies in the literature have shown strong agreement in the benefits of pre-performance exercise, but the superior exercise type (e.g., anaerobic, aerobic, other) remains uncertain. The purpose of our study was to identify which exercise type had the largest impact on a Stroop test, designed to simulate a recall-type exam students may take in class. Twenty-two healthy individuals ages 18-25 completed the study. Conditions consisted of a baseline test where no exercise was completed prior to the Stroop test and then three additional timed test sessions where aerobic, anaerobic, or meditation exercises were completed, with the order of the three exercise sessions randomized. Aerobic exercise involved cycling on a stationary bike at 13 mpg with 1kg of resistance. Anaerobic exercise consisted of three sets of body-weight exercises (wall sits, planks, isometric hold with TheraBand). A video-based guided meditation was watched for the meditation session. The exercises were followed by the completion of the Stroop test where total attempts and correct attempts were recorded. After all three sessions, participants rated which type of pre-test exercise helped increase Stroop test performance the most. We hypothesized that pre-test anaerobic exercise would yield the highest Stroop test scores, but that all three pre-test exercise activities will yield higher scores than the baseline Stroop performance. These outcomes may help identify how short, single bouts of exercise can increase performance in cognitive-type tests, a strategy students could utilize to increase academic performance.

F-03: The Effects of ACL Reconstruction on Performance

Great Hall
Victoria Wood, Health Sciences
Xavier Eilers, Health Sciences
Project Advisor: Prof. Rachel Gleason

Abstract
Anterior cruciate ligament (ACL) injuries are common in sports, often leading to functional impairment and long-term consequences. Surgical reconstruction is a standard treatment to restore knee stability, yet individuals, particularly females, face prolonged neuromuscular and biomechanical deficits, predisposing them to reinjury. Mechanoreceptor damage and muscle strength deficits post-ACL reconstruction increase the risk of diminished proprioception and coordination, raising concerns about re-injury. This study explores the impact of ACL reconstruction on performance outcomes, such as

balance and long jump, in college-aged females during fatigue protocols, aiming to bridge the gap in tailored rehabilitation strategies for this demographic. Females were recruited to participate in this study. Subjects completed a consent form and questionnaire to check that they exercised two days a week minimum, had their reconstruction within the past five years but post one year, and had no physical limitations. Subjects completed a fatigue protocol, consisting of three minutes of cycling on the Wahoo Kickr Smart Bike, ten squats, and ten step downs. After two rounds of the fatigue protocol, subjects completed the Y-Balance test and a single leg long jump test. Muscle oxygen of the quadriceps was monitored with a Moxy Monitor. All tests were analyzed using an ANOVA test, comparing intra and inter-leg differences. We expect that ACL-reconstructed legs will exhibit lower performance outcomes compared to their nonsurgical counterparts. Due to lack of understanding of performance outcomes for female athletes following ACL reconstruction, there is a need for more research on targeted interventions in female ACL rehabilitation.

F-04: Effect of Foot Position on the Pedal on Cycling Efficiency

Great Hall

Will Ayers, Health Sciences
Ethan Huang, Health Sciences
Xuan Nguyen, Health Sciences
Project Advisor: Dr. Nikita Kuznetsov

Abstract

When cycling, individuals typically pedal using the forefoot rather than the midfoot or rearfoot. Studies in the past have found no significant difference in cycling efficiency when changing foot position anteriorly and posteriorly (Van Sickle and Hull, 2007; Chartogne, et al., 2016). The purpose of this study is to test whether foot placement on the pedal affects physiological cost of cycling. We hypothesized that moving the foot more posteriorly on the pedal (mid-foot placement) vs. forefoot would decrease cycling efficiency, especially at higher required mechanical power output levels. Ten subjects will ride on a stationary bike using two different foot positions (forefoot vs. midfoot) and two different power outputs (60 vs. 120 Watts). The steady-state absolute VO2 consumption during this submaximal test will be recorded and used to calculate the Gross Efficiency (GE) index, which is the ratio of work output to energy expenditure during physical activity. A two-way repeated measures ANOVA will be used to identify how GE changes with foot positioning and power output. Preliminary data indicate no significant impact of foot placement on GE across both power settings ($p>0.05$), although GE is notably higher at 120 Watts. The GE values were around 0.18, which is consistent with the previous literature. The results of this study will provide information on the physiological costs associated with foot placement on the pedal while biking at submaximal effort. These results would be applicable to a wide range of recreational cyclists and could help optimize performance.

F-05: Testing Applicability of the Leading Joint Hypothesis in Frisbee-like Throwing

Great Hall

Conner Gray, Health Sciences: Pre-Physician Assistant
Project Advisor: Dr. Nikita Kuznetsov

Abstract
Humans exhibit a broad spectrum of skilled perceptual-motor behaviors, from typing to playing tennis, yet the central nervous system's regulation of the musculoskeletal system's elements is not fully understood. The Leading Joint Hypothesis (LJH) offers a perspective on multi-joint movements, suggesting that for each action, there is a primary "leading joint" while secondary "trailing joints" follow, experiencing passive "interaction" torque generated by the leading joint. This implies active muscle control is only needed for the leading joint, with trailing joints requiring intermittent control to channel interaction torques to produce a desired movement of the whole limb. This study aims to investigate the joint interaction pattern in frisbee-like throwing. Five participants performed frisbee-like throws in horizontal plane using their elbow and wrist under conditions of slow-velocity and fast-velocity throws, with instructions to relax their wrist. Kinematic data on the arm, forearm, and wrist movements were captured using inertial measurement units, alongside electromyography on bicep, triceps, and forearm muscles to record muscle activation. LJH predicts that during both fast-velocity throws, the IMU and EMG recordings will show the earliest muscle activity at the triceps muscle (indicating it as a leading joint), with no muscle coactivation at the wrist muscles (trailing joint). However, during slow-velocity throwing and no-throwing conditions, we expect muscle activation at both the leading and trailing joint(s). The study aims to test the applicability of the LDJ in frisbee-like throwing. Theoretical ideas of LDJ can be helpful to improve motor learning in sports and rehabilitation.

F-06: Does Verbal Feedback Type Impact Maximum Vertical Jump Height?

Great Hall

Genesis Manganese, Health Sciences
Spiel Paul, Health Sciences
Project Advisor: Dr. Susan Kotowski

Abstract
Verbal feedback has been found to increase performance of tasks such as swimming, running, and walking. Verbal feedback works by mediating the effects of fatigue to achieve more optimal levels of efficiency, speed, etc. There are two types of verbal feedback: positive and negative. While there are studies that show the effectiveness of positive feedback on performance, there is not consistent data comparing the effectiveness of either positive or negative feedback. Furthermore, little data exists showing how the gender of the proctor (encourager) can affect the performance of the athlete. The purpose of the study was to see how positive feedback versus negative feedback from either the same or opposite gender proctor/encourager affected the maximal vertical jump height during repeated jumps. Twenty subjects were recruited, screened for eligibility, and, after consenting to participate, completed a questionnaire with demographic and personality-based questions. Participants then were shown a video on how to perform a vertical jump, before performing 3 sets of 15 maximum vertical jumps set to a metronome with one minute of rest between sets with no verbal feedback (baseline). The height of the jumps were measured using a digital jump mat. Participants then completed 2 additional days of testing (with at least 2 days rest in-between) where additional sets of jumps were completed with the addition of either positive or negative feedback (randomized). For half the participants, the encourager was the same gender as the participant, and for the other half the encourager was the opposite gender.

F-07: The Effects of Shoulder Position on Bicep Brachii Activation

Great Hall

Madicke Jobe, Health Sciences: Pre-Medicine and Nutrition
Owen McLain, Health Sciences: Pre-Physical Therapy
logan schmidt, Health Sciences
Project Advisor: Dr. Zachary Sievert

Abstract
Our study aims to investigate how different shoulder positions affect the activation of the biceps brachii muscle during bicep flexion resistance exercises. Limited research shows that shoulder position from extended to neutral to flexed changes biceps activations. Here we use electromyography (EMG) to identify which shoulder position elicits the greatest relative activation (i.e., electrical activity produced by the muscle). The EMG of the biceps brachii will be measured in shoulder extension, anatomical position, and shoulder flexion. The EMG data will be derived from an elbow flexion curl exercise and a metronome will be used to keep consistent speed of repetitions. We anticipate that performing a bicep curl with the shoulder in an extended position will produce the greatest EMG activation due to the reduced force generating capabilities in an extended position. This extended position would have increased biceps activations from having to recruit more muscle fibers to complete the biceps curl with the relative external load and the induced stretch of the biceps from the initial starting position. Results of this study can be used to inform strength training and rehabilitation programs.

F-08: Dominance-Related Lower Limb Force Disparities in Take-off and Landing During Trials Based Jumping on Asymmetry

Great Hall

Victoria Young, Health Sciences: Pre-Physical Therapy
Jacob Bolin, Health Sciences: Pre-Medicine
Project Advisor: Dr. Zachary Sievert

Abstract
Lower limb asymmetry occurs when there is a difference in the strength, power, or force between dominant and non-dominant legs. Significant asymmetries can exist between lower limb force production during the take-off and landing phases during jumping. This asymmetry can potentially lead to injuries during jumping or landing. The main purpose of this study is to compare the asymmetries measured between dominant and non-dominant legs during take-off and landing phases of jumping at peak height. The participants will be aged 18-25 and considered physically active. The participants will be asked questions about their physical background and capabilities. Each participant will jump and land on force plates under a specific condition with both dominant and non-dominant legs. This process will be repeated using three different conditions, landing on both legs, left leg, and right leg. The expected results are that there will be asymmetry between the dominant and non-dominant leg when landing on both feet. There will be more imbalances in the non-dominant leg landing than the dominant leg. During the trials where the participant would land on either their dominant or non-dominant leg, we often had

to complete a trial rerun due to imbalances. It can be concluded that of the stable landings, the dominant leg showed less asymmetry than the non-dominant leg.

F-09: The Effects of Fatigue on Dynamic Balance in Individuals with Chronic Ankle Instability

Great Hall

Parth Patel, Health Sciences: Pre-Medicine
Alex Hansen, Health Sciences: Pre-Medicine
Project Advisor: Prof. Rachel Gleason

Abstract
Ankle injuries are the most common lower extremity injury for any running sport. An injury or recurrence of an injury to the ankle joint may lead to chronic ankle instability (CAI), a functional and mechanical deficit of the ankle joint. Dynamic balance is hypothesized to be affected by fatigue and poor balance increases the risk for ankle sprains. This project's purpose is to identify the difference between fatigue and dynamic stability measured from time to stabilization and a YBT, within individuals with CAI. We hypothesize that an individual with CAI will have a high time to stabilization due to the decreased proprioception in the leg with CAI than the leg without CAI. Twenty participants, ages 18-25 will be recruited that had history(s) of ankle injuries. Participants will perform a pre/post fatigue YBT test and a single leg lateral hop onto a force plate. The results should show a significantly greater TTS and significantly lower YBT score in the posterior lateral direction in the CAI ankle post fatigue compared to the "healthy" ankle. Our results showed that after a fatigue protocol there was a significantly greater TTS and decrease in dynamic balance in the instable ankle than the healthy ankle. Our results agree with Lacy et al. (2019) that there is a decrease in TTS. These results allow clinicians to understand as athletes fatigue their dynamic balance decrease significantly and a risk of injury to the athlete increases.

F-10: Body-Weight vs. Resistance-Based Grip Training Effects on Forearm Flexor Endurance in Novice Rock Climbers

Great Hall

Gregory, Pudloski, Health Sciences: Pre-Medicine
Alexander Harrison, Health Sciences: Pre-Physical Therapy
Project Advisor: Dr. Susan Kotowski

Abstract
Rock climbing is a growing recreational and competitive sport which attracts climbers of various expertise. Performance within the sport relies on "grip strength" or endurance within the hand and forearm flexor muscles during isometric contractions of varying durations. Previous studies have relied on experienced rock-climbing athletes when assessing grip strength. We investigated two grip training regimens to determine the most efficient grip training method for beginner climbers. All participants conducted a diagnostic hang test on a rock-climbing grip until failure, then were randomly assigned into one of two groups. Group one conducted dead-hangs on a pull-up bar; group two conducted the same sets and repetitions as group one did, except they utilized a Thera-Band wrapped around nails to simulate a hand grip trainer. Group two was instructed to squeeze the Thera-Band until they reached

45-degrees of flexion at the PIP joint which would promote adequate isometric contraction of the intrinsic hand flexors. The two groups conducted four sets of five ten-second repetitions week one. During week two, another set was added for five sets total. Following the two-week training regiment, the participants conducted a final hang test. The difference between the diagnostic and final hang times between the two groups were compared using a paired t-test. We hypothesized that the overhand dead hang training protocol will yield greater gains in muscular endurance compared to the Thera-Band training protocol due to the similarity between the training protocol and the final endurance test.

F-11: Gender Differences in Muscle Oxygenation Recovery Following Intermittent Cycling Exercise

Great Hall
Keeton Burnside, Health Sciences
Sasha Kuehn, Health Sciences
Project Advisor: Dr. Daniel Carl

Abstract
Differences in fatiguability between human males and females following repeated cycling power outputs has been documented. However, potential differences in muscle oxygenation recovery levels as a potential explanation has not been measured. Understanding differences between male and female muscle oxygenation recovery profiles would be beneficial in establishing both rehabilitation treatment and athletic performance protocols. We hypothesize that females will recover muscle oxygenation levels more robustly than males following 4 x 60s maximal effort cycling bouts with 30s recovery between bouts. Subjects participated in a single day session that included the following: A 4-6 minute warm up on the cycle ergometer (Wahoo KICKR). Four, one-minute maximal effort cycling bouts separated by 30s of recovery between. At the completion of the 4th bout, subjects remained seated on the cycle ergometer for 3 minutes while oxygen recovery levels (Moxy Oxygen Monitor) and blood lactate levels (Lactate Plus) were measured. Heart Rate and Power output were also recorded. Results are pending, but we expect that females will have an enhanced recovery profile compared to males participating in the same exercise.

Category G: Chemical Frontiers

G-01: Conformational Dynamics of Hexamer and Pore Loops of Spiral Configuration of Hsp104

Great Hall
Mercedes Leum, Chemistry
Project Advisor: Dr. George Stan

Abstract
The heat-shock protein HSP104, from Saccharomyces cerevisiae or Brewer’s yeast, plays a crucial role in protein quality control by unfolding aberrant or toxic proteins to maintain protein homeostasis. HSP104 performs as a hexameric nanomachine by resolubilizing abnormalities such as amyloids and aggregates in the biological environment that cause neurodegenerative disorders such as Alzheimer's and

polyglutamine disease. Interactions between the heat-shock protein and the amyloid substrate are facilitated by translocating the substrate along the axial channel from polypeptide to polypeptide, contacting various pore loop active sites, in the presence of ATP hydrolysis. However, the conformational changes of pore loop interactions with the substrate remain incompletely understood. So far, the machine's functional states have been discovered: spiral (PDB ID: 5vya) and ring (PDB ID: 5vjh). This computational study aims to explain the asymmetric pore dynamics of HSP104 by conducting all-atom molecular dynamic simulations for commotions of the spiral configuration. Our results are informed by root mean square deviation (RMSD) analysis, root mean square fluctuations of specific α-carbon atoms, principal component analysis (PCA), and dynamic cross-correlation (DCCM) analysis to discern correlated motions of regions in the hexameric structure during our molecular dynamic simulations.

G-02: The Fenton Project: Forming Carbon-Carbon Bonds Using Fenton's Reagent and Para-xylene

Great Hall
Anna Rice, Chemistry
Project Advisor: Dr. Allan Pinhas

Abstract
Fenton's Reagent (iron (II) and peroxide in water) is known for its ability to unravel DNA and degrade biological molecules like lipids and proteins. Similar chemistry is used to clean up toxic waste sites as well. On the other hand, the Fenton Project set out to explore how Fenton's Reagent could be used to create carbon-carbon bonds. The formation of carbon-carbon bonds in water is a rare occurrence especially when compared to reactions in organic solvents. Previous research has proven this to be possible in many different capacities (including the coupling of nitriles, ketones, and simple polar aromatics). However, in my branch of this project, I analyzed the reaction pathways of using Fenton's Reagent with a nonpolar aromatic starting material- para-xylene. Through my work in the lab and in the use of Gas Chromatography- Mass Spectrometry (GC-MS), I was able to successfully confirm the creation of several different coupled products, their relative abundances, and possible mechanism pathways. The results of my work on this product will aid in the discovery of new ways to form carbon-carbon bonds and possible factors that may affect the creation of specific products above others.

G-03: Dynamic Covalent Bonds in Polyurethane PolyHIPEs for Self-healing Properties

Great Hall
Kate Custer, Chemistry
Project Advisor: Dr. Neil Ayres

Abstract
The goal of this research is to incorporate dynamic covalent bonds into polyurethane polyHIPEs to create stimuli-responsive properties such as self-healing. Polyurethanes are a widely used polymer found in furniture, insulation, electrical appliances, and more. Polyurethane is synthesized from alcohols and isocyanates. Previous research created a method to synthesize polyurethane polyHIPEs

(PU-PHs) with uniform pore distribution via a PU-prepolymer. This is important because uniform porosity gives uniform properties throughout the polyHIPE. Structures of the PU-prepolymers were confirmed using NMR and IR. Dynamic covalent bonds have self-healing properties, which are important due to the current need for sustainable materials. These dynamic bonds can be broken and reformed when external energy (like heat) is applied. To test for self-healing abilities, we did a cut or scratch test followed by heating the sample in an oven to see if the cuts/breaks mended. We worked on incorporating two different types of dynamic covalent bonds in this research: disulfides and boronic acid esters. PU-PHs containing disulfide bonds were synthesized from cyclical isocyanates but did not show self-healing properties. This may be due to the limited surface area where bonds can reform. Current research underway is using a linear isocyanate due to its increased flexibility. Boronic acid ester dynamic bonds in PU-PHs are still being studied. This research is more complicated since the boronic acid ester must be synthesized and then functionalized with a thiol (type of alcohol). Possible applications for self-healing polyHIPEs include protective coatings, biomedical applications such as tissue scaffolding, flexible electronics, and more.

G-04: Synthesis and Characterization of Sulfur-functionalized Rotaxanes and their Precursors

Great Hall

David Maleh, Biochemistry
Project Advisor: Dr. David Smithrud

Abstract
Rotaxanes are large molecules consisting of a "wheel", an "axle" fed through the wheel, and two blocking groups on either side of the axle locking the wheel in place on the axle. The blocking groups and wheel may undergo stepwise chemical modification in order to carry out a broad range of chemical processes. The aim of our work was to determine whether rotaxanes can form disulfide bonds, a specific type of bond between two sulfur atoms, within a biological system. The culmination of this research may lead to new antiviral agents.

G-05: Synthesis, Photochemistry and Dynamics of Halogen Substituted Azido Phenol

Great Hall

Trevor Henry, Biochemistry
Project Advisor: Dr. Anna Gudmundsdottir

Abstract
Azides, nitrogen-based compounds, offer potential applications across many fields of research. This study delves into the photochemistry and dynamics of three azido phenol types: bromo-, chloro-, and iodo-based. Our goal is to synthesize multiple azides, purify them, grow the crystals and do mechanistic studies. We investigate how substituents on the aryl azide segment affect their photochemical reactivity and crystal dynamics. Employing a multidisciplinary approach blending chemistry, materials science, and physics, we conduct experiments-synthesis, purification, crystal growth, and mechanistic study-to unveil the underlying mechanisms governing their behavior. Inspired by past research, particularly on azide photodynamics, we hypothesize that differing substituents (bromo, chloro, and iodo) influence reactivity

profiles and crystal dynamics due to variations in packing and intermolecular forces. We anticipate the substituent choice significantly impacting photochemical reactivity and dynamic of their crystal. Our conclusion suggests the substituent on the azide segment crucially dictates photochemical reactivity and product distributions. This research will advance knowledge in azide chemistry, offering insights into bromo, chloro, and iodo-based azide reactivity patterns, facilitating the development of tailored nitrogen-containing compounds for various applications.

Category H: Water for Life

H-01: The Humidity Entrainment of Insect Circadian Clocks

Great Hall
Luke Lutz, Biological Sciences
Project Advisor: Dr. Joshua Benoit

Abstract
This project was to understand the relationship between humidity conditions and insect behaviors, as well as to determine the presence of a humidity-associated circadian clock in Drosophila and mosquitoes. In our studies, Drosophila and mosquitoes were subject to a humidity entrainment period, where humidity levels cyclically fluctuated from low to high conditions over the course of 24 hours, to determine if a behavioral response occurs and to establish a rhythmic behavioral pattern. Following this period, the insects were then exposed to constant humidity environment to determine if rhythmic behavior continued in the absence of the rhythmic environmental cues. We found that after humidity entrainment, both Drosophila and mosquitoes exhibited a rhythmic behavioral pattern under constant humidity conditions. These studies were followed by an assessment of Drosophila and mosquito genetic mutants associated with circadian rhythms, which exhibited no rhythmic behavior during the humidity entrainment and constant humidity conditions. Our results suggest that humidity-associated behavior is under circadian control and point to potential genes responsible for the humidity entrainment of the circadian clock in insects.

H-02: Characterizing the Controls on Lake Water Isotopes for Diatom Biomarker Paleohydrology Calibrations

Great Hall
Michael Schenk, Geology
Project Advisor: Dr. Aaron Diefendorf

Abstract
Isotopic ratios of hydrogen and oxygen compared to the universally accepted standard of 200-500 m ocean depth provides information about precipitation and evaporation. Higher values of δ2H and δ18O indicate increased evaporation and temperature, as the lighter isotopes evaporate first and heavier isotopes remain. Analyzation of lacustrine diatoms are utilized to quantify isotopic ratios of the past, with their highly branched isoprenoids preserving the isotopic signal. Diatom studies are often sampled from singular lakes, lacking in a wider context of how isotopes behave across regions. To bring a context

linking regions across the United States and further develop the diatom biomarker, this study characterizes the hydrology of 47 lakes within the Adirondacks, New England, Midwest, and Upper Midwest. Sampled lakes range in areas from 0.024 km2 to 322 km2, elevations of 58 m to 664 m, and lake depths up to 38 m. Water chemistry data such as pH, conductivity, and silica content, along with modeled mean annual precipitation estimates and precipitation samples from the lake locations add to the hydrologic characterization. The measured δ2H and δ18O values are higher than the modeled precipitation estimates across all lakes, an average difference of 6.7 per mil for δ2H and 1.8 per mil for δ18O, indicating that the sampled lakes have evaporation enrichment in the heavy isotope signal. Our aim is to advance the understanding of what controls lake water isotopes across regions and narrow the focus of hydrologic cycle factors, providing societal benefit towards understanding how future hydrologic cycles will behave.

H-03: Despite Habitat Improvements, Mussel Relocation Struggles

Great Hall

Braedon Titus, Biological Sciences
Bennett Vail, Environmental Studies
Project Advisor: Dr. Stephen Matter

Abstract
We surveyed the freshwater mussel relocation efforts in the Mill Creek. Freshwater mussels were relocated at a couple of sites along the Mill Creek about 6 years ago, and have not been documented since their relocation. Although our research is not complete just yet, we have been to a multiple different relocation sites and are still yet to find a freshwater mussel.

H-04: Lack of Evidence For Successful Freshwater Mussel Reintroduction in the Mill Creek

Great Hall

Bennett Vail, Environmental Studies
Project Advisor: Dr. Stephen Matter

Abstract
In June 2019, three Mussel species (Lampsilis powellii, Lasmigona complanata, Pyganodon grandis) were reintroduced into the Mill Creek in Cincinnati, Ohio. This effort was intended to increase biodiversity within the previously polluted and environmentally damaged Mill Creek. Through conscious environmental efforts and modification, the Mill Creek has undergone restoration to attain higher biodiversity and decreased pollution. In this study, research colleagues and myself surveyed the three Mussel species that were reintroduced. Through various methods and recorded measurements, I was able to conclude that there was a strong lack of evidence for the success of these reintroduced Mussel species.

H-05: Comparison of Methods for Woody Debris Assessment in the Ohio River

Great Hall

Adam Daniels, Biological Sciences
Project Advisor: Dr. Michael Booth

Abstract

The Ohio River is a vital aquatic resource used for transportation, recreation, and potable water. To ensure and better the Ohio River's health and water quality, management evaluates the state of riverine habitat using the ORSANCO-derived Ohio River Fish Index(mORFIn). mORFIn scores are obtained through sampling of fish and macroinvertebrate populations, habitat, and water quality at sites throughout the Ohio River watershed. Through the enhancement of habitat and hydrologic features, large woody debris is an important part of sampled habitat that provides substrate and shelter for fish, macroinvertebrates, and periphyton communities. However, the turbidity of the Ohio River can often make measurement of woody debris difficult. Currently, it is quantified by visually counting wood along the shoreline, though applications through this method are still unclear. Thus, there is a need to develop methods to better quantify available habitat in the river. We aim to determine whether the employment of sonar side-scan could potentially provide a more efficient and accurate method to estimate habitat. We used recreational side-scan sonar to survey 10 miles of shoreline and capture imagery of submerged woody debris on the Ohio River near Cincinnati, Ohio. At the same time, counts of shoreline wood were made and recorded. Sonar imagery was processed in ReefMaster and analyzed in ArcGIS Pro. We anticipate a significant difference in the accuracy of woody debris quantification between the side-scan sonar and visual methods. This could potentially provide a more efficient and accurate means of habitat assessment, subsequently leading to a healthier river.

H-06: Impact of Cyanobacteria and Their Associated Toxins on Fish Gut Microbiomes

Great Hall

Brock Shellhaas, Biological Sciences
Project Advisor: Dr. Michael Booth

Abstract

The field of freshwater fish microbiome is still widely under-studied and is largely focused on marine fish and fish mucous membranes. The gut microbiome of fish is a gateway to understanding the influences of toxins and primary producers in a system. Knowing the impact on the microbiome can give light to the health of the fish in the system or the overall health of the system. It's known that the Central stoneroller fish has a vast diversity of its gut microbiome but also is very immersed in its environment as it consumes algae in the system. Diving into relationships between the environment and fish gut microbiome in a simulation, the goal was to find direct links between toxins and the impacts on the Central Stonerollers. The target species, the Central stonerollers, are native to the Little Miami River; the fish collected from the experiment system were then dissected. The guts were extracted and DNA sequenced by the Environmental Protection Agency. The outcome of this work will help build an understanding of the health of our streams and fish compared to the toxins that are produced by primary producers.

H-07: Investigating Fish Gut Microbiomes Along a Nutrient and Primary Producer Gradient

Great Hall
Andrew Long, Biological Sciences
Project Advisor: Dr. Michael Booth

Abstract
Nutrient runoff remains a significant anthropogenic pollutant in aquatic ecosystems, impacting ecosystem functions and altering the diversity and composition of organisms at the foundation of the food chain, such as algae and bacteria. These changes affect organisms like fish that rely on these foundational species as a food source. Consequently, alterations to food sources can influence fish growth, health, development, and potentially their microbiomes. While traditional indicators such as weight, length at age, and physical anomalies are commonly used to assess fish health, the significance of microbiomes in this context remains less understood. Despite evidence linking microbiomes to critical aspects of fish health, including growth, development, immunity, and ultimately mortality, their role as a health metric remains underexplored. For these reasons, we seek to better understand how variation in ambient nutrients and associated changes in algal food resources impact the gut microbiomes of herbivores that consume algae. To achieve this, we chose to analyze the gut microbiome of the Central Stoneroller (Campostoma anomalum), an obligate herbivore and common fish species in eastern North America. These analyses will measure gut microbiome composition and diversity, allowing us to discern patterns and correlations between nutrient site data and microbiome compositions. These findings hold the potential to identify any connections between nutrient pollution, periphyton food sources, and fish health, thereby informing better nutrient management policies for freshwater ecosystems. Ultimately, this research aims to contribute to ongoing discussions in aquatic ecology while expanding on the understanding of the impacts of nutrient pollution on aquatic ecosystems.

H-08: Sustainable and Cost-Effective Defluoridation of Rural Tanzanian Groundwater through Pyrolyzed-Eggshells Packed into Parallel Adsorbent Columns

Great Hall
Dillon Patel, Chemical Engineering and Chemistry
Adit Kulkarni, Chemical Engineering
Project Advisor: Dr. Stephen Thiel

Abstract
This project aims to develop a defluoridation water treatment process for the water supply of the community of Burere, Tanzania. Current fluoride levels in the community is approximately 5 times above the World Health Organization's recommendations. Excessive exposure to fluoride poses health and quality challenges to the community. Significant design constraints are imposed on this project including cost, material supply, technical labor, and equipment sourcing. The system had to handle substantial water flow rate, low capital costs, and deliver minimal ongoing costs to the community. This study began with the investigation of 10 water treatment methods, each of which were extensively researched for feasibility and viability. Amongst the process choices, pyrolyzed-eggshells utilized as an adsorbent filtrate emerged as the most favorable process. Engineering considerations and calculations were refined to provide a more comprehensive evaluation of the process design. The system comprises

12 filter columns arranged in parallel receiving water from an elevated tank to allow flow via gravity. The initial project investment was furnished by Engineering without Borders, with ongoing operational costs supported by the village in Burere. The anticipated capital outlay for the current design shows economic promise, estimated at around $5,000. Annual operating cost was minimized in this design due to the availability of eggshell material which is currently local waste. After confirmation of design upon further scale up and laboratory testing, the aspirational outcome of this study is the construction of the finalized design.

Category I: Cincinnati Matters

I-01: Presence of Roaming Cats in Urban Parks

Great Hall
Zoe Aldana, Biological Sciences
Eric Lane, Biological Sciences
Project Advisor: Dr. Stephen Matter

Abstract
Felis catus, or the domestic housecat, has been named one of the top 100 most destructive invasive species on the planet. Our primary objective in this study was to monitor public parks near urban areas to determine the presence of roaming cats in the Cincinnati and Covington area. We chose these locations because there have been significant reports of roaming cats in Covington, and Hamilton county has a robust TNR (trap, neuter, release) program with multiple locations throughout the area. To test the difference in cat frequency between urban parks in the two counties, motion-sensing cameras baited with cat food were placed at different locations around Covington to establish an interactions/hour metric, which we could then compare to data from various city parks around the Greater Cincinnati area, using the same testing method. The interactions/hour data for testing sites in Hamilton county were considerably lower than sites within the city of Covington. In many testing sites, zero cats were observed per hour, and other animals like squirrels, raccoons and dogs were observed consuming the cat food. We propose that high participation in TNR programs, decreased access to supplemental feeding, and lower abundance of mating opportunities within Hamilton county to be contributing factors in the discrepancy.

I-02: Carbon Crediting: A Green Space Bandage or Cure

Great Hall
Noel Bradford, Environmental Studies
Project Advisor: Dr. Amy Townsend-Small

Abstract
The City of Cincinnati has proposed the Green Cincinnati Plan to help reduce greenhouse emissions and improve sustainability. Within this plan, there are many actions proposed to help make the city sustainable. Specifically, one proposed action focuses on whether carbon crediting can be an incentive to create green spaces throughout Cincinnati. Currently, there has been little research done on carbon

credits in Cincinnati, although my preliminary research on other cities has shown that carbon credits can help incentivize green spaces but with little impact on overall carbon emissions. Partnering with the city's Office of Environment and Sustainability, I have conducted research centered around this question: How can the City of Cincinnati provide incentives and support for the use of carbon crediting and/or carbon offset programs to fund tree planting, maintenance, land conservation, and forest rehabilitation? In order to provide the Office with the information needed, I conducted research on how cities similar to Cincinnati have handled this action. Topics such as the upkeep of green spaces and how they affect the surrounding communities have also been observed. Additionally, data on the effectiveness of carbon crediting and carbon offsetting was collected. The outcome of this work will allow the city of Cincinnati to put in place actions to support green spaces.

I-03: Diet Quality, Diet Diversity, Food Insecurity, and WIC Participation Among Infants Enrolled in a Home Visiting Program

Great Hall

Reid Bradley, Political Science
Project Advisor: Dr. Cathy Stough

Abstract
We aimed to evaluate whether diet diversity and quality in infants at-risk for health disparities and enrolled in a home visiting program associated with food insecurity and participation in the Special Supplemental Nutrition for Women, Infants, and Children (WIC) program. Twenty-eight mother-infant dyads completed three 24-hour diet recalls via phone when infants were 9 months old as part of a pilot randomized controlled trial examining efficacy of an infant obesity prevention program. Dyads were recruited from Every Child Succeeds, a home visiting program to promote parenting skills and healthy development in families with young children. Diet recall data were used to calculate the USDA Healthy Eating Index (HEI), which measures diet quality (range 0-100) and the World Health Organization Minimum Diet Diversity (MDD) score to assess infant diet diversity.Infants were diverse in race/ethnicity (40% Hispanic, 20% Non-Hispanic Black), and most families were low income (80% <$30k) and enrolled in the WIC program (73%). Only 53.6% experienced high food security. Average HEI score was 47.04 (SD = 7.34), and 75% of children met MDD criteria. Diet diversity and quality didn't relate to food security (p= .46, p= .12, respectively) or participation in the WIC program (both p=.87).Infants participating in a home visiting program displayed adequate levels of diet diversity. Infants also showed diet quality similar to national samples, but because the HEI measures used haven't been adapted to populations under two, the results may not be accurate.

I-04: The Possibility of Expanding Curbside Recycling in Cincinnati to Include Hard-to-Recycle Materials

Great Hall

Mary Grace Nishimori, Environmental Studies
Georgia Walters, Environmental Studies
Isabel Bowling, Environmental Studies
Project Advisor: Dr. Amy Townsend-Small

Abstract
As consumption increases, safe disposal of materials is becoming challenging. Mismanagement of trash harms air and water quality and contributes to greenhouse gas emissions. The new production of plastic is also more harmful than recycling used plastics. Cincinnati currently has a standard curbside recycling program. This project investigates how the city can expand its recycling program. This project is working in accordance with the goals of the Green Cincinnati Plan to include e-waste, textiles, and other hard to recycle materials in curbside recycling. We have reviewed literature and investigated how other cities recycle. Additionally, we surveyed Cincinnati residents to gain a better understanding of how knowledgeable Cincinnati is on recycling. We expect to find that the best way to improve the recycling program is to start small and to first expand the current system to areas where recycling is unavailable. It is important to involve the community when changing a familiar system. Education will be crucial since there is a lot of confusion about what can be recycled curbside. Residents also need to be informed about the current state of resource degradation for them to care about reusing materials. The outcome of our research will inform the best ways to educate the community and implement more recycling options. Our next steps include sending our research to the city of Cincinnati so they can implement it when moving forward with their zero-waste initiative.

I-05: Academic Success of First-Generation College Students Through the Lens of Intersectionality and Varying Backgrounds

Great Hall
Peyton Crandall, Social Work
Project Advisor: Dr. Gary Dick

Abstract
First-generation students face challenges being the first in their families to attend college. Students with parents who did not attend college are less likely to earn a degree. In relation to this, the risk of facing challenges and barriers related to their background and intersectionality of being a first-generation student increases their ability to perform in school and meet their criteria for academic success. The purpose of this study is to explore multiple factors that could influence their academic success. A secondary aim was to determine what they considered success individually. Research methods included a 10-item survey using a convenience purposeful sample of UC students at Blue Ash, Clermont, and Main Campus. The sample consisted of 22 students. Results indicate that first-generation students are more likely to be facing challenges that hinder their college experience.

I-06: Retention: Voices of Child Welfare Case Workers

Great Hall
Isabelle Zsembik, Social work
Project Advisor: Dr. Gary Dick

Abstract

The problem within child welfare agencies is people quit all the time and get burnout easily. There are high caseloads, stress, and not enough support. Case workers work long hours, do not get paid enough, and they do not have the right amount of training before going into the field. I have interviewed case workers on their views of working at Butler County Children Services and how they see the retention and high caseloads at the agency. In the year 2023, 22 people were hired at Butler County Children Services and 25 people resigned. This means they ended up losing 3 more people than hired and over 100% turnover in just one year. When coming back from winter break a whole unit and supervisor was gone after just one month. The supervisor went over to the foster care side, and 3 case workers quit because they didn't know what they were really getting into and were just thrown into the job. The other 2 case workers were moved to different units due to this happening. With this situation occurring, there is even higher caseloads on other case workers, with some case workers having 15 cases since case workers are constantly quitting and causing more stress and work on others.

I-07

Shifted to Poster #C-10

I-08: Analyzing Strategies for Completing a Comprehensive Biodiversity for Cincinnati Incorporating Citizen Science for Cincinnati

Great Hall

Nina Nash, Environmental Studies and Geology
Project Advisor: Dr. Amy Townsend-Small

Abstract

Due to climate change, the Earth is experiencing its sixth mass extinction event. This crisis is concerning because biodiversity is directly tied to ecosystem health and ecosystem services. Healthy, biodiverse ecosystems can perform ecosystem services efficiently and effectively. In response to our climate crisis, the Green Cincinnati Plan was developed to reduce greenhouse emissions and enhance the natural environment. One priority action identified in the Green Cincinnati Plan is to complete a Biodiversity Assessment for Cincinnati, incorporating citizen science. The goal of this study is to examine and analyze how Biodiversity Assessments have been successfully completed in other cities, understand the current efforts to survey biodiversity in Cincinnati, and use this information to suggest a strategy to accomplish the priority action. In this presentation I will describe how other cities have completed Biodiversity Assessments and incorporated citizen science. This will provide necessary information for Cincinnati officials to reference moving forward.

I-09: Investigating the Potential of Mycorrhizal Fungal Inoculants in Prairie Ecosystem Restoration.

Great Hall

Aaliyah Mann, Environmental Studies
Jack Wigginton, Speech-Language Hearing Sciences
Project Advisor: Dr. Kenneth Petren

Abstract
This research investigates the influence of mycorrhizal fungal inoculants on native plant vitality and soil health through greenhouse experiments and soil analyses, Our goal is to elucidate the intricate relationships between mycorrhizal fungi, native plants, and overall ecosystem health, with the aim of enhancing sustainable practices in restoration efforts. By measuring plant growth parameters and soil health indicators, we aim to uncover the mechanisms through which mycorrhizal fungal inoculants affect the establishment and vigor of native plant species in prairie ecosystems. The outcome of this research will provide valuable insights into the role of mycorrhizal fungi in promoting native plant resilience and fostering soil health. These findings have the potential to revolutionize prairie ecosystem restoration practices, informing more effective and sustainable approaches. Moreover, our research contributes to a deeper understanding of symbiotic relationships in ecosystems, transcending disciplinary boundaries and enriching the collective knowledge base. This knowledge empowers practitioners, policymakers, and conservationists to make informed decisions, ultimately leading to the preservation and restoration of prairie ecosystems for future generations.

I-10: Does Familiarity Breed Contempt? Pre-mating Exposure and Mating in the Wolf Spider *Schizocosa ocreata*

Great Hall
Reese Miller, Biological Sciences
Project Advisor: Dr. George Uetz

Abstract
Even among invertebrates, social experience influences behavior. The primary goal of this research project was to understand how female recognition and exposure to males of the same species would impact successful copulation in the wolf spider Schizocosa ocreata. Juvenile spiders were collected from the Cincinnati Nature Center in the Fall of 2023 and raised to maturity under controlled lab conditions. After reaching maturity, female spiders were paired with males for three weeks before being assigned one of three treatment groups: exposed female/familiar male, exposed female/unfamiliar male, and unexposed female/unexposed male. Spiders were placed in individual square containers with all but one side covered to allow visual observations of the paired spider (with control spiders having no visual access to other spiders). After three weeks of exposure, mating trials were run for each pair. Initial results showed that while mating varied among treatments, familiarity did not make a significant difference. However, further analysis showed that mating was not entirely independent of exposure; spiders exposed to a conspecific were more likely to mate, regardless of familiarity with the potential mate. Further analysis showed that latency to mate was significantly shorter for exposed spiders, and that some individual behaviors affecting copulation varied as well. While male courtship behaviors were not associated with mating success, female behaviors (receptivity, resistance and aggression) were. Of these, female resistance was significantly higher for unexposed spiders. In conclusion, pre-mating exposure to conspecifics influences behavior and increases the likelihood of mating.

I-11: Impact of Negative Environmental Exposures on Brush-legged Wolf Spider Male Courtship Behavior

Great Hall

Ethan Brown, Biological Sciences
Project Advisor: Dr. George Uetz

Abstract

Physiological stressors, such as pathogenic infection from bacteria and environmental contaminants like the heavy metal Lead (Pb) , can impact a wide range of animal taxa. Wolf spiders in the genus Schizocosa have been used as model species due to their complex mating systems, in which physiology and health of individuals is a factor. The effects of lead exposure, pathogenic infection, and a combination of both on male-female mating interactions was tested. Juvenile spiders were collected in autumn and reared to maturity in the lab. These spiders were assigned to several treatments: infection with Pseudomonas aeruginosa bacteria, exposed to 5k PPM lead in soil, both infected and exposed, and a control (uninfected, unexposed). Males and females from each treatment were paired (Infected x Control, Pb x Control, Pb x Infected, Control x Control) in mating trials. Videos of interactions were recorded for up to 30 minutes and were then scored using the animal behavior software BORIS. Results suggest that lead exposure and infection may impact the complex courtship behaviors of males, as well as female receptivity and resistance to mating.

I-12: The Impact of Rising Temperatures on Wolf Spider Phenology

Great Hall

Zoe Hicks, Biological Sciences
Project Advisor: Dr. George Uetz

Abstract

Climate change is one of the defining challenges of our time, and accelerating global warming is a destabilizing factor for ecosystems in every corner of the world. As ectotherms, invertebrates are expected to be affected by our changing climate, with warmer temperatures causing faster growth rates. The goal of this research is to understand what impact rising temperatures due to climate change have had on the phenology, or annual life cycle of the wolf spider, Schizocosa ocreata. In order to quantify this relationship, molt records of spiders collected from the Cincinnati Nature Center as part of ongoing research from 2001 to 2023 were evaluated. From each year, four dates were obtained: the dates when the first male and first female matured, and the dates when half of the male and half of the female populations had matured. Growing degree days (GDD), a measure of heat accumulation, were calculated for each year prior to the start of maturation to determine the relationship between temperature and maturation rate. The results show a strong correlation between cumulative GDD and advanced maturation dates, with both male and female wolf spiders maturing 25 to 30 days earlier today than in 2001. These findings are clear evidence that rising temperatures are having a significant effect on the phenology of wolf spiders and underscore the importance of further investigation into the impacts of climate change on invertebrate populations around the world.

I-13: Interaction Between Pathogenic Infection and Environmental Toxins on Morphological Development of Wolf Spiders *(Lycosidae)*

Great Hall

Henry Temaj, Biological Sciences
Project Advisor: Dr. George Uetz

Abstract

Pollution with heavy metals such as lead (Pb) constitutes a major source of environmental contamination of natural ecosystems and the wildlife they contain. However, physiological stress from environmental toxins is not the only threat to wild animal populations, as risk of pathogenic infection is also present. Investigation into combined impacts of these physiological stressors and how they interact to affect individuals and populations is the objective of this study. The brush-legged wolf spider, Schizocosa ocreata, is a model species for reproductive behavior and the factors that affect it as well as a biosentinel for environmental contamination. In this study we focused on the effects of lead exposure, pathogenic infection, and a combination of the aforementioned on the development of morphological traits in S. ocreata. Juvenile wolf spiders were collected from the Cincinnati Nature Center in fall 2023 and raised in a controlled lab until maturity. At the penultimate instar, spiders were either (a) treated with pathogens; (b) exposed to lead contaminated soil for 28 days; (c) both or (d) neither (controls). Initial measures of body morphology (size, weight) and indicator traits used by females in mate choice (foreleg tuft size and fluctuating asymmetry or FA) suggest that lead may be an important factor impacting development.

I-14: Assessing the Reintroduction of Various Freshwater Mussel Species in the Mill Creek

Great Hall

Olivia Marsh, Environmental Studies
Braedon Titus, Biological Sciences
Bennet Vail, Environmental Studies
Project Advisor: Dr. Stephen Matter

Abstract

The goal of this project is to determine whether or not the 2019 reintroduction of freshwater mussels in the Mill Creek was successful. The Mill Creek was once known for being one of the most polluted bodies of water in North America. Freshwater mussels are a great indicator of water quality. Surveys of multiple locations in the Mill Creek were conducted to search for and identify species such as the Giant Floaters, the Fatmuckets, and the White Heelsplitter mussels. The outcome of this research will result in a better assessment of the quantity and biodiversity of freshwater mussels in the Mill Creek.