2025 Student Presentations

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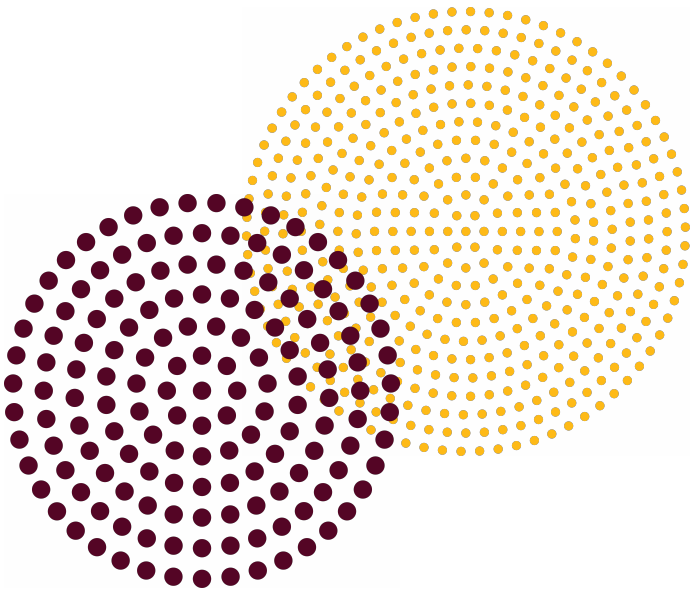

College of the Arts and Media

Art & Design

MERGE

Presenter: Amanda Jackson

Co-presenter: Claudia Waske

Faculty supervisors: Rose Brauner, Steve Leeper

MERGE is a two-minute 2D animated short film/pilot teaser for a web series aimed at young adult audiences. It will be animated in ToonBoom Harmony and use a combination of character rig animation and digital hand-drawn animation. The controlling idea for this project is “What if tattoos turned people into beasts?”, this is the driving question that our film sets out to encompass. As for the plot synopsis, MERGE follows the fates of three young adult friends as they are lured into an eclectic tattoo parlor and discover that the tattoos, parlor, and its inhabitants are not as they seem.

Building My Brand: Crafting a Professional Identity for Success in Animation

Presenter: Maddie O’Mara

Faculty supervisor: Rose Brauner

This project focused on creating a personal brand identity and portfolio to help both myself and fellow young animators succeed in the competitive animation industry. Using software like Adobe Illustrator, Canva, After Effects, and Photoshop, I have created a variety of promotional materials to develop my professional identity as an animator. The goal was to establish a professional brand that reflects my style and skills, inspired by successful animators such as Ginni Joie and Eva Cremers. Through research on branding, marketing, and freelance success, this project has enhanced my ability to market myself in the industry. My brand identity has been incorporated into a digital portfolio that showcases my work and exemplifies my artistic identity. Additionally, this project addresses the need for more career preparation in art and design programs, offering a valuable guide for future students.

Wisp

Presenter: Issac Dunham

Co-presenters: Maddie O'Mara, Jessie Chen

Faculty supervisor: Jeremy Catarino

Wisp is a 3D animated short that blends 3D animation with a painterly 2D aesthetic. It follows Lute, a small forest spirit, and his robot companion, Robby, as they struggle to keep Robby’s failing battery charged by collecting magical wisps. When Robby accidentally damages his battery beyond repair, Lute replaces it with one from a decomposing robot, offering only a temporary fix. The pair embarks on a journey to find Robby’s inventor and restore him. The film explores themes of loss, mortality, and the mysteries surrounding Robby’s origins and the wisps.

Runesoul Animated Film

Presenter: Sarah Rivera

Faculty supervisor: Jeremy Catarino

I will be presenting progress on my senior thesis animated film named ""Runesoul"". It is a self made story about a fictional world. The pilot is about two friends who are guards encountering a cursed being and a fight ensues.

"File_Not_Found" Senior Thesis Film

Presenter: Helena Schneider

Co-presenter: Jacob Bonacci

Faculty supervisor: Jeremy Catarino

Presenting the process behind making a 3D animated short film about what happens when problems arise in animation film production.

Zaa

Presenter: Natalie Vanwagner

Co-presenters: Ainslee Urtel, Hailey Rigg

Faculty supervisors: Jeremy Catarino, Rose Brauner, Steve Leeper

For our project, we will be producing a short animated film that explores the inner workings of an old, run-down pizza shop. This film will incorporate multiple animation

techniques, including stop-motion animation using handcrafted paper puppets and digital animation. The digital animation will primarily consist of 2D hand-drawn character and element animation, produced in Toon Boom Harmony. The stop-motion sequences will be created using Dragonframe, a professional stop-motion animation software, allowing for precise frame-by-frame control under the camera. Additionally, Adobe After Effects will be used to enhance the film with effects animation and supplementary animated sequences, ensuring a visually rich and dynamic presentation.

Brave New World

Presenter: Blue Grant

Faculty supervisor: Brian Elder

Brave New World is a series of paintings that projects the effects of global warming on the environmental, and the consequences of these effects on humanity.

“The Creation Poem"- Design & Visual Effects

Presenter: Jessie Chen

Faculty supervisor: Steve Leeper

The Creation Poem film project is an 8-minute fully animated film inspired by James Weldon Johnson's iconic poem, The Creation. My role in the project involves incorporating natural movement patterns into 2D visual effects using Toon Boom Harmony and designing environments in Photoshop. Through visual research, I studied the motion of birds, butterflies, leaves, and water to enhance the film's storytelling and themes. Additionally, I analyzed the artwork of Aaron Douglas to develop a simplified, abstract visual style that aligns with the film's aesthetic.

As a 2D visual effects animator, I aimed to simplified the complexity of the natural phenomenon, reducing it to its essence, and interpreting it through a refined shape language. Over the course of three months, I designed six environment backgrounds. I learned to apply a style guide effectively, create visually supportive environments, and explore the fine line between character and environmental design.

While I was unable to complete the bird animation, I realized the importance of presenting my process clearly. Moving forward, I need to communicate my work in a way that helps my professor understand both my progress and my final vision. This project reinforced the value of iterative learning, style consistency, and effective documentation while deepening my appreciation for nature's role in animation.

Collateral: Mass Influence and the Design of Persuasion

Presenter: Amy Adams

Co-presenter: Skky Lawrence

Faculty supervisor: Clark Most

The theme of this year's showcase: "Collateral: Mass Influence and the Design of Persuasion," will delve into how design shapes perception, influences emotions, and controls narratives. We aim to explore design's dual role as a powerful tool for expression and influence. Our showcase will highlight how design can simplify complex ideas into impactful imagery that resonates with large audiences, sparks action and builds alliances. We will explore the psychological reactions to elements such as color, type, and form and how they help promote ideas to individuals. We will also educate viewers about the power of symbolism, and how symbols can become the face of revolutions.

Just as design can influence change and bring us together, it also has the power to divide and alienate. This exhibit will dive into the unethical and darker side of design, and analyze the impact of design within fake news, AI and powerful misinformation and disinformation campaigns.

Our exhibition's mission is to provide guests with an in-depth showcase of how design shapes mass communication, while also offering critical thinking strategies and skills that help them reevaluate their relationship with media. We want to cause a paradigm shift in the way guests view design. We hope to equip them with the tools to question how design influences the way they communicate, how it shapes their view of the world around them, and how it can bring us together or rip us apart.

Untamed Spirits

Presenter: Riley Robinson

Faculty supervisor: Johanna Paas

""Untamed Spirits"" is a visual exploration of the connection between human identity and spirit animals, materialized through three oil paintings. These works will depict characters that blend human and animalistic features of the lion, macaw, and koi fish. Each individual piece will be entitled “Bound to *insert animal*”

1. Bound to the Lion – Illustrating a character with a huge afro to symbolize the lion’s mane and sharp teeth.

2. Bound to the Macaw – Illustrating a character with layered, feather like hair that is red, blue, and yellow. Along with having a long pointy nose similar to a beak.

3. Bound to the Koi Fish – Illustrating a character that has vitiligo to represent the pattern of a koi fish.

Creating a fusion of mythology, cultural heritage, and self-expression. The project aims to celebrate the symbolism of spirit animals while challenging traditional representations in contemporary art. I chose these animals because they align with my art style and connect to me in some way personally. Engaging with social and cultural themes of identity, heritage, and the reclamation of ancestral connections. The artwork will serve as a medium to discuss representation in art, particularly for the Black community, and how visual storytelling can be used to express cultural pride and resilience. Additionally, it challenges the historical erasure of animistic traditions in Westernized narratives by reintroducing them in a contemporary artistic form.

Communication, Journalism & Media

Ariana Grande's Impacts with Thank U, Next

Presenter: Jordan Craighead

Faculty supervisor: Edward Hinck

This paper analyzes musical artist Ariana Grande’s 2018 hit song, Thank U, Next. This paper outlines the rhetorical situation that called Grande’s song into existence, uses genre theory to analyze Grande’s song, and argues that Grande’s song invites her audience to relate to her vulnerability and adopt a mindset of appreciation in order to find happiness after relationships end. Grande’s impact can be seen in the way other popular artists have integrated into the genre she created, and the way various social movements have used her words to ignite momentum.

Intersectionality in Intercollegiate Debate and Forensics

Presenter: Audrey Konitsney

Faculty supervisor: Edward HInck

This paper explores the intersectionality framework within the context of intercollegiate debate and forensics, examining the barriers faced by marginalized participants due to overlapping identities related to race, gender, sexuality, socioeconomic status, and ability.

While these activities have long served as platforms for advocacy, education, and personal expression, the absence of intersectional considerations limits their inclusivity and equity. By reviewing existing literature and identifying key structural, cultural, and behavioral challenges in competitive debate, the paper argues for a more intentional integration of intersectionality to create more accessible and diverse environments. Drawing on Kimberlé Crenshaw's pioneering work on intersectionality, the paper highlights the underrepresentation of women and minorities in collegiate debate and calls for comprehensive reforms, including curriculum adjustments, inclusive judging practices, and mentorship initiatives. Through these efforts, debate and forensics can evolve into spaces where multiple marginalized perspectives are valued, enhancing educational outcomes and fostering a culture of social justice. The paper concludes with a call to action for debate organizations to prioritize intersectionality, not only to promote diversity but to align with their educational mission to address real-world inequities.

Language is Brat: How a Singular Word Influenced Sociopolitical Power Structures through a Viral Pop Culture Movement

Presenter: Cody Wilson

Faculty supervisor: Edward Hinck

By acknowledging and assessing language as the primary form of human's subconscious and systemic use of symbols, one can analyze how it can be used as a powerful tool of rhetoric. Specifically, the singular word brat's five-hundred-plus year existence is an important example of how both hegemonic power structures and the marginalized groups that live under its societal umbrella attempt to gain control and influence over the use, allocation, and consumption of language and its rhetoric. Combined with the rapid innovation of modern technology, its streamlined and swift distribution - and the human population's affinity for rapidly consuming language through it - the most basic form of human's primary symbol system, a singular monosyllabic word, can branch out and become a simultaneous representation of empowerment and oppression to the effect of influencing social ideologies and structures as benign as pop culture and as massively significant as presidential elections.

Music

Examining Instructional Approaches to the Physiological and Psychological Aspects of the Adolescent Female Voice

Presenter: Claire Gilling
Faculty supervisor: Nancy Summitt

The adolescent female voice change is a complex process that significantly impacts young singers both physiologically and psychologically. While extensive research has been conducted on the male voice change, the challenges faced by adolescent female singers remain underexplored in music education. This paper examines the physiological aspects of the female voice change, including vocal breathiness, range limitations, and the influence of hormonal fluctuations. It also explores the psychological effects, such as decreased vocal confidence, fear of judgment, and the development of vocal identity. The role of choral

directors in addressing these challenges is crucial, as effective instructional approaches can enhance both the skill level and self-efficacy of adolescent female singers. Strategies such as vocal assessments, flexible voice classification, targeted vocal exercises, and inclusive repertoire selection can support students through their vocal development. By fostering an environment that acknowledges and supports the female voice change, choral educators can ensure that young female singers maintain confidence and continue their musical growth.

College of Business Administration

Accounting

The Effects of going Remote

Presenter: Ninah Kayfesh

Faculty supervisor: Lori Olsen

The drastic effects of COVID-19 created lasting effects within most in-office jobs. Many people were forced to take their work home and never came back, at least not full-time. There seem to be both positives and negatives when choosing to work remotely over working in-person. There has been some research applied to this topic already, but I have found that they have truly varying results. Throughout this research many distinct aspects of remote work will be examined. There will be some demographic information considered. However, overall, this paper will look at the opinions and perspectives of modern-day accountants on remote work. Both the advantages and disadvantages will be considered and compiled through a survey. Those results will be reviewed for possible trends and similarities. The findings and conclusions of all of the research will then be laid out to form connections throughout the rest of the paper.

Business Information Systems

Endless Runner

Presenter: Hunter Goffnett

Faculty supervisor: Denise McBride

The goal of this project is to create a minimalist game as a piece to put on my portfolio for the highly competitive game development industry. This project will utilize my creativity, business acumen, and software engineering to learn about what the true process of game development is like. I will be able to gain first-hand experience in a video game engine and be able to see what the post-dev process is like.

Another part of this project is a literature review. This review will discuss gameplay loops, user interface design, and overall game design aspects and techniques. Five sources will be used to review these concepts. The knowledge from these reviews will help show the author the importance of these design elements. The hope is to integrate objects that have dynamic gameplay and difficulty. The game will be designed on an iterative basis to help

prepare me for the iterative development of the real work. These points will hopefully lead to the development of the best game possible.

Economics

The Effect of Education and Good Governance on Corruption in Selected African Countries

Presenter: Oluwakemi Sofowora

Faculty supervisor: Jason Taylor

Corruption significantly impedes economic development, affecting both developed and developing nations. This study examines the impact of education and good governance on corruption in five selected African countries - Cameroon, Ghana, Rwanda, Sudan, and Mauritania, using panel data from 2001 to 2017. The research employs the Ordinary Least Squares (OLS) estimation technique to analyze the relationship between educational attainment, governance indicators, and corruption levels.

Findings indicate that while primary and secondary education have a positive correlation with corruption, tertiary education has a negative impact, suggesting that higher education reduces corrupt practices. Similarly, certain governance indicators, such as government effectiveness and control of corruption, unexpectedly show a positive relationship with corruption, highlighting inefficiencies in policy enforcement. On the other hand, rules of law and regulatory quality negatively influence corruption, supporting the argument that strong institutions help mitigate corrupt activities.

These results suggest that while education can be a tool for reducing corruption, its effectiveness depends on the level of attainment. Additionally, improving governance structures alone may not be sufficient if not backed by strict enforcement and transparency. The study recommends strengthening higher education, enforcing anti-corruption policies, and enhancing institutional frameworks to combat corrupt in Africa.

Entrepreneurship

HandyMap

Presenter: Jade Walleman

Faculty supervisors: John Gustincic, Ken WIliams, Cleamon Morrer, Misty Bennett

HandyMap is an innovative app that enhances campus navigation by focusing on accessibility. It provides users with detailed maps that highlight key accessibility features such as ramps, elevators, and other essential resources, ensuring individuals with disabilities can move around with ease. The app also identifies potential barriers, such as steps or narrow doorways that a user might need to avoid.

One of the main features of HandyMap is its adaptability, allowing customization based on the user's specific needs. HandyMap incorporates various forms of universal design which makes the app functional for a wide range of disabilities. This versatility promotes greater

independence for students, staff, and visitors by enabling them to navigate campus spaces efficiently, without needing assistance.

Additionally, HandyMap's emphasis on inclusivity goes beyond basic navigation. It promotes a campus culture that ensures everyone has equal access to facilities and services. By addressing the unique challenges faced by individuals with disabilities, it empowers users to confidently and independently explore their surroundings.

Agricultural Tourism in Southwest Michigan

Presenter: Adam Frost

Faculty supervisor: Michael Pisani

As a former farm laborer with multiple years of local orchard work that focused on agricultural tourism, I became familiar with the industry and associated strategies. Through my agricultural experience, I developed deep connections with farmers from many communities across Southwest Michigan. I leveraged this understanding and network to examine three agricultural tourism enterprises, employing a case study methodology to evaluate how these three farms supplemented their core farm incomes from various forms of agricultural tourism. This project demonstrated various opportunities, challenges, and benefits of agricultural tourism for Southwest Michigan farmers. Additional findings highlighted positive economic externalities for this region, providing guidance for local policymakers and farm owners.

Marketing, Hospitality & Logistics

Sustainability or Profit? How We Can Have Both

Presenter: Jaden Barnard

Faculty supervisor: Sean Goffnett

The subject of this project is sustainability in logistics, and the goal is to alter current perspectives on the topic. People often see sustainability initiatives as being at odds with profit; that a business that works to be sustainable must sacrifice revenues in return. Fortunately, this is generally not the case. In a statistical analysis, Govindan et al. (2020) found a positive correlation between sustainability initiatives and business performance. I will present evidence to further their work. Best practices put in place my companies leading the charge in sustainability will be evaluated. This work will enter the conversation with a new perspective that a business can increase sustainability—with a focus on logistics and supply chain—while increasing profits and provide recommendations for how to do so.

College of Education and Human Services

Fashion, Interior Design & Merchandising

In-lab Design and Implementation of Manikin Stand for Body Scanning and Calculating Infant BSAC in a Stroller

Presenter: Stanley Okimmiri

Faculty supervisors: Lauren Agnew, Tanya Domina

Infants are vulnerable to extreme weather due to their underdeveloped heat regulation system and skin sensitivity. Exposing an infant to hot temperatures outdoors in a stroller can cause overheating and dehydration due to their inability to regulate their internal temperature properly. Additionally, an infant in a stroller is positioned closer to the ground, increasing the likelihood of ultraviolet (UV) rays reflecting off the sidewalk or concrete, increasing the risk of UV skin damage. Infant well-being and comfort in a stroller are paramount and are highly influenced by the stroller design. Stroller designers should consider how comfortable and safe an infant will be in a stroller. To meet these needs, a specialized infant thermal manikin stand was developed that is stable, adjustable, durable, and capable of mimicking the sitting positions of infants. The manikin stand was constructed with an extrusion framework that provided structural stability. A pivot and swivel mount allowed for smooth adjustments, enabling the manikin to be positioned at various inclination angles. The tri-connectors improved stability at the junctions with the bracket, which provided additional support to secure the manikin during experiments. This project is designed to hold the infant manikin during object scanning and surface area calculations, which aid in the ergonomic and environmental assessment of infant stroller designs. The adjustable nature of the manikin stand allows for simulating vary.

Comparison of Polyester, Cotton, and Abaca Fibers in Regards to Thermal Comfort

Presenter: Zoë Renner

Co-presenter: Cullen Douglas

Faculty supervisors: Lauren Agnew, Tanya Domina

With the rise of fast-fashion clothing and accessories, sustainability and ethical fashion are pressing topics for apparel manufacturers. Landfills are packed with clothing items made from synthetic fibers that take hundreds of years to decompose. Considering this, the goal of our research is to find a sustainable, environmentally friendly, and biodegradable textile alternative to lessen the industry's impact on the environment. We have found a promising alternative in the abaca plant, a cousin to the banana tree. While cotton is a well-known material and considered sustainable, this fiber is a water-intensive crop, resulting in negative environmental impacts. In contrast, abaca uses a significantly smaller amount of water in its growing process and creates extremely strong fibers. We also analyzed polyester, another common fabric on the market that is harmful to the planet because of its plastic content. This research continues a previous student, Brady Pitcher's, hot plate testing with abaca fabric conducted and presented at SCREE 2024. We are expanding upon his research by testing shirts made of abaca, cotton, and polyester. To do so, we utilized a thermal manikin in the Center for Merchandising and Design Technology (CMDT) at CMU. Testing adhered to ASTM F129. Preliminary results are promising, as the abaca shirt performed similarly to both the cotton and polyester shirts in terms of thermal comfort.

Reimagining Modern Maternity in Workwear: Inclusive Apron Design for the Service Industry

Presenter: Lauren Fulk

Co-presenter: Lee Landis

Faculty supervisor: Pimpawan Kumphai

Pregnant women in the food service industry often struggle with ill-fitting uniforms, particularly serving aprons that do not accommodate their changing bodies. Despite the growing maternity market, there is a lack of aprons specifically designed for expecting mothers in the waitressing profession. This research utilizes the Functional, Expressive, and Aesthetic (FEA) framework (Lamb, J. M., & Kallal, M. J., 1992). to develop an adaptive apron that meets the needs of pregnant and postpartum workers. The study aims to gather insights into the experiences of pregnant food service workers to inform the design of a functional and comfortable apron prototype. Postpartum comfort is also considered, ensuring the apron serves a multifunctional purpose beyond pregnancy. Since working mothers juggle multiple responsibilities, a well-designed apron that provides ease of wear, flexibility, and practicality is essential. Three adaptive apron designs were developed based on feedback from pregnant working mothers. These designs prioritize comfort, functionality, and aesthetic appeal, offering a solution that enhances the work experience for pregnant women in the food service industry. By addressing this unmet need, this research contributes to the development of inclusive and adaptive apparel that supports women throughout pregnancy and beyond.

Sensory Regulation Through Apparel: Designing a Therapeutic Hoodie for Teens

Presenter: Emily Gonzalez

Co-presenter: Shaniya Coffee

Faculty supervisor: Pimpawan Kumphai

This study explores the role of apparel in mitigating anxiety and sensory overstimulation in teenagers, particularly those with ADHD, through the development of a therapeutic aromatherapy hoodie. Using a user-centered design approach, the study incorporates insights from surveys, interviews, and focus groups conducted on high school students in a small Midwestern town. The functional, Expressive, Aesthetic (FEA) framework by Lamb and Kallal (1992) guided design decisions to ensure a balance of practicality, emotional support, and aesthetic appeal. Key design elements include a noise-reducing quilted hood, discreet pockets for aromatherapy scent pods, and multi-strand drawstrings with tactile fidget features. Soft, breathable materials such as fleece-backed jersey and cotton blends were selected for their comfort and sensory benefits. Three conceptual designs were created and evaluated by the high schoolers. The participants favored the hoodie's discreet sensory features, oversized fit, and multifunctional drawstrings. User feedback shaped the final design, demonstrating the potential of apparel to support emotional well-being. The researchers will create the prototype of the hoodie from the final design and assess its performance through wearability studies and physiological testing, refining the design and

expanding its application in mental health support. Reference: Lamb, J. M., & Kallal, M. J. (1992). A conceptual framework for apparel design.

Functional Design Project: Design Ideation for Gloves and Jacket Anemia Clothing Support

Presenter: Anna Malonson

Co-presenter: Sheree Patton

Faculty supervisor: Pimpawan Kumphai

This study investigates the thermal properties and analyzes the heat distribution to women arms to identify areas that retain or lose heat more efficiently. Anemia is defined as “a condition that develops when your blood produces a lower-than-normal amount of healthy red blood cells.” (NIH, 2022) There are many types of anemia, including but not limited to: iron-deficiency, vitamin B-12 deficiency, and hemolytic anemia. Women with anemia often struggle with cold sensitivity, particularly in their extremities, which can impact daily comfort and well-being. Our study started off with a questionnaire posted on online forum sites such as Facebook, and Reddit. We were able to fine tune the parameters and materials used in our future trial after receiving responses from ladies diagnosed with anemia. Using infrared thermography and air permeability tests at the CMDT testing lab, we will assess temperature variations across different regions of the body in various environmental conditions. By determining the zones most prone to heat loss, we can develop targeted solutions for improving warmth retention throughout the body. The findings from our experiment will aid in our gloves and jacket design tailored for women with anemia. We incorporate strategic insulation and heat-trapping materials/fabric in key areas. This research bridges medical analysis with functional fashion design, offering a practical and stylish approach to enhancing thermal comfort for individuals with anemia.

The Creation of a Functional Work Pant for Knee Replacement Patients

Presenter: Emily Stabile

Faculty supervisor: Pimpawan Kumphai

Knee replacement surgery is one of the most common surgical procedures in the United States, with over 800,000 performed annually. By 2030, this number is projected to increase by 673%, reaching nearly 3.5 million procedures per year (The Center Oregon). This rapid growth highlights the rising demand for functional, adaptive apparel that addresses the mobility challenges and post-surgical discomfort faced by individuals recovering from knee replacements.

This study examines responses from individuals who have undergone knee replacement surgery to better understand their mobility limitations and clothing needs, particularly in work pants. Using the Functional, Expressive, and Aesthetic (FEA) framework (Lamb & Kallal, 1992), the research identifies key design criteria for an ideal post-surgery pant. Data collected through Google Forms informed the development of a final design incorporating high-stretch, breathable fabric, removable knee support, a professional silhouette, and

adjustable closures. Additionally, built-in zippers on both sides of the knees enhance mobility and air circulation, ensuring optimal comfort and confidence in workplace settings.

Three initial design sketches were created based on the research findings, with participants providing feedback. A revised version of one sketch was finalized following a second round of survey responses. This study contributes to the growing field of adaptive apparel by addressing the specific needs of post-knee replace.

Adaptive Apparel Design for Limited Hand Coordination

Presenter: Shelby Taber

Faculty supervisor: Pimpawan Kumphai

Many individuals experience poor hand coordination due to conditions like arthritis, Parkinson's disease, or carpal tunnel syndrome, which can cause tremors, joint pain, stiffness, and numbness, making dressing difficult. According to the CDC, around 53 million adults in the U.S. suffer from arthritis (CDC, 2024). This study aims to develop adaptive apparel and closure designs to assist those with poor hand mobility. It also explores alternatives for individuals with heart catheters, as magnetic closures pose potential risks.

To understand the challenges faced, interviews were conducted with individuals and caregivers. Participants tested various closures on a button-up shirt, identifying hook and loop fasteners as the easiest and most comfortable to use. Participants noted that pulling on garments was a common struggle, limiting their clothing choices, particularly for professional and formal attire.

Based on these insights, ChatGPT was used for design inspiration, leading to initial sketches. Feedback from participants guided the final design, featuring hook and loop closures concealed by decorative bows and removable Edwardian-inspired compression cuffs. This design blends style with discreet adaptive elements, improving accessibility and fostering independence. The study highlights the need for more functional, stylish adaptive apparel, especially for professional settings.

Redefining Fashion: Designing Inclusive Apparel for Individuals with Dwarfism

Presenter: Charlize Wright

Co-presenter: Nigar Sultana

Faculty supervisor: Pimpawan Kumphai

This study examines the clothing challenges faced by women ages 20-30 with Hypochondroplasia, a form of dwarfism. Approximately 65,000 individuals in the U.S. are affected (Little People of America [LPA], 2023), so there is a significant need for inclusive, functional, and stylish apparel. Standard clothing often fails to accommodate unique body proportions, such as shorter limbs and longer torsos, leading to discomfort and restricted mobility. Using the functional, expressive, and aesthetic (FEA) framework (Lamb & Kallal, 1992), this research aims to design garments that prioritize comfort, fit, and self-expression. The study involves interviews and 3D body scanning of a participant with Hypochondroplasia. The scans provide precise body measurements, enabling the development of a custom corset and skirt. The participant's preferences include dark, form-

fitting, and classy clothing but highlight struggles with long sleeves and pant legs. The final design features a strapless corset with a heart-shaped bust and a mullet-style lace skirt, incorporating stretchable, breathable fabrics to enhance comfort and mobility. This research highlights the need for inclusive fashion, demonstrating how 3D body scanning and design software create well-fitted garments that improve confidence, accessibility, and overall wearability for individuals with dwarfism.

Enhancing Accessibility Education in Interior Design

Presenter: Cole Taylor

Faculty supervisor: Julie Zuo

Accessibility in interior design is essential for creating inclusive and functional spaces. However, traditional teaching methods often rely on static resources, which can make accessibility concepts feel abstract. While experiential learning helps build awareness and empathy, it does not always teach students how to apply accessibility guidelines effectively in design and often fails to convey the complexities of accessibility.

This presentation focuses on the design phase of a pilot pedagogy that explores the use of 3DVista, an interactive 3D virtual tour software, to enhance accessibility education by allowing students to engage with design concepts in an immersive and hands-on way.

Specifically, it focuses on how 3DVista introduces and visualizes these features in the living, dining, and kitchen areas. By bridging theory with interactive virtual exploration, students can navigate the digital environment, reference ADA guidelines, and assess accessibility features in real-time. Interactive elements, such as embedded annotations referencing codes and guidelines, as well as material selection analysis, help connect theoretical knowledge with practical application. Scenario-based challenges foster critical thinking and problem-solving skills. Additionally, instant feedback and collaboration enhance engagement and deepen students' understanding of accessible interior design solutions.

MSA Program

The Impact of Leadership Style on Employee Job Satisfaction in Healthcare Setting: A Comparative Study of Transformational and Transactional Leadership

Presenter: Charity Ohotu Omaji

Faculty supervisor: Abby Mcguire

Effective leadership is critical in healthcare settings, where job satisfaction directly impacts employee retention, workplace morale, and patient care quality. This study examines the comparative impact of transformational and transactional leadership styles on employee job satisfaction within healthcare organizations. Transformational leadership, characterized by inspiration, motivation, and individualized support, is widely recognized for promoting a positive work environment. In contrast, transactional leadership, based on structured rewards and performance monitoring, emphasizes order and task completion. Using a quantitative cross-sectional survey, this study collects data from healthcare professionals to assess the relationship between leadership styles and job satisfaction. The research utilizes

the Multifactor Leadership Questionnaire (MLQ) and the Minnesota Satisfaction Questionnaire (MSQ) to measure leadership behaviors and employee satisfaction levels. Statistical analysis, including t-tests and regression models, will determine the extent to which leadership styles influence satisfaction outcomes. The findings aim to provide healthcare administrators with evidence-based insights to enhance leadership practices, improve job satisfaction, and optimize healthcare workforce management.

Burnout in the Nonprofit Sector: Strategies to Retain and Motivate Passionate Staff

Presenter: Emily Gibson

Faculty supervisor: Abby Mcguire

Employee burnout is a common and devastating issue that many organizations in the nonprofit sector face. The consequences of burnout can have a snowball effect, depleting both financial and human resources in an attempt to mitigate consequences like staff turnover and underserved clients. This secondary research project aims to examine staff burnout from a holistic standpoint: who is most deeply affected by burnout and why, its effect on job satisfaction, how an organization's resources play a role, and the strategies developed to address burnout. Using the National Audubon Society as a case study, key themes such as stability, inclusion, trust, satisfaction, and innovation are discussed and used to develop practical strategies to help nonprofits support their vital workforce.

The Impact of Leadership Styles on Project Success in Agile Project Management: A Case Study of Oracle Corporation

Presenter: Srinija Kommareddy

Faculty supervisor: Abby Mcguire

Leadership styles significantly influence Agile project success by shaping team collaboration, adaptability, and efficiency. This study examines the impact of transformational, transactional, and servant leadership on Agile project management at Oracle Corporation, a global leader in enterprise software and cloud computing. Agile methodologies require flexible and effective leadership to navigate dynamic project environments. The research explores how leadership styles affect innovation, efficiency, goal achievement, and stakeholder engagement, while also considering the role of team structure and project complexity.

Findings indicate that transformational leadership fosters innovation and adaptability, transactional leadership enhances efficiency and goal achievement, and servant leadership strengthens team cohesion and engagement. However, no single leadership style is universally superior, as effectiveness depends on project demands and team dynamics. These insights provide valuable guidance for organizations aiming to optimize leadership strategies within Agile frameworks to drive successful project outcomes.

The Role of Digital Learning and Collaboration Platforms in Enhancing Engagement and Development for MSA Adjunct Faculty Teaching Online

Presenter: Bushira Moro

Faculty supervisor: Abby Mcguire

Faculty engagement and professional development are critical to the success of higher education institutions, particularly for adjunct faculty teaching in online programs. This study examines the role of digital learning and collaboration platforms in enhancing engagement and professional development opportunities for adjunct faculty in the Master of Science in Administration (MSA) program at Central Michigan University. The research employs a qualitative approach, utilizing surveys to explore faculty experiences with digital tools, institutional support mechanisms, and perceived barriers to engagement and development. Key areas of investigation include the effectiveness of digital platforms in fostering faculty interaction, the challenges faced in utilizing these tools, and the resources available to support professional growth. Findings from this study will provide insights into how digital tools can be better leveraged to enhance faculty engagement and development, offering recommendations for institutional improvements. The results aim to contribute to ongoing discussions on best practices for supporting online adjunct faculty and strengthening their connection to the university community.

The Challenges Women Human Resources Officers Cace at Toyota Tsusho India Private Limited (TTIPL)

Presenter: Venkata Ram Rudhvik Talluri

Faculty supervisor: Abby Mcguire

The study examines the barriers preventing women HR officers at Toyota Tsusho India Private Limited (TTIPL) from advancing into leadership roles. It explores gender biases, workplace discrimination, limited mentorship, and restrictive organizational structures that hinder career growth. Using qualitative research methods, including interviews and thematic analysis, the study investigates decision-making limitations and policy effectiveness. The research aims to propose inclusive workplace strategies to improve gender equity in HR leadership at TTIPL.

Teacher & Special Education

Exploring the Need for Autism-centric Sex Education for Autistic Youth

Presenter: Nix Henry

Faculty supervisor: Dawn Decker, Brandi Ainsley

For youth with autism, the challenges of puberty can be complicated by neurodivergence, comorbidities, gender identity, and sexual orientation. For instance, practices, like masking and mirroring, and interventions such as Applied Behavior Analysis (ABA) influence autistic behaviors, suppress the development of individuality and identity, and weaken the sense of self. This, when coupled with sensory processing differences and difficulty understanding and practicing social norms, conditions are created that invite abuse, trauma, PTSD, anxiety, and other threats to personal health and well-being. These factors can also affect the development of autonomy, complicate psychosexual development, and interfere with success and satisfaction within intimate relationships. All this establishes a compelling

argument in favor of autism-centric sex and relationship education for young adults with autism.

The studies included in this project represent a small portion of the research available about autism, sex, and their potentially dangerous and damaging intersections. However, each was chosen to illustrate the profound need for additional research and sex and relationship education tailored to autistics that can be modified for different levels of independence. There is still much to understand about the intersectionality of gender identity, sexual orientation, mental health diagnoses, sexual-social behaviors, and physical well-being for autistics.

Creating Spaces for Everyone: A Journey through Inclusive School Activities

Presenter: Jocelynne Moore

Faculty supervisor: Holly Hoffman

This research project seeks to analyze extracurricular school activities that are available for students with disabilities. The aim is to better understand the significance, accessibility, inclusion, and limitations surrounding extracurricular activities. Through surveying currently existing inclusive extracurricular programs, at the elementary middle and high school levels, I hope to gain a better understanding of their successes and challenges. With this data, I plan to add to the literary discourse regarding extracurricular programming for students with disabilities. I anticipate gathering a broadened perspective of inclusive extracurriculars from group leaders, families, and students within these qualitative surveys. By the end of this project I hope to have a well rounded understanding of inclusive extracurricular programs in order to better advocate for their successful implementation within my professional community.

College of Health Professions

Communication Sciences & Disorders

The Autistic Perspective on Positive Affirmations and Verbal Praise

Presenter: Dakhota Krahulik

Faculty supervisor: AnnMarie Bates

This capstone project's goal was to investigate the perspectives of individuals with autism regarding positive affirmations and verbal praise. The project aimed to expand knowledge on how affirmations can affect the perspectives of people with autism socially and academically. After a review of current research articles that highlight studies relating to the success of college students with autism, questions on the subject of affirmations arose. Upon the review of literature on the topic of affirmations and autism, it became clear that there is not much knowledge on the subject. In addition to the limited research pertaining to affirmations and autism in general, the studies that have occurred are based on children. This revealed a critical gap in the literature that this project aimed to address. It also aimed to capture how affirmations can impact the lives of college students with autism and their perspectives of affirmations. The results were expected to build on previous knowledge

about individuals with autism and provide a basis for potential future research. The results will further understanding of how individuals with autism learn and socialize with others, especially in the college setting.

Benefits of Learning American Sign Language

Presenter: Caroline Hefner

Co-presenters: Meagan Treadwell, Alexis Liedel, Brooke Mallie, Kylie King

Faculty supervisor: Beth Boman

It is well known that most schools require students to take a language class; While many take French or Spanish, American Sign Language is slowly gaining popularity. Learning a secondary language has many benefits, but learning ASL has many other benefits that other languages do not have. For example, it can foster analytic thinking, enhance multitasking, and improve social cognition and executive control (National Library of Medicine). To understand the benefits of sign language through various articles and journals, we created a survey to compare some of the listed benefits with ASL vs non-ASL students. We formulated questions by taking a deeper look into what students could take away from learning ASL. Sign language users produce sign movements with a signing space, which means that signers designate a 3D area in front of their bodies to create space to sign. One experiment showed that hearing signers performed significantly better than the non-signers on a task involving 180º rotation (Emmorey et al.). We implemented this into our survey by having participants rate their ability to rotate an object in their head. Our survey showed positive results that ASL learners have seen increased benefits in visual-spatial capabilities as well as body language. The goal of this research was to better understand the benefits of a visual language and its impact on other areas of memory/learning.

How Technology Supports the Maintenance of Friendships of People with Aphasia

Presenter: Makieran McSherry

Faculty supervisor: Natalie Douglas

Aphasia is a disorder that affects one's ability to communicate. Therefore, aphasia can impact one's social relationships. Because of this, people with aphasia struggle to maintain their friendships. However, one aspect that can help with this is the use of technology. Many friendships containing an individual with aphasia and many friendships in general have been maintained with the help of technology. I will be classifying different types of technology and correlating that data with what type of aphasia and relationship the individual has. With this data, I will create a guide to help friends of aphasia utilize the best technological form that will work for them. Overall, this project will help me gain more knowledge about aphasia and allow me to support a population I will be working with in the future as a speech-language pathologist.

Thematic Analysis of Storytellers' Experiences from Aphasia! This is our World

Presenter: Allison Strnad

Faculty supervisor: Katie Strong

Background: Storytelling is fundamental to human identity and social connection, with language playing a central role in how we share our narratives and make meaning of life events. Aphasia, an acquired language impairment following brain damage, disrupts this essential ability, significantly impacting social participation, relationships, and quality of life. Despite these communication challenges, story-based interventions for identity reconstruction have emerged as a supportive approach, aligning with Seligman's PERMA framework from positive psychology. The My Story Project method was adapted into ""Aphasia! This is Our World,"" a 10–12 week online story co-construction intervention within Virtual Connections for Aphasia. The program paired 37 storytellers with aphasia with graduate student coaches from a master's program in speech-language pathology, trained in identity and story methods, to create personal narratives about living with aphasia, culminating with a storytelling celebration in the Virtual Connections community.

Aim: To qualitatively examine the experiences of storytellers with aphasia who participated in this online story co-construction program.

Method: From six consenting storytellers (CMU IRB-approved), three were selected for this study. Semi-structured interviews were conducted using an accessible interview guide provided to participants in advance. Interview data were analyzed using Reflexive Thematic Analysis.

Exercise Physiology

Prevalence of Metabolic Syndrome Among Males vs. Females Based on Daily Step Count: A Preliminary Analysis

Presenter: Isabella Andreski

Co-presenter: Marguerite Ponda

Faculty supervisors: Rachael Nelson, William Saltarelli

Approximately 34% of U.S. adults have Metabolic Syndrome (MetS) characterized by ≥3 cardiometabolic risk factors. Accumulating ≥10,000 steps/day has been recommended to reduce risk factors for MetS, yet it remains unclear whether 10,000 steps/day is effective at preventing MetS among overweight, non-exercising, male and female adults. Purpose: To examine the prevalence of MetS among male vs. female overweight, non-exercising, adults who get at least 10,000 steps/day. Methods: Prevalence of MetS was determined for 74 male (n=15) and female (n=59), non-exercising (i.e., <20 minutes/day, <3 days/week of planned exercise), overweight (BMI: 32.9±5.6 kg/m2), adults (39.4±14.1 years). MetS components (i.e., elevated or abnormal waist circumference, blood pressure, blood glucose, triglycerides, and/or HDL cholesterol) were measured after an overnight fast. Those with ≥3 MetS components were identified as having MetS. Participants wore an accelerometer for three consecutive days to determine average daily step count, and stratified into groups (e.g., <10,000 vs. ≥10,000 steps/day). Results: MetS was not observed in participants that accumulated ≥10,000 steps/day. Overall prevalence of MetS was 32% in those who accumulated <10,000 steps/day, and similarly between males vs. females (27 vs. 34%,

p=0.76). Conclusion: Preliminary findings suggest that accumulating ≥10,000 steps/day is sufficient to prevent MetS in overweight, non-exercising adults regardless of sex.

Effectiveness and Feasibility of Student Facilitated Exercise Training on Markers of Health and Fitness: A Preliminary Analysis

Presenter: Hannah Ewing

Faculty supervisors: Rachael Nelson, William Saltarelli

Regular exercise improves cardiovascular health markers, and exercise adherence is higher when training is supervised by certified personnel. However, the impact of exercise facilitated by pre-professional students remains unclear. This study examined the feasibility and effectiveness of student-facilitated exercise training on health and fitness markers. Eleven previously inactive adults (54 ± 14 years; 3 males, 8 females), with no recent cardiovascular disease history, participated in a quasi-experimental study. Participants completed 24 exercise sessions (3 days/week for 8 weeks). Health, fitness, and mental health markers were measured before and 72 hours after the last session. Physical health markers included weight, waist circumference, blood pressure, and fasting blood glucose. Fitness was assessed with the 6-minute walk test (6MWT) and grip strength. Mental health was evaluated using quality of life and depression questionnaires. Feasibility was determined by exercise compliance and program completion rates. No significant improvements were found in physical or mental health markers. A significant increase in 6MWT distance was observed (508 ± 85 vs. 571 ± 66 meters, p=0.04). Grip strength showed a trend toward improvement (30 ± 5 vs. 33 ± 7 kgs, p=0.10). Compliance was 69%, and 80% of participants completed the program. Preliminary results suggest that student-facilitated exercise training can improve cardiovascular fitness and strength, also acceptable compliance.

Assessing the Validity and Accuracy of two Commonly used Resting Metabolic Rate (RMR) Prediction Equations

Presenter: Kaylee Scharrer

Faculty supervisor: Paul O'Connor

This study aims to assess the validity and accuracy of two commonly used resting metabolic rate (RMR) prediction equations by using indirect calorimetry and DXA, specifically the Cunningham equation and Harris-Benedict equation. Consenting males (n=7, age: 21.7 ± 1.7 years, height: 180.8 ± 6.8cm, weight: 85.8 ± 21.0kgs) and females (n=13, age: 21.2 ± 1.5 years, height: 167.8 ± 7.0cm, weight: 67.4 ± 18.5kgs) who were non-diabetics, not receiving radiational therapy, and not currently taking metabolism-altering drugs were recruited for the study. A cross-validation design was used to calculate the accuracy of the equations compared to the results of indirect calorimetry and DXA. Participants reported to the lab after an overnight fast. The participants lay down on the DXA scanner bed for 30 minutes. After 15 minutes a hood was placed over their head to assess gas exchange to measure their RMR via indirect calorimetry. Following this a DXA was performed to assess body composition. Using the measurements each subject's RMR was estimated via the prediction equations and then compared to the results of the indirect calorimetry. Both the Cunningham equation (r-squared=0.872; Beta=0.934; p=0.001) and the Harris-Benedict

equation (r-squared=0.805; Beta=0.897; p<0.001) were closely and positively correlated with the RMR. Both equations are reasonable predictors of RMR although the Cunningham equation has shown a slightly higher correlation. Age or sex had no impact on the results.

Impact of Exertional Heat Stress on Verbal Memory

Presenter: Jayden Bonsall

Co-presenters: Molly Behen, Cambrya Ankoviak, Shane Fitzpatrick

Faculty supervisors: Micah Zuhl, Hajime Otani

Evidence suggests that verbal memory is influenced by exercise. The proposed mechanism was enhanced cardiovascular response (i.e., heart rate) induced by aerobic exercise, which may support brain blood flow and thus cognitive function post exercise. Aerobic exercise in a hot environment can exaggerate heart rate as the body enacts thermoregulatory mechanisms such as redistribution of blood flow and sweating. This study investigated the effects of aerobic exercise in the heat on verbal memory. Ten (7 female, 3 male), physically active individuals, aged 19-23 were randomized to either 45 minutes of low intensity aerobic exercise in a heated environment (36C, 40% RH) or room temperature (20C, 19% RH). Heart rate, estimated core temperature, and thermal tolerance were recorded during both trials. Following exercise, the Rey's Auditory Verbal Learning Test was administered. The Samn-Perelli Fatigue questionnaire was also used to measure subject's fatigue pre and post exercise. Average words recalled were slightly higher in the temperate exercise group than in the heated group (9.9 words vs 9.45 words). RAVLT immediate learning was higher in the temperate group versus the heated group (49.5 total words vs 47.25 words). RAVLT forgetting was higher in the temperate exercise group compared to the heated exercise group (2.83 words vs. 1). Together, these findings suggest exertional heat stress may lower immediate learning, but possibly improve memory. The mechanisms are unclear.

Effects of Hot Water Immersion on Markers of Heat Acclimation

Presenter: Christiana Donkor

Co-presenters: Michael Platt, Isaac Tiguridaane, Jordyn Elders, Peyton Thibodeau, Marian Avila

Faculty supervisor: Micah Zuhl

Athletes who live in temperate areas are advised to heat acclimate before competing in hot environments. Traditional recommendations suggesting 60-100 minutes of daily heat exposure over 2 weeks are difficult to implement due to hard training schedules. An unexplored approach is combining short-term exercise with HWI. Therefore, this study sought to determine if combining short-term exercise with HWI will promote heat acclimation adaptations. Using a randomized controlled study, 5 (23±3 years, 3 male,2 female) non-heat acclimated participants were randomized into 2 groups, including 40 minutes of HWI (40□C water); or 20 minutes of exercise in a heat chamber (36 C□ 40% RH) followed by 20 minutes HWI (E+HWI), completed five consecutive days of heat exposure. A heat tolerance test (HTT) consisting of 45 minutes of treadmill exercise at 50% VO2 max (36□C 40% RH) was performed before (HTT1) and after (HTT2) heat acclimation. Preliminary results indicate core temperature was similar at the end of HTT1 for both HWI and E+HWI (38.29+/-

0.29 vs. 38.38+/-0.08C, respectively). A decrease in core temperature was observed in HTT2 versus HTT1 in the HWI trial (37.84+/-0.20 vs. 38.29+/-0.29C, respectively). Core temperature increased slightly at HTT2 versus HTT1 in the E+HWI trial (38.69+/- 0.54 vs. 38.38+/-0.08C, respectively). Preliminary results suggest that the addition of exercise to HWI does not lead to thermoregulatory adaptation to heat. Hot water immersion alone may be viable.

Health Administration

Milton S. Hershey Medical Center: Nurse Retention Analysis

Presenter: Nachelle Walker

Faculty supervisor: Nailya Delellis

Penn State Health's Milton S. Hershey Medical Center faces high nurse turnover due to burnout, inadequate compensation, and lack of career advancement. Our analysis explores current retention strategies, including wage increases and enhanced benefits, and identifies areas for improvement. We propose solutions such as mental health support, career advancement opportunities, flexible work arrangements, and recognition programs. By addressing the diverse needs of different generational cohorts, we aim to improve nurse retention and job satisfaction.

Informants with Knowledge of Multiple Healthcare Systems Compare Access in the U.S. to Canada, Germany, and the U.K.

Presenter: Paige Weid

Co-presenters: Kennedy Bowles, Elise Bratton, Kim Dewey

Faculty supervisor: Lana Ivanitskaya

It is rare for people to have experience in multiple national healthcare systems and can compare countries on how well they deliver services. We call them unique informants. We evaluated how the informants with knowledge of multiple health systems discuss access to health services by analyzing a subset of 7,169 social media comments from 53 YouTube videos. The 3 most mentioned countries were selected: Canada, Germany, and the U.K. After identifying comments evaluating access to health services, we coded specific access issues. Of all comments contributed by Canadians, 47% touched upon access to care, while only 15% of German or British comments did. Canadians disagreed on how access to care compared in the U.S. vs. Canada. Most comments by Canadians suggested it was better in the U.S. due to long wait times in Canada. British informants also disagreed but most commenter inferred that access was better in the U.K. than in the U.S. Unique informants from the U.K. also pointed out high healthcare costs in the U.S. and poor access to quality care in the United States. In comparison, Canadian informants were more likely to emphasize issues related to service access. This focus set Canadians apart, as they expressed greater concern about healthcare availability. In contrast, German informants praised the accessibility of German healthcare, asserting that the U.S. system provides inferior access. The high costs of healthcare in the United States was the most significant concern.

Nutrition & Dietetics

Grant Writing for a Nutrition Program for Adolescent Gymnasts

Presenter: Samantha Towers

Faculty supervisor: Leslie Hildebrandt

Due to the extreme physical demands of their sport, gymnasts are some of the most under fueled athletes, which can lead to additional issues with injuries, performance declines, amenorrhea, and other health concerns. The problem is, many gymnasts either do not realize they are in an under fueled state, or do not know how to access reputable nutrition resources. This project began by outlining a nutrition education program for adolescent gymnasts and then moved into writing a grant that could be used to secure future funding for that program. Rather than relying on the gymnasts themselves to make nutritional changes, the program provides tailored educational tools to gymnasts, as well as their parents and coaches. Furthermore, the program will be administered in-house at a gymnastics facility, securing vital institutional support for proper nutrition. Both the program outline and the grant proposal will be incredible resources to take forward and jumpstart a career as a registered dietitian (RDN).

Physical Education & Sport

Unintended Consequences: How the Transfer Portal is Affecting APR and Terminal Degree Rates

Presenter: Josie Ransley

"Co-presenters: Ashlyn Norris, Ava Denton

Faculty supervisor: Daniel Ballou

Since the NCAA introduced the Transfer Portal in 2018, athletes no longer have to sit out a season when switching schools. While meant to help student-athletes and coaches, some have taken advantage of it. Combined with the extra year of eligibility granted due to Covid-19, this policy has increased student-athlete attendance in post-undergraduate programs. However, many do not intend to complete these programs, using only their final eligibility years. This study looks at how the Transfer Portal affects academics, especially schools' Academic Progress Rates (APR). A survey of 52 NCAA Division 1 academic professionals suggests the portal lowers APR scores. Many student-athletes leave their graduate programs once their eligibility ends, often due to lack of financial support or motivation. Current Transfer Portal rules may hurt APR scores and academic programs. Survey participants suggested changes to reduce these issues. These ideas should be considered to protect both college sports and academics. This study is ongoing and will continue collecting data for a clearer conclusion.

Public Health

Optimizing University-Nonprofit Partnerships for Mobile Healthcare: A Pilot Study Using Mobile Health Central Clinic in Mount Pleasant, Michigan.

Presenter: Omomoemi Emmanuella Agbegha

Faculty supervisor: Janae Bady

Access to healthcare remains a critical challenge for underserved populations, including students and community members with limited healthcare options. This study, "Optimizing University-Nonprofit Partnerships for Mobile Healthcare: Enhancing the CMU Mobile Health Clinic," explores the role of mobile clinics in bridging healthcare gaps and improving service delivery. Using a parallel-method approach, this research will assess patient experiences, barriers to healthcare access, and the effectiveness of university-community partnerships in expanding mobile health services.

Data will be collected through separate yet complementary quantitative surveys and qualitative semi-structured interviews, along with observational analysis during CMU Mobile Health Clinic outreach events. The study aims to evaluate patient satisfaction, common health concerns, engagement levels, and operational challenges to identify areas for improvement. Findings will provide insights into optimizing service delivery, strengthening partnerships, and expanding outreach efforts to enhance the clinic's impact.

By leveraging university resources and nonprofit collaborations, this research seeks to develop evidence-based recommendations for improving healthcare accessibility, increasing patient engagement, and ensuring the long-term sustainability of mobile healthcare services for students and the broader community.

Stroke Awareness and Education

Presenter: Morgan Bennett

Co-presenters: Abigail Hewitt, Allison Idema, Emily Jacobs, Courtney Reisler, Lauren Revord

Faculty supervisor: Elizabeth-Jean Bowman

Hundreds of thousands of individuals around the United States are having strokes every year, yet eighty percent of them are preventable according to the American Heart Association. Our research project was designed to educate and promote awareness of strokes around Isabella County, hoping that the residents would be able to recognize when a stroke is happening, and what they should do next. Our research team members are all pre-health students interested in preventative medicine. Many of us have seen first-hand the consequences and deficits that can occur when strokes are left untreated, and this typically results from a lack of education regarding strokes. We created a presentation discussing what a stroke is, the different types, how to detect one, risk factors, and what to do when someone is having a stroke. We presented at various assisted living facilities around Isabella County and conducted a pre-test and post-test to measure the impact of our presentation. Positive data indicated that our presentation improved the education and awareness of strokes at each of these facilities. The goal of our research was to improve the knowledge and awareness of strokes in Isabella County, hoping that we will see more individuals preventing and treating them early, so we will see a decrease in permanent deficits and death from strokes as we progress in our careers as healthcare professionals.

HPRC's Influence on Undegraduate Success and Development

Presenter: Cameron Farkas

Co-presenters: Xandar Holtrust, Hisham Danoun, Ella Smith

Faculty supervisor: Beth Boman

The Health Professions Residential College (HPRC) is a living learning community of undergraduate students all with health-related majors. All students who join the HPRC are required to take HPS 101, an Intro to Health Professions course that aims to broaden the understanding of what careers the field of health professions contains. HPS 101 is available to any student at CMU, so it accommodates a diverse population of majors from undecided to declared health majors. The purpose of this research project was to discover how beneficial the HPRC is to undergraduate students. The importance of this research is to determine the usefulness and efficacy of the HPRC. Ten HPS 101 courses were surveyed in the Fall 2024 semester using a Google form. Ninety-three student responses were recorded. Students were asked about their involvement in the HPRC, their grades, mental health, and leadership, service, and networking opportunities on campus during that semester. The data we observed shows that the HPRC tends to have higher success with networking, finding leadership roles, and engaging in service opportunities. HPRC students typically have a higher sense of belonging at CMU. The results shows that the HPRC places emphasis on more than just academic performance, it provides more opportunities for success in other routes that allows the students to become more well-rounded professionals for future careers. The HPRC helps accomplish the college's goal of creating well rounded individuals.

Qualitative Analysis of Workplace Interventions Using the Augusta Scale Among Healthcare Professionals: Report from a 2024 Survey of the National Academies of Practice Membership

Presenter: Paige Weid

Co-presenters: Kathleen Hodgkins, Zach Hoffman

Faculty supervisors: Neil MacKinnon, Preshit Ambade

Previously, we created a 22-item Augusta Scale for Workplace Mental Health and Well-being (WP-MH&WB) based on the U.S. Surgeon General's Framework and validated it among healthcare workers. We worked with the National Academies of Practice (NAP) to assess WP-MH&WB among interprofessional healthcare practitioners across 16 academies. In Fall 2024, an online survey using the Augusta Scale, one-item burnout, loneliness, personal and professional fulfillment, and demographic questions was distributed to members, with frequent email reminders for completion. The open-ended questions were then qualitatively analyzed to identify common themes among participants. Out of 255 respondents, the two most common workplace interventions reported were access to support services and workplace support. The most common concern regarding workplace wellbeing was lack of connection. Further, most academies reported the highest frequency of workplace support for mental health-related workplace interventions. However, optometry and respiratory care reported the highest frequency of access to support services. Moreover, most academies reported access to support services for health-related workplace interventions. In contrast,

occupational therapy and pharmacy reported the highest frequency of workplace support. The survey revealed important differences in the availability and desire for workplace well-being-related measures across academies.

College of Liberal Arts and Social Sciences

English Language & Literature

Why are accents important for us to hear?

Presenter: Grace Biju

Faculty supervisor: Sarah Prielipp

This project covers all the ways different accents are actually incredibly beneficial for everyone to hear!accents are an essential part of individual and regional identity, reflecting a person's background, culture, and life experiences. By listening to different accents, we gain insights into diverse cultural perspectives, fostering empathy and appreciation for linguistic diversity. Accents also contribute to effective communication by allowing us to better understand regional variations in pronunciation, which can help avoid misunderstandings. Additionally, hearing a range of accents broadens our auditory perception and language skills, improving our ability to interpret speech in various contexts. The presentation would stress that hearing accents is not just about listening to sounds but about recognizing the rich history and story that each accent represents, encouraging respect and inclusivity in all forms of communication. Learn how accents can benefit you directly throughout this presentation!

Out-of-Hospital Cardiac Arrest and Public Education on Resuscitation

Presenter: Annelise Hansen

Faculty supervisor: Sarah Prielipp

According to the CDC, approximately 1,000 out-of-hospital cardiac arrests (OHCAs) happen every day. The American Heart Association states that to improve survival rates, 15% of the population should know how to perform CPR and operate an AED. To combat this, it is imperative to push for public education on resuscitation methods and other basic first-aid skills.

51 individuals were surveyed on their pre-existing knowledge, along with their willingness to take a free first aid class. Along with the survey, three emergency medical professionals were interviewed on their observations related to this issue. According to the survey, 88.2% of participants had already been educated on how to perform CPR and use an AED. When asked if they would attend a free community course on how to perform CPR and use an AED, along with other first aid skills, 80.4% stated that they were interested.

As an emergency medical professional in an ambulance and the emergency room, I have made my observations on out-of-hospital cardiac arrest (OHCA) and patient outcomes. If 80% of the community was interested in first-aid education, more people would, theoretically, experience better outcomes after cardiac arrest. In my experience, those who received bystander care before the first responder's arrival, their outcome was generally

better than those who received no care. My purpose is to present this information to encourage the community to receive first-aid education.

The Effects of Racism against Latin America in American Society

Presenter: Carley Young

Faculty supervisor: Sarah Prielipp

The effects of racism against Latin America can be seen to be long-lasting and harmful, and this racism has been weaponized in recent history in order to manipulate and control narratives in American society. Bringing to light our own potential biases will further prevent this weaponization from occurring. This paper attempts to compile pre-existing data into a single comprehensive study, detailing viewpoints from previous research as well as contemporary evidence of the effects of racism in American society. In order to build this foundational comprehensive study, a literature review was utilized. Primary research, consisting of an anonymous survey, is being conducted and the results will be gathered in the form of various graphs.

Writing the Body, A Short Story Collection

Presenter: Hannah Gregory

Faculty supervisor: Matthew Roberson

This creative project includes six works of original short fiction that focus on feminist literature. The stories draw inspiration from literary theorist Helene Cixous, whose theory of feminist literature posits that in order to express themselves and create space for feminine perspectives in literature, women should write freely about their experiences and worlds, with a particular emphasis on the female body. This project seeks to emulate Cixous's ideals, with each story covering a topic pertinent to the experience of being a woman, including aging, caregiving, and body image. The stories range in genre from realistic to surreal, but together, they seek to provide a snapshot of the complexities of being a woman.

"Central Odyssey": A Choose-Your-Own-College-Experience

Presenter: Olivia O'Toole

Faculty supervisor: Jonathan Truitt

Central Odyssey, a digital narrative project, embodies an intersection of game design and creative writing. This project, while primarily text-based, leverages the principles of interactive storytelling and game mechanics to explore and represent the diverse student body at CMU. By utilizing game design concepts such as "the magic circle", as well as immersion more generally, the project creates a structured yet deeply engaging environment where players can explore various facets of university life through different identities. The defense of this project under the game design umbrella is founded on its use of interactive elements that are quintessential to gaming—decision-making, branching narratives, and player engagement—despite its heavy reliance on narrative text. This approach not only enhances the storytelling aspect but also deepens the educational impact, making it a powerful tool for prospective students and broader audiences alike. Central Odyssey demonstrates how game design techniques can be employed to enhance narrative depth

and player engagement in educational settings, offering a model that could be adapted for broader applications beyond the university environment.

History, World Languages, and Cultures

From Monolith to Mosaic : A Historiography of the Environmental Histories of the Ancient Mediterranean and Near East

Presenter: Jasmine Alpert

Faculty supervisor: Brittany Fremion

From Monolith to Mosaic : A Historiography of the Environmental Histories of the Ancient Mediterranean and Near East"" is an Honors capstone paper reviewing the field of environmental history as it pertains to the ancient Mediterranean and Near East. Modern environmental history is a growing and diversifying area of history that has changed much since its initial conception as part of the greater American environmental movement in the 1960s and 1970s. The capstone will look into how environmental history has added to greater historical knowledge about the ancient Mediterranean and and Near Eastern world. In particular, it will explore how the interdisciplinary nature of the field lends it well to understanding earlier time periods that often lack as many written accounts, as well as, how ancient Mediterranean and Near Eastern environmental histories have changed and evolved.

Asian Pacific American Heritage Month (APAHM) 2024

Presenter: Shreya Abraham

Faculty supervisor: Alejandro Gradilla

This project was a cultural initiative organized as part of Central Michigan University's commitment to diversity, equity, and inclusion. It was carried out during Asian Pacific American Heritage Month (APAHM) in 2024, a month dedicated to celebrating the contributions, histories, and cultures of Asian Americans, Pacific Islanders, and Native Hawaiians. As the Chair for APAHM 2024, I led the planning and execution of this initiative, working closely with student organizations and university offices, including the Multicultural Academic Student Services (MASS) office, to ensure meaningful programming throughout the month.

The primary goal of this project was to provide educational and engaging experiences that highlighted the diverse identities, traditions, and historical narratives of Asian and Pacific Islander communities. Through a carefully curated calendar of events—including panel discussions, cultural performances, and interactive workshops—the project aimed to foster cross-cultural understanding and create a space for dialogue on issues affecting these communities."

Alternative to Life: EFIL and CMU's Underground Press of the Late 1960's

Presenter: Campbell Geary

Faculty supervisors: Mitchell Hall, Jay Martin

This is a history project covering a specific topic in the history of Central Michigan University (CMU). Set against the background of student activism and New Left movements of the late 1960s and early 1970s, this project examines EFIL, a student run independent newsletter that was published as a direct response to the official student paper at Central Michigan University from 1968 to 1971. Demonstrations and student run alternative media were common then, but many universities have been understudied in this topic, including CMU. Using secondary sources and archival collections about underground media and activism during the late 1960s and early 1970s, this project determined the level of influence that EFIL had on other forms of independent student media at CMU. This adds new interpretations and context to the history of Central Michigan University during one of the most tumultuous times on campuses across America, and provides insight into what types of sources can be useful to understanding institutional histories within wider historic context.

Physician Assistants: An American Profession Inexistent in Latin America: A Comparative Study About Its Benefits

Presenter: Rachel Atterberry

Faculty supervisor: Alejandra Rengifo

In the United States, many citizens are ignorant to the idea that systems in America do not exist and may not work in other countries. This being said, a vital component within healthcare, physician associates are obsolete in Latin American countries. Good and accessible healthcare is vital to the success of a nation and in the United States, the Physician Assistant profession was developed in order to improve and expand the access to healthcare. There are few examinations published regarding the reasons behind this. In hopes of understanding more, this research delves into the historical significance of physician associates in America and how this profession was developed. It is hoped that this research will aid in helping understand how Latin America, and Argentina in particular is able to have a fairly developed healthcare system without physician associates. This was my honors capstone project.

Politics, Society, Justice and Public Service

The Regional Regime Complex: Analyzing the Impact of Regional Refugee Regimes

Presenter: Calvin Older

Faculty supervisors: Prakash Adhikari, Wendy Hansen

The goal of this research is to better understand the impact of regional treaties on the number of refugees hosted by countries around the world. While the 1951 Refugee Convention and its 1967 Protocol remain the gold standard international regime for dealing with refugees, countries around the world have entered into various regional treaties in responding to the continued rise in the number of refugees. While previous research has pointed out regime type and economic factors as significant in understanding refugees' destination choice, we know little about the impact of regional institutional arrangements such as treaties, conventions, and historical events on state's responses to refugees. Using

data from the UNHCR on resettlement of refugees around the world, we test the impact of regional inter-governmental organizations such as the Organization of African Union, the Cartagena Declaration on Refugees, and others on resettlement of refugees in these regions. The findings show that certain refugee conventions, such as the Cartagena Declaration, have a significant positive impact on the number of refugees hosted by states, suggesting that future research can benefit from analyzing the impact of regional treaties on refugee resettlement.

Do you love your neighbors? Understanding Public Opinion Toward Immigrants and Foreigners in Africa

Presenter: Brady Whalen

Faculty supervisor: Prakash Adhikari

The goal of this research is to understand public opinion toward foreigners and immigrants in Africa. While countries around the globe welcomed immigrants and refugees during the first half of the Cold War, an increasing number of them started adopting stringent policies to regulate the inflow during the 1980s and 1990s, with many of them in recent years starting to impose total ban. Countries like the United States and Germany, historically noted for their generous policies toward refugees, are moving to end such policies restricting the inflow of immigrants. Others like Turkey, Pakistan, and Malawi are reversing their open-door policies towards refugees fleeing conflict in neighboring countries. What explains this increasing trend of policy reversals toward refugees and immigrants? What are the potential implications of governments' stringent policies on national, regional and global security? What socio-economic and security factors are associated with such more stringent policies? To address these questions, we use data from the Afrobarometer to analyze public opinion toward foreigners and immigrants in Africa. Quantitative findings are supplemented by qualitative information gathered through fieldwork in Malawi.

Disaster Related Sexual Violence

Presenter: Emma Daniel

Faculty supervisor: Elizabeth Walter-Rooks

Disasters, such as those caused by climate change or pandemics, have consequences beyond what may seem obvious. Some examples include Hurricane Katrina and the Covid-19 pandemic. Disasters lead to an increase in sexual violence, notably sexual assault and rape, as well as intimate partner violence. Consequences of this sexual violence has physical and mental health effects, and contributes to the community's recovery or lack of recovery from the event. This is generally fueled by systemic problems including sexism and racism. There are ways to decrease disaster related sexual violence through education and policies to assist marginalized populations and those particularly in danger of sexual violence.

Psychology

The Effects of College Living Environments on Students Mental Health

Presenter: Anthony Rentzel

Co-presenters: Madalyn Belmore, Heather Mousseau, Kyla Welch, Jazmine Nguyen, Grace Boynton

Faculty supervisor: Beth Boman

Screen time is often never thought of when going about an individual's day. However, it has a large impact on the user's function in different aspects of life. This is an important topic to study, specifically among young adults, who struggle the most with phone addiction. Our study aims to identify the effects of screen time on an individual and how it perceives their outcomes of functionality at college. Our survey was conducted on individuals that are currently in college. We aimed to identify whether screen time has a significant impact on the student's performance calculated through grade point average (GPA). Our goal within this study is to help college students understand the impact of daily screentime related to their GPA and campus involvement in hopes screentime rates decrease while student involvement increases.

The Relationship Between Parents' Child-Centered Skills and Sensitivity in Parent-Child Interaction Therapy

Presenter: Cora Evele

Co-presenters: Lindsey Ringlee, Serena Piasini

Faculty supervisor: Larissa Niec

Parent child interaction therapy (PCIT) is an evidence-based treatment for young children with behavior problems. PCIT uses in vivo feedback to parents while they interact with their child to coach them on appropriate and healthy parent-child interactions. Research has shown this method to be effective at reducing behavioral concerns, but fewer studies have examined the relationship between PCIT and emotional availability within a parent-child dyad, especially parent sensitivity and child responsiveness. This study examines the relationship between parents' child-centered skills and sensitivity within the relationship. We will use the Emotional availability Scales (EAS) and the Dyadic Parent-Child Interaction Coding system (DPICS- III) to analyze archived videos of PCIT coaching sessions during the Child Directed Interaction (CDI) phase. We expect that as parents' child-centered interaction skills increase, as measured by the Dyadic Parent-Child Interaction Coding System-III, parent sensitivity and child responsiveness will also increase, as measured by the Emotional Availability Scale.

Assessment of Parent Feeding Practices: Exploring the Psychometric Properties of an Observational Coding System

Presenter: Serena Piasini

Faculty supervisor: Larissa Niec

Healthy and unhealthy feeding practices impact child health outcomes, but parent-reported and observed practices often mismatch. No observational system has assessed feeding

practices' sensitivity to treatment change. This study examined the Observational Measure of Positive and Negative Feeding Activity (OM-PANFA) in a pilot RCT of Parent Child Interaction Therapy (PCIT), an obesity prevention model. Archival data from caregivers (N = 28) of 2- to 7-year-olds who recorded mealtime videos at three time points were analyzed. OM-PANFA demonstrated good to excellent inter-rater reliability (r = .79 to .98), though concurrent validity was mixed. Analyses with and without covariates (child behavior problems, parenting stress) were conducted. Without covariates, PCIT-Health caregivers significantly increased Praise Healthy Mealtime Behavior (PH, ηp2 = .229) and Describe Mealtime Activities (DM, ηp2 = .172) from pre- to post-treatment. These gains were not significant at follow-up, though scores remained higher than pre-treatment. With covariates, PH remained significant (ηp2 = .198) for PCIT-Health participants, while DM showed a large effect size (ηp2 = .178) but was not significant. Contrary to expectations, Pressure to Eat did not decrease for PCIT-Health participants. OM-PANFA is a promising tool to assess treatment sensitivity, which could allow researchers to investigate the efficacy of PCIT-Health at targeting parent feeding practices.

Who's Been Included? Examining the Gender, Racial and Ethnic Composition of Caregivers in PCIT Research

Presenter: Lindsey Ringlee

Faculty supervisor: Larissa Niec

Families from marginalized communities have often been underrepresented in psychological treatment outcome research. Although there has been more than 40 years of research on PCIT in the United States, it is unclear to what extent the research has included families from diverse gender, racial, and ethnic backgrounds. This study aimed to address this gap by reviewing the sample compositions of published PCIT outcome studies. We included 61 original randomized controlled trials, quasi-experimental, and single-group PCIT studies conducted in the US from 1980 to 2021. Forty-six of the studies reported caregiver gender, with 83% of caregivers identifying as women, 17% as men, and 0% as non-binary. Twenty-five studies reported caregiver race/ethnicity. The racial distribution included 61% White, 25% Latine, 16% Black, 4% other than the options provided, 2% American Indian/Alaska Native, and less than 1% Multiracial, Asian, Native Hawaiian/Pacific Islander. Based on these findings, the gender composition of caregivers in PCIT outcome research heavily underrepresents male caregivers. This is consistent with the parenting research generally and limits the ability to understand male caregivers' experience in parenting interventions. The racial distribution of caregivers in PCIT research approximately reflects the US composition in some communities (e.g,. White, Latine, Black); while other communities remain underrepresented (e.g., Asian).

Mindfulness and Directed Forgetting of Emotional Stimuli

Presenter: Lauren Steyer

Co-presenters: Emma Kane, Rebeka Scheich

Faculty supervisor: Hajime Otani

Mindfulness has attracted the attention of researchers in recent years because mindfulness has been shown to have multitude of benefits at both physical and psychological levels (Creswell, 2017). In particular, the present study will focus on one aspect of the mindfulness effect, increased attentional capacity, which is assumed to promote greater cognitive control (Davis and Hayes, 2011). In the present study, this notion is applied to a phenomenon referred to as directed forgetting. In a directed forgetting (DF) study, participants are presented with information (such as a list of words), and they are asked to remember some of the information (remember information) and forget the other (forget information), even though subsequently they are asked to recall both types of information. Typical results from these studies show that participants recall greater amount of remember information than forget information, showing a DF effect. These studies show that participants are capable of exercising cognitive control (Gamboa et al., 2017). However, such cognitive control becomes more difficult when information is emotionally arousing. The present study will test the notion that engaging in a mindfulness exercise will increase cognitive control and increase a DF effect even when the study material is emotionally arousing.

The Analysis of Neural Inflammation in Alzheimer's Mouse Models

Presenter: Mia Dante

Faculty supervisors: Kevin Park, Kyunghee Han, Cynthia Damer

Alzheimer's Disease is one of the most common neurodegenerative diseases with nearly 6.2 million people in the US having the disease in 2022. Alzheimer's can either be sporadic – makes up 99% of cases, or familial (genetic) – makes up 1-2% of cases. This genetic linkage led to the development of animal models used to demonstrate various aspects of human Alzheimer's pathology. In recent years, white matter loss has been added to the pathologies of human AD. In this study, we compared two familial mouse models NCCR _x0001D434__x0001D45D__x0001D45D__x0001D441__x0001D43F_-_x0001D439_, and _x0001D434__x0001D45D__x0001D45D__x0001D441__x0001D43F_-_x0001D439_; and one sporadic mouse model NCCR, to demonstrate tau positive cells in white matter. The models were treated with either a ringer injection or an immunostimulant injection every 2 months from ages 4 months to 10 months. At 18 months, the animals were perfused, and their brains were sectioned. The brain sections were stained with PHF1, staining tau positive cells, which were qualified in the corpus callosum. These cells were counted using stereology and then analyzed using a two-way between subjects ANOVA. Stereology results yielded both significant genotype and treatment effects for PHF1 positive staining in the corpus callosum.

Pre-Choice Feeding Increases Impulsivity in Pigeons

Presenter: Katie Monske

Co-presenter: Grace Redwanz

Faculty supervisor: Mark Reilly

Smethells and Reilly (2015) found that preference for a smaller, immediate food alternative over a larger, delayed alternative increased when rats were given a pre-trial pellet immediately before the choice trial. The purpose of the present study was to replicate this pre-choice feeding effect in a different species. Pigeons were given the choice between 6-s

access of grain following a delay and 2-s access of grain immediately. Delay values were individually tailored to produce intermediate levels of preference. The study compared no pre-choice feeding with a 2-s access to grain immediately before the choice trial. Impulsive choice increased when food was presented before the choice trial which replicated previous experiments and provides further evidence for the pre-choice feeding effect.

Ecological Momentary Assessment of Everyday Forgetting Compared to Subjective and Objective Memory Measures

Presenter: Arianna Jepsen

Faculty supervisor: Reid Skeel

This study assessed the relationship between a novel, smartphone-based ecological momentary assessment (EMA) technique to capture everyday forgetting, with an objective memory measure, the Rey Auditory Verbal Learning Test (RAVLT), and a self-reported memory measure, the Everyday Memory Questionnaire – Revised (EMQ-R). Forty-five undergraduate students were recruited as part of a larger study and completed a questionnaire to collect demographic information, the RAVLT, and filled out the EMQ-R and then completed a survey sent through their phone three times a day for seven days assessing instances of semantic, episodic, and prospective memory errors. Total daily memory errors were significantly correlated with EMQ-R and were not significantly correlated with summed RAVLT trial 1-5 scores. EMQ-R scores were not significantly correlated with summed RAVLT trial 1-5 scores. A multiple regression revealed that EMQ-R scores and summed RAVLT trial 1-5 scores were significant predictors of total daily memory errors as they jointly explained 42% of variance in total daily memory errors reported. EMQ-R scores, and summed RAVLT trial 1-5 scores were both significant predictors of total daily memory errors. Findings of this study indicate that the frequency of daily memory errors as reported in an EMA assessment measure was significantly related to and predicted by the EMQ-R but also captured variance in forgetting not explained by the subjective memory measure.

Predicting Characteristics of Vape Use with the MMPI-3

Presenter: Brittany Mitton

Faculty supervisor: Nathan Weed

This poster reports results of a study in progress evaluating the utility of the MMPI-3 in predicting frequency and context of vape use with criterion items written to serve as potential correlates of the Restructured Clinical (RC) and Shyness (SHY) scales. 27 vaping behavior items were written to serve as plausible correlates of the eight RC scales and the SHY scale. The purpose of this analysis was to explore the top empirical correlates so far for each MMPI-3 scale of interest.

Women & Gender Studies

Menstrual Rhetoric: How Advertisements Shape Our Ideas About Menstruation and Gender

Presenter: Jaiden DeLong

Faculty supervisor: JoEllen DeLucia

This project aims to explore the rhetoric used in association with menstruation by popular menstrual product companies. Specifically, the research will investigate the relation between social stigmatization of menstruation and period poverty, while also highlighting the importance of menstrual rhetoric in shaping society's views on gender. Through the framework of feminist ideologists Chris Bobel and Alma Gottlieb, as well as current research on the societal perspectives of menstruation, I will seek to determine the impact of menstrual activism on rhetoric displayed in period ads. How does rhetoric in menstrual product advertisements symbolize ongoing shifts in how individuals view and/or think about periods? I hypothesize that the rhetoric illustrated by period product companies reflect groundbreaking shifts in the ideology associated with menstruation, with ideas that focus on transparency, visibility, inclusion, and "empowerment." Despite the shift to more "uplifting" tones in the rhetoric associated with periods, menstrual product ads also reflect long-standing societal stigmas associated with menstruation, including ideas of concealment and shame.

College of Medicine

Sleep Smarter: Innovative Screening for Obstructive Sleep Apnea with Apple Watches

Presenter: Tejas Kakunje

Co-presenters: Hayat Srour, Lauren Gaskill, Nidhi Naik

Faculty supervisors: Ahmad Hakemi, Rebecca Renirie

Obstructive Sleep Apnea (OSA) is a widespread sleep disorder with significant health consequences. Despite effective treatment options, screening remains challenging due to subtle symptoms, approximately 80% of individuals with OSA remain undiagnosed. Wearable devices, particularly the Apple Watch, present a promising method to address critical gap in screening efforts.

A systematic literature search across multiple databases yielded 93 studies. After applying inclusion criteria, four studies were identified for detailed analysis. Ballinger et al. (2018) achieved a c-statistic of 0.83 for OSA detection using machine learning on heart rate data. Han et al. (2024) validated smartphone-based ambient sound recording for AHI estimation, showing a strong correlation ($r = 0.958$) with standard home sleep apnea tests. However, these studies have limitations, like confounding factors and restricted samples, affecting generalizability. Apple Inc.'s proprietary accelerometry-based algorithm analyzed data from 4,702 participants and was clinically validated in 1,448 individuals, achieving 66.3% sensitivity and 98.5% specificity.

The Apple Watch represents a significant advancement in OSA screening, offering a practical, scalable, and non-invasive solution for early detection.Effective integration into clinical workflows will require physician education to ensure accurate interpretation of wearable device data, appropriate patient referrals, and optimal use for diagnosis and management.

Routine Preoperative Stress Testing does not Impact Postoperative Cardiac Events in Patients Undergoing Elective EVAR

Presenter: Matteo Mazzella

Faculty supervisor: Ryan Kim

Pre-operative stress testing is regularly undertaken for patients undergoing endovascular aortic repair (EVAR) for an abdominal aortic aneurysm; however, utilization has been inconsistent. We assessed the frequency and outcomes of patients undergoing preoperative stress testing before elective EVAR. Retrospective analysis of a statewide quality registry database was performed for all patients undergoing EVAR between 1/2016 and 12/2023 and a total of 6,680 patients were included in the final analysis. Outcomes analyzed were 30 day and 1 year rate of major adverse cardiac event (MACE), all-cause mortality, myocardial infarction (MI), transient ischemic event (TIA)/stroke, length of stay and readmission. Of the 6,680 patients included in the final analysis, 1,952 underwent pre-operative stress testing. We found that there was no difference in our primary outcomes whether a patient did or did not have a pre-operative stress test. We did note that patients were more likely to have a significantly longer length of stay if they had an abnormal stress test. Our analysis found that patients were more likely to have an abnormal stress test if they had a prior CVD/TIA, CHF, DM, CAD, hyperlipidemia, hypertension, COPD, prior PCI or prior CABG. However, there is no difference in outcomes between patients who have either an abnormal or normal preoperative stress test. These results prompt questions regarding the value of routine stress testing prior to elective EVAR.

College of Science and Engineering

Biochemistry, Cell & Molecular Biology

Investigating the Functional Relationship between Copine A (CpnA) and PatA, a Ca2+ -ATPase, in Dictyostelium

Presenter: Cody Morrison

Faculty supervisor: Cynthia Damer

Copines (Cpn) are calcium-dependent membrane-binding proteins found in many eukaryotic organisms. Dictyostelium discoideum has six copine genes (cpnA-cpnF). CpnA binds to phosphatidylserine (PS) and translocates from the cytosol to the plasma membrane and intracellular organelles in response to increased intracellular calcium. cpnA knockout cells (cpnA-) exhibit multiple phenotypic defects. We found that cpnA- cells have increased intracellular calcium compared to wild-type cells. Chelating calcium decreased intracellular calcium and PS exposure in both cpnA- and wild-type cells. The increased intracellular calcium in cpnA- cells suggests a defect in a calcium pump. Previous research showed cpnA-

cells made large contractile vacuoles (CVs) that were defective compared to wild-type cells. We explored whether CpnA interacts with PatA, a Ca2+-ATPase that localizes to the CV membrane. We found that CpnA co-precipitates with PatA. Western blotting revealed that incubating wild-type and cpnA- cells in media containing CaCl2 increased PatA expression in both cell types, and the amount of PatA did not differ between wild-type and cpnA- cells. Using a patA antisense plasmid, we knocked down the expression of PatA in wild-type cells and found that the patAKD cells have similar phenotypes to cpnA- cells. patAKD cells also had a severe osmoregulation defect. Overall, these results suggest that CpnA may interact directly with PatA on the surface of CVs to cause the activation of PatA.

Structure and Expression of Vasa, Engrailed, and Hedgehod Genes in the Shrimp Penaeus Vannamei

Presenter: Evan VanDriessche

Faculty supervisor: Philip Hertzler

The purpose of experimentation is to analyze the spatial expression of the developmental genes hedgehog, engrailed, and vasa in the shrimp Penaeus vannamei. The analysis of spatial expression will be performed by observing specimens stained through HCR RNA-FISH, an enhanced form of in situ hybridization that facilitates high-resolution imaging of fluorescently stained messenger RNA. Stained specimens will be viewed through a Nikon A1R confocal microscope. The embryotic, early and late nauplius, and protozoa larvae stages of Penaeus vannamei are the different specimens that will be stained for experimentation. It is expected for hedgehog to be expressed in a striped pattern along the body, colocalized with engrailed genes. Vasa is expected to be found specifically in germline cells in the gonads as it is closely associated with the formation and migration of germ cells. The comprehension of the spatial expression of genes hedgehog, twist, and vasa allows the function and relationships of said developmental segmentation genes to be analyzed and compared to other crustaceans. The location of intron splice sites in the associated genetic sequences of hedgehog, twist, and vasa will provide supplementary analysis involving the variation of said splice sites across different crustaceans. Comparisons allow similarities among crustacean species to be highlighted but also have the potential to reveal points of changes in the evolution of developmental genes in crustaceans.

Light-based Synthetic Tools for Basic and Translational Neuroscience Research

Presenter: Ashley Slaviero

Faculty supervisor: Ute Hochgeschwender

Directed evolution is a powerful technique for improving protein activity for translational and basic research. Rational evolution takes advantage of thoroughly assessed and understood amino acid sequences and three-dimen¬sional structures of target proteins to generate variants without large structural/functional disrup¬tions, decreasing library size. Using these principles, we previously designed and screened two rational evolution libraries of light-sensitive transcription factor EL222, based on multiple sequence alignment of homologous proteins, identification of functionally significant residues, and back-to-consensus mutagenesis. In Library I we identified four variants with higher response to LED stimulation and similar background levels in the dark. Library II combined mutations from Library I,

yielding improved double mutant D61A/E68A. Alternatively, random evolution libraries contain hundreds of thousands of variants, limiting efficacy of screening in mammalian cells. Here, we developed a pipeline for random evolution of D61A/E68A with the goal of obtaining an improved variant with further mutations. This pipeline involves error-prone PCR, transfection onto landing pad stable HEK293 cell lines (which express only a single variant per cell), single seeding of cells, and screening by LED. The top EL222 variant will be used in transcriptional systems in mammalian cells and in vivo. These systems will be tuned for activation by both bioluminescent and LED light sources.

Unique Informants Compare Healthcare Costs in the U.S., Canada, Germany, and the U.K.

Presenter: Ella Kenworthy

Co-presenters: Kimberly Dewey, Kennedy Bowles, Paige Weid, Elise Bratton

Faculty supervisor: Lana Ivanitskaya

Social media users offer insights about healthcare systems, comparing the U.S. to others. While most people have experience with only one health system, some have lived in different countries, providing perspectives for cross-country comparisons. We analyzed 7,169 social media comments from YouTube videos (2014-2023) to identify 6.5% of comments by informants – commenters with knowledge of different health systems. Informants from top 3 countries, comparing their country's healthcare costs to the U.S., were selected for analysis: Canada (95 comments), Germany (68 comments), and the U.K. (62 comments). Coding focused on issues of access.

Most comments by Germans (75% of comments), British (65%), and Canadians (61%) deemed U.S. healthcare costs excessive. Canadian healthcare was the most debated in comparison to the U.S. system: Some Canadians argued that the U.S. system was better overall, while others preferred the Canadian system. Commenters discussed high U.S. prescription and insurance that limit access to healthcare, costs vs. wait times, external control, overtreatment in the U.S., and overall perceptions. Comments by 14% of Canadians, 11% of Germans, and 10% of British people criticized U.S. healthcare overall.

In conclusion, the high costs of U.S. healthcare were most criticized, limiting access. However, some Canadians preferred the U.S. system. These findings highlight the role of cost, insurance, and access in shaping public perceptions of healthcare systems.

Transcription Factors that Regulate The col-19p::gfp Adult Cell Fate Marker During Dauer

Presenter: Anuja Dahal

Faculty supervisor: Xantha Karp

Stem cells maintain the capacity to produce multiple cell types during quiescence. However, the mechanisms that coordinate multipotency and quiescence are poorly understood. C. elegans lateral hypodermal seam cells are multipotent in larvae and differentiate in adulthood. Seam cells maintain multipotency during the quiescent dauer larva stage, adopted after the second larval molt in adverse conditions. The DAF-16 transcription factor

coordinates multipotency and quiescence to regulate cell fate during dauer. Dauer larvae that lack daf-16 express an adult cell fate marker, col-19p::gfp, indicating that daf-16 blocks adult cell fate during dauer. col-19p::gfp is regulated transcriptionally, but DAF-16 does not bind the col-19 promoter, leaving open the question of what genes regulate col-19p::gfp expression. To answer this question, we used RNAi to knock down the expression of 110 transcription factors in wild-type or daf-16(null) dauers, observing the effect on col-19p::gfp expression. RNAi of ceh-60, nhr-68, and dcp-66 suppressed the misexpression of col-19p::gfp in daf-16(null) dauer larvae, suggesting these genes activate col-19p::gfp. DCP-66 is a subunit of the NuRD chromatin remodeling complex. However, RNAi knockdown of other NuRD subunits did not suppress the col-19p::gfp expression phenotype, suggesting that dcp-66 might regulate col-19p::gfp expression through a NuRD-independent mechanism. Overall, we identified novel regulators of an adult cell fate marker in dauer.

daf-16/FOXO Regulates the Expression of the let-7 microRNA in Opposite Directions during and after Dauer to Control Hypodermal Seam Cell Fate

Presenter: Matthew WIrick

Faculty supervisor: Xantha Karp

In response to adverse conditions, C. elegans can enter dauer after the second larval molt. If conditions improve, dauer larvae can recover and resume development as post-dauer (PD) larvae. The mechanisms by which developmental pathways are modulated to accommodate dauer are poorly understood. We have shown that daf-16 blocks the expression of the col-19p::gfp adult cell fate (ACF) marker during dauer. The expression of the let-7 family microRNAs (let-7s) in larval stages indirectly activates the onset of ACF. We found that levels of the let-7s were upregulated in daf-16(0) dauer larvae and this upregulation is necessary for col-19p::gfp expression in daf-16(0) dauers. We also found that depletion of a transcriptional activator of let-7 during non-dauer development, NHR-23, reduced levels of let-7 transcription in daf-16(0) mutants. Thus, during dauer, daf-16 opposes ACF by repressing nhr-23, leading to reduced expression of the let-7s. Strikingly, daf-16 plays an opposite role after dauer because daf-16(0) PD adults lack adult characteristics. Consistent with this opposite role, we found that the let-7s were downregulated in the daf-16(0) PD larvae. However, different from dauer, daf-16 and nhr-23 appear to regulate ACF in parallel after dauer. Together, we propose that daf-16 coordinates dauer and developmental progression by opposing the expression of the let-7s and ACF during dauer arrest and then promoting the expression of the let-7 and ACF as development resumes.

Polymeric Hydrogel Skin Scaffold Degradation Analysis of Varying pH and Temperature

Presenter: Eliza Atkinson

Faculty supervisor: Anja Mueller

Third-degree burns are difficult to treat and one of the present treatment options are temporary skin scaffolds. While these skin scaffolds provide a structural framework for cells and encourage wound healing, current skin scaffolds are not biodegradable and need to be removed during the healing process leading to scarring. This research project uses a hydrogel skin scaffold composed of a mixture of plant-based polysaccharides in hopes of

developing a scaffold that is biodegradable and that mimics the rate of wound healing. In this project, we begin to identify the degradation rate of the products within the hydrogel at differing pH and temperature.

A Bioluminescent Kinase Sensor-Based Gene Circuit for Real-Time Monitoring and Control of Inflammation

Presenter: Osheen Dubey

Faculty supervisors: Eric Petersen, Jesse Bakke, Julien Rossignol

Chronic inflammation is the cause of numerous diseases, including autoimmune diseases and neurodegenerative diseases. In the central nervous system, chronic inflammation exacerbates diseases such as Alzheimer's and Parkinson's. New therapies, including JAK inhibitors, lack cell specificity and lead to severe side effects. To circumvent these limitations, we are developing a Bioluminescent Kinase Sensor (BlinKS) coupled with a synthetic gene circuit for real-time inflammation monitoring and control. BlinKS is designed to detect JAK/STAT pathway activation and convert it to bioluminescent signaling that regulates gene expression via the light-sensitive transcription factor EL222. The system uses a split luciferase that is reconstituted with activation, a phospho-amino acid binding domain that serves as a detection mechanism for the phosphorylation events, and a kinase substrate phosphorylated by activated JAK or STAT proteins. The bioluminescent signal will enable autonomous transcriptional control over therapeutic proteins. To further increase the sensitivity and specificity of BlinKS, we are optimizing luciferase variants, tweaking sensor components, and including additional kinase targets, like JAK1. We will validate the system in vitro with cell-based assays to determine whether the sensors can detect inflammatory signaling and induce optogenetic gene circuit activation. This will furthermore establish its utility for studying inflammation and developing targeted therapies.

Investigating ERK Kinase Regulation in Oocyte Development Across Species

Presenter: Leah Themel

Faculty supervisor: Jennifer Schisa

Fertility declines with age, and while the mechanisms underlying infertility remain largely elusive, it is well known that oocyte quality plays a crucial role. Past research has suggested that regulation of protein phase transitions may be key to maintaining oocyte quality. Our lab has identified that the ERK kinase is a regulator of phase transitions in C. elegans oocytes. In this study, we aim to determine whether the role of ERK in regulating protein phase transitions is conserved in a closely related species, C. remanei. My initial experiment focuses on determining if activated ERK is detected in maturing oocytes of C. remanei using antibody staining techniques. To investigate this, I segregated female worms into mated and unmated populations. After dissecting the worms and fixing the tissue, I used an antibody that binds to activated ERK if it is present in the oocytes. We hypothesized that if the ERK regulatory mechanism is conserved across C. elegans and C. remanei, we will observe activated ERK only in oocytes of the mated females. If our prediction is true, I will perform RNA interference experiments to explore the effects of ERK knockdown on protein phase transitions in C. remanei oocytes. This approach will deepen our understanding of the relationship between ERK regulation of phase transitions and oocyte quality. We anticipate

that the data will provide valuable insights into the fundamental mechanisms of fertility and oocyte maturation across different species.

Development of Monosaccharide Chemical Reporters to Probe Lipoglycan Synthesis and Transport in Mycobacteria

Presenter: Caleb Mensah

Co-presenter: Carson Bush

Faculty supervisor: Benjamin Swarts

Bacterial cell surface glycolipids are critical in the adaptation of bacteria to their surroundings and pathogenesis. Understanding and elucidating bacterial glycolipid biosynthesis and transport is of great importance. Mycobacteria are a class of bacteria characterized by a dual-membrane cell envelope of unique composition and structure. Unlike Gram-positive and Gram-negative bacteria, mycobacteria cell envelope has highly specialized biosynthesis and translocation machineries. The cell envelope is known to be mostly populated with inositol and mannose-containing glycans called phosphatidylinositol mannosides (PIM) and their multi-glycosylated derivatives, lipomannan (LM) and lipoarabinomannan (LAM). Several transporters that translocate phosphatidylinositol mannosides across the outer mycomembrane are not known and the dynamics of phosphatidylinositol mannosides biosynthesis in a bacteria cell is not understood. Lack of tools in labeling these glycans remains an obstacle to advancing knowledge in key aspects of their biosynthesis pathway. Using approaches that encompass synthetic chemistry, chemical biology, transport assays, and molecular biology, we have developed chemical probes that metabolically label PIMs in intact bacteria and spheroplasts. This enables us to visualize PIM/LM/LAM and to identify the form of PIM that is translocated.

Finding Potential Epimeric Azido- and Amino-trehalose Inhibitors for the TreS Pathway in Mycobacterium Tuberculosis

Presenter: Ki'auna Meyer

Faculty supervisor: Benjamin Swarts

Tuberculosis (TB), a disease caused by Mycobacterium tuberculosis (Mtb), is a global health issue with millions affected every year. The persister state of Mtb provides a barrier to effective treatment, mainly because of its ability to form drug-tolerant biofilms and enter a dormant state through the TreS pathway. My research aimed to design and synthesize specific epimers of the known TreS inhibitors 6-TreAz and 2-TreNH2, as well as two other epimers, to facilitate future experiments evaluating their potential to inhibit Mtb growth. Specifically, I used a luminescence-based UDP-Glo assay to test whether the trehalose-synthesizing enzyme TreT could synthesize these trehalose analogue epimers starting from the corresponding glucose analogues: 2-azidomannose, 3-azidoallose, 4-azidogalactose, and 6-azidoglucose. The results showed that 2-epi-TreAz and 6-TreAz could be produced by TreT with an efficiency similar to that of the positive control, glucose, paving the way for future evaluation of their potential as inhibitors of the TreS pathway in Mtb. In contrast, 3-epi-TreAz and 4-epi-TreAz could not be synthesized by TreT. These findings indicate that the structural modifications of glucose analogues could influence their ability to react with TreT

to form trehalose derivatives and potentially influence their ability to make compounds that could be used in an inhibitory function.

Biology

Phenotypic Characterization of Copine D Mutants in Dictyostelium

Presenter: Bridget Plude

Faculty supervisor: Cynthia Damer

Genetic screenings and functional studies indicate that copine proteins are highly expressed in human cancer cells. Copines are a family of Ca2+-dependent membrane-binding proteins found in eukaryotes. Humans have nine copine genes that are differentially expressed in various tissues. However, the functions of copines are unknown. We are using Dictyostelium, which has six copines genes, as a model organism to investigate the function of copines. We obtained two insertional cpnD mutants and the parental AX4 cell line from the Dictyostelium REMI mutant project to investigate the function of cpnD. We then characterized the phenotypes of the two cpnD mutants focusing on phenotypic defects we previously observed in cpnA and cpnC null mutants. Both cpnD mutants were less adhesive and had less SibA expression than parental AX4 cells. Additionally, cpnD mutants grew faster in axenic culture than the parental AX4 cells. cpnD mutants appeared to develop with normal timing and morphology. The mutants showed no significant difference in contractile vacuole size compared to AX4 cells when placed in water. However, cpnD mutants had increased PS exposure. Our data shows that cpnD mutants have distinct phenotypes from cpnA and cpnC mutant cells, and indicates that all three copines have distinct functions. Our objective is to determine the biological functions of each copine gene. This knowledge is valuable in understanding the function of copine genes and their roles in human cancers.

The Cost of Social Dominance using Territory Manipulations in Males of the cichlid fish Astatotilapia Burtoni

Presenter: Tyler Beyett

Faculty supervisor: Peter Dijkstra

Rank or position within a dominance hierarchy determines access to valuable resources and reproductive opportunities. In many social species, individuals compete aggressively for territories, especially if territory ownership is a prerequisite to reproductive success. Although territory ownership comes with many benefits, territory defense is metabolically costly, and how animals manage these costs is unclear, in part because few studies manipulate territoriality under controlled conditions. To address this knowledge gap, we altered structure availability to assess how markers of territoriality (relative gonad size and behavior) influence oxidative stress in males of the highly social cichlid fish Astatotilapia burtoni. We housed males individually with an artificial cave or not, and these focal males had visual access to a neighbor, which were also given a cave or not. All males expressed an upregulated reproductive system as evidenced by vibrant coloration and large gonads. However, to our surprise cave ownership did not significantly increase relative gonad size. We did not find any indication that cave presence affected our measures of oxidative stress (lipid peroxidation, ratio between free and oxidized glutathione). However, we found that

oxidative stress was positively linked to relative gonad size, providing some experimental evidence that territoriality carries an oxidative cost. Future work will assess the impact of cave presence on behavior and oxidative stress.

Evaluating Sediment Microbial Microplastic Degradation Spanning the Continental Shelf of Antarctica

Presenter: Regan Kopesky

Co-presenter: Regan Kopeaky

Faculty supervisor: Xantha Karp

Some animals can pause their development in a stress-resistant stage called diapause. In favorable conditions, C. elegans larvae develop continuously through L1-L4 stages before reaching adulthood. In adverse conditions, C. elegans larvae can enter the stress-resistant and developmentally arrested dauer larva stage after the second larval molt. If conditions improve, dauer larvae can recover and complete development as post-dauer larvae, displaying the same developmental outcomes as their continuous counterparts. One factor contributing to these outcomes appears to be the modulation of microRNA (miRNA) activity. MiRNAs and associated proteins form the miRNA-induced silencing complex (miRISC), which binds to the 3'-UTR of target mRNAs to silence protein production. alg-1 and alg-2 are partially redundant genes encoding the core miRNA Argonaute proteins within miRISC. After continuous development, adults lacking alg-1 display vulval bursting (Rup) or protrusion (Pvl). However, these phenotypes are suppressed in post-dauer alg-1(0) adults. We hypothesize that this phenotypic suppression is the result of increased miRNA activity in post-dauer animals. RNA-binding proteins (RBPs) are known modulators of miRISC activity and are candidates for enhancing miRNA activity after dauer. Thus far, we have screened 27 RBP-encoding genes and found that rpb-8, lars-1, eef-1B.1, mcm-6, lin-41, and aco-2 are all required for alg-1(0) animals to develop without vulval defects. "RNAi Screen for RNA Binding Proteins that Enhance microRNA Activity after Dauer Diapause in C. elegans

Evaluating Sediment Microbial Microplastic Degradation Spanning the Continental Shelf of Antarctica

Presenter: Katie Howland

Faculty supervisor: Deric Learman

Microplastics (MPs) are small in size, less than 5mm, yet detrimental to the fragile ecosystem of Antarctica (1). MPs threaten the ecosystem as they are often ingested and magnified in higher trophic levels (2). Current studies have noted that MP concentrations in Antarctic marine waters and marine sediments rival highly traveled oceans in the Northern hemisphere (3, 4). In addition to MPs, phthalates, a plasticizer used in plastic, are a contaminant of emerging concern (5). Phthalates leach out of plastics into the environment (6), posing a threat to human and environmental health (5, 7). This study aims to investigate the genetic potential of microbes to degrade synthetic MPs. DNA was extracted and sequenced from ten sites spanning three regions: Antarctic Peninsula (AP), Eastern Antarctica (EA), and Western Antarctica (WA). Resulting DNA sequences were assembled into contigs and binned into metagenome assembled genomes (MAGs). MAGs were

annotated with a curated set of plastic degradation enzymes to search for extracellularly secreted MP degradation enzymes (8). Taxonomically, eight Hyphomicrobiaceae, sixteen GCA-2729495, and eleven SG8-38 MAGs were documented with the genetic potential to degrade an abundance of MPs. Additionally, two Alphaproteobacterial MAGs were documented with complete phthalate degradation pathways. The abundance of MP degradation genes suggests bioremediation of MPs may be an effective tactic for reducing MP contamination.

Importance of Zooplankton Abundance to Growth and Survival of Larval Lake Whitefish and Cisco in Laboratory Experiments

Presenter: Miranda Devan

Faculty supervisor: Scott McNaught

Lake Whitefish (Coregonus clupeaformus) and Cisco (C. artedi) are culturally, economically, and biologically important to the Great Lakes region. Over the past two decades Lake Whitefish populations have declined due to low larval survival, whereas Cisco populations have increased. Declining zooplankton, the main food for larval fish, may differentially affect growth and survival of the two fish species. The purpose of this study was to examine how zooplankton abundance affects growth, body condition (Kc), and survival of larval Lake Whitefish and Cisco when alone and together during a 3-week lab study. Beginning with 106 fish in each tank, we monitored survival and added food daily. We randomly selected 6 fish each week to be euthanized, measured, and weighed. Fish from mixed tanks were genetically identified. Survival decreased over time and was higher in high-zooplankton treatments but did not differ by species. Growth rates significantly increased over time but were not influenced by fish species, presence of a competitor, or zooplankton treatment. Kc was significantly increased over time. Cisco in mixed tanks had lower Kc than those in tanks alone, while Lake Whitefish were not impacted. These results suggest that higher zooplankton abundance could improve both species' survival in the Great Lakes. Larval fish growth was unaffected by food, but juveniles may be impacted more by food density.

Clearing the Vertical Transfer Pathway to STEM Education at Central Michigan University

Presenter: Logan Mueller

Co-presenter: Jordan Kobielus

Faculty supervisors: Wiline Pangle, Shane Cavanaugh

Community college is stigmatized in academia, often negatively impacting transfer students. Studies show that universities address the transfer system by creating articulation agreements to provide knowledge about how credits will transfer. Yet, many transfer students report feeling a lack of support. At Central Michigan University (CMU), there is a large population of transfer students (just under 10% of entering students last fall), which will likely increase due to The Michigan Guarantee, a new state initiative providing free community college for in-district students. Here, we examine the experience of vertical transfer students, defined as students who attended a community college after graduating from high school and then transferred to another college or university, in Science,

Technology, Engineering, and Mathematics (STEM) at CMU. Specifically, we explored how STEM vertical transfer students were being perceived and supported at CMU, and ways the current pathway could be improved. We present themes that emerged from our student surveys, including credit transferability, professor relationships, transfer information routes, and feelings of belonging. We conclude with a list of recommendations for the College of Science and Engineering to continue to support vertical transfer students at CMU.

Investigating the Role of Protein Transporters as Novel Regulators of the Quality of C. elegans Eggs

Presenter: Ashley Cichon

Faculty supervisor: Jennifer Schisa

Female infertility is a common condition and reduced egg quality is often the cause. We are interested in identifying mechanisms that affect egg quality. Several proteins in human eggs undergo regulated condensation into granules during the cell cycle, suggesting that proteins may need to be condensed or decondensed at different times to promote egg quality. C. elegans is a useful model as the worms are transparent and we can monitor condensation using green fluorescent protein tags on proteins of interest. In C. elegans, a protein transporter called COPB-2 was found to inhibit the ectopic condensation of the RNA binding protein MEX-3 in oocytes. COPB-2 is essential for trafficking of proteins between the ER and Golgi and mutations in this gene are linked with several cancers. I used RNA interference (RNAi) to determine if COPB-2 is required to inhibit ectopic condensation of CAR-1 in oocytes. We synchronize worms, to be at the same stage of development and then expose them to bacteria expressing double-stranded copb-2 RNA. The dsRNAi will deplete copb-2 mRNA and we can assess if there are effects on CAR-1 condensation. Preliminary results suggest COPB-2 does not regulate CAR-1 condensation. Our results suggest that COPB-2 may specifically regulate MEX-3. In the future, we seek to determine how COPB-2 regulates condensation in eggs, if other genes involved in ER-Golgi trafficking are required and better understand the extent to which protein condensation affects egg quality.

How important is the cytoskeleton in maintaining good quality eggs?

Presenter: Christya Haddad

Faculty supervisor: Jennifer Schisa

Phase transitions of RNA-binding proteins (RBPs) in cells are similar to phase transitions of water. The molecules can exist in differentially condensed forms from diffuse to gel-like to the most condensed solid state. Each RBP has specific functions that rely on being in a certain state; therefore, proper regulation between physical states is essential to maintaining cell health. Our lab is investigating the extent to which the dysregulation of phase transitions causes poor quality oocytes and infertility. The cytoskeleton has been shown to play an important role in regulating protein phase transitions in some cells. The eukaryotic cell cytoskeleton is composed of actin, tubulin, and intermediate filaments. My past experiments using the C. elegans nematode model system have shown that depleting actin causes RBPs to ectopically condense in oocytes, indicating that actin is required to prevent RBP condensation in oocytes. Because tubulin is a second major component of the cytoskeleton implicated in regulating phase transitions, I hypothesized that tubulin would be

similarly required to prevent RBP condensation in oocytes. I predicted that depleting the expression of alpha-tubulin subunits would de-polymerize microtubules in the cytoskeleton, which would promote the ectopic condensation of RBPs. I used RNA interference to deplete alpha-tubulin expression in nematodes that have a fluorescent reporter tagged an RBP called MEX-3. The reporter allows for live imaging of the oocytes to monitor condensation of the RBP. My preliminary results show that depleting the expression of tubulin causes RBPs to ectopically condense into granules in oocytes, supporting the idea that tubulin is required to regulate protein phase transitions in oocytes. Ultimately, gaining insight into the regulation of phase transitions of RBPs will provide insight into their function in determining oocyte quality and may eventually be useful in therapeutics.

Blocking Calpain Cleavage of Tau: A Protective Strategy Against Neurodegeneration in Flies

Presenter: Cooper Allers

Faculty supervisor: Michelle Steinhilb

Alzheimer's disease is a widespread and debilitating neurodegenerative disorder marked by progressive cognitive decline, starting with mild impairment and leading to total functional loss. The microtubule-associated protein tau is central to disease progression, with evidence implicating both hyperphosphorylation by protein kinases and proteolytic cleavage by calpain in the neurodegenerative process. To investigate calpain's role, we administered three calpain inhibitors (Calpain Inhibitor VI, Calpain Inhibitor XI, and Calpeptin) to flies expressing human tau protein in their photoreceptor neurons. Since tau expression induces neurodegeneration in fly retinal cells, we tested whether inhibiting calpain-mediated tau cleavage could prevent neuronal death. To evaluate the efficacy of these treatments in reducing toxicity, we employed scanning electron microscopy (SEM) and light microscopy to qualitatively assess morphological improvements in the eyes of drug-treated flies.

Cracking the Calpain Code: A Fly's Guide to Conquering Machado-Joseph Disease

Presenter: Logan Douglas

Faculty supervisor: Michelle Steinhilb

Machado-Josephs disease (MJD) is a neurodegenerative disorder that affects about 1 in 20,000 people worldwide. MJD is in a family of polyglutamine disorders caused by repetitive DNA sequences that lead to progressive loss of coordination and ultimately nervous system dysfunction. MJD can be effectively modeled in the common fruit fly, Drosophila melanogaster. This project focuses on the proteolytic enzyme calpain since the Steinhilb lab and others have demonstrated the importance of calpain cleavage in several neurodegenerative diseases, including MJD. Our lab has shown previously that MJD-induced neuronal toxicity can be suppressed by genetically reducing calpain expression in flies. This project employs transgenic flies that express the human MJD protein in photoreceptor neurons to investigate whether pharmacological calpain inhibition can suppress MJD-induced toxicity as well. Utilizing four commercially available calpain inhibitors, we measured the effect of reducing necrosis and return of pigmentation to assess how well each drug ameliorates MJD-induced toxicity. Discovering pharmacological methods for reducing the

pathological burden of MJD in a model organism is the first step to producing effective therapies for clinical trials.

Assessing How Freshwater Mussel Growth Varies with Water Temperatures in the Kalamazoo River Watershed

Presenter: Tadiwanashe Mutasa

Faculty supervisor: Daelyn Woolnough

Native freshwater mussels (family Unionidae) play a vital role in balancing the aquatic ecosystem. As filter feeders, they help purify water by removing suspended particles, algae, and pollutants, cycle nutrients, and provide food for other species. Despite their ecological importance, many freshwater mussel populations are in decline due to environmental stressors. This study investigates the relationship between summer water temperatures and mussel growth in the Kalamazoo River, aiming to identify the optimal temperature range for their development. We hypothesized that the freshwater mussels' growth is temperature-dependent and that they have an optimum summer temperature range they grow the largest, which is in warm waters (>21^{0}C). To test this hypothesis, surveys were conducted during the summers of 2018 and 2019 across 122 sites in the Kalamazoo River watershed using standardized timed search methods. We analyzed length data from over 3,400 mussels, focusing on the most abundant species in the watershed. We will present how the lengths of species considered relate to summer water temperature. By understanding how temperature variations affect mussel growth, this research will provide valuable insights into the ecological needs of freshwater mussels and offer practical recommendations for their conservation.

Chemistry & Biochemistry

Green Synthesis of Vanillin: A Novel Pathway from Eugenol and Riboflavin

Presenter: Faith Anderson

Faculty supervisor: Anton Jensen

Vanillin, the primary component of vanilla flavor, is a highly valued compound used in food, fragrance, and pharmaceutical industries. There is a limited supply of natural vanillin from plant sources, so a sustainable and renewable alternative is needed to fill the gap. Traditionally, vanillin is synthesized from ligin or guaiacol. This paper explores using eugenol and riboflavin as starting compounds. Eugenol, a phenolic compound found in cloves, and riboflavin, a vitamin, were subjected to a series of experiments to facilitate the rearrangement and oxidation of eugenol into vanillin. These experiments involved mixing riboflavin (oxidized or reduced) with eugenol at various temperature and pH values. The results of these experiments were analyzed using UV and NMR spectroscopy. Progress and data will be reported.

Synthesis of Phenoxazinone

Presenter: Avery Rowe

Faculty supervisor: Anton Jensen

Attempts to synthesize a phenoxazinone (PX) from 3-amino-4-hydroxybenzenesulfonic acid with various compounds were unsuccessful up to this time. When the sulfonic acid is dissolved in water with barium hydroxide no reaction occurs over time. The solution slowly darkens, but PX does not form. When the sulfonic acid is dissolved in water and allowed to sit, PX does not form. When this aqueous solution is irradiated for various lengths of time, PX does not form. When the sulfonic acid is dissolved in water with iron chloride and heated, PX does not form. When the sulfonic acid is dissolved in water with iron chloride and irradiated with light, a precipitate forms. However, neither the precipitate nor solution contain significant amount of product. When the sulfonic acid is dissolved in methanol and irradiated at various lengths of time, a new product forms which is not PX.

The Interaction of Actin with the Actin Cross-linking Domain of the MARTX Toxin in Vibrio cholerae

Presenter: Turner Tomatti

Faculty supervisor: Stephen Juris

Vibrio cholerae is a gram-negative, water-borne bacterium. When humans ingest V. cholerae-contaminated food or water, it can cause the illness cholera. Cholera is an illness that kills thousands of people each year, which prompted researchers to sequence its genome in 2000. With V. cholerae's genome sequenced, researchers have been able to map out virulent pathways. I will be looking at a specific toxin that V. cholerae utilizes and the mechanism by which it works. I will use labratory techniques such as protein purification, bacterial transformations, and protein crystallography to determine the three dimensional structure of the actin-cross linking domain that V. cholerae toxins disrupt. This would help us understand how certain biological mechanisms of toxins work.

Empowering Student Scientists: Development of a Mobile Spectroscopic Analysis Tool for Environmental Nitrate Testing in H2O Q Programs

Presenter: Ashley Brown

Faculty supervisor: Dale LeCaptain

The H2O Q program, originally designed by the ACS Midland Local Section and housed at Central Michigan University (CMU), equips middle and high school classrooms with environmental water quality testing kits. These kits include nitrate testing tools that utilize an enzyme reduction process, offering a safer alternative to traditional cadmium-based methods. While the program provides handheld spectrometers and visual color comparison cards, many schools find the spectrometers cost-prohibitive, and the comparison cards lack accuracy. To address this, our research focuses on developing a mobile application as a cost-effective and accurate spectroscopic analysis tool for nitrate testing. This study validates the accuracy of a mobile application for measuring nitrate levels in water samples, comparing it to a standard photodiode method. Using a 3d printed custom cuvette holder for optimal for data collection, there is a positive correlation between absorbance and saturation, supporting the app's efficacy in determining nitrate levels. A two-point calibration method based on the app's saturation values closely matches the expected concentrations measured by the photodiode across multiple trials. This innovative approach aligns with H2O Q's mission to foster authentic scientific experiences in classrooms while promoting

environmental stewardship. Our work validates the relationship between saturation, hue, and absorbance to potentially enhance the method accuracy.

Cost-Effective Screening for Microplastics and Fluorescence in Natural Water Samples

Presenter: Nora Jannenga

Faculty supervisors: Dale LeCaptain, Mark Jones

The H2O-Q project, developed by the Midland Section of the American Chemical Society, engages 7-12 grade students in active water quality research, including a focus on microplastics detection. This project involves the continued development and testing of a prototype method for microplastics screening. Inspired by ""Yooperlite" hunting, the search for florescent granite rich with sodalite on the shores of Lake Superior, the particles left behind after running through the H2O-Q water filter apparatus were examined under different light sources. Analysis under ultraviolet light revealed man-made microfibers and microplastics in much greater quantities than identified with visible light and the naked eye. This research seeks to advance educational resources and contribute to the understanding and ongoing analysis of environmental microplastic contamination. The aim is to determine the quantitative correlation between visually filtered particles and fluorescing particles on the same filter using the simple, cost-effective visual screening tool provided by H2O-Q. The goal is to establish how the H2O-Q project fluorescent measurements correlate with the actual quantity of particles present in natural water samples, as determined by gravimetric analysis and SEM imaging.

Synthesis and Evaluation of D-mannitol-based Dendrimers

Presenter: Blessed Agbemade

Faculty supervisor: Choon Lee

Antioxidants are recognized for their ability to protect cells from oxidative stress by scavenging free radicals, which initiate a chain of reactions leading to oxidative stress and the pathogenesis of various diseases in the human body. While many natural antioxidants exist, most are small and ineffective at achieving the therapeutic concentrations necessary for effectively scavenging radicals and shielding cells from oxidative damage. Furthermore, through the Fenton reaction, they can generate additional free radicals when exposed to transition metal ions such as Cu(II) and Fe(III). This phenomenon is referred to as pro-oxidant effects. This research focuses on synthesizing dendritic antioxidants that exhibit high stability and potency without pro-oxidant side effects. Lee's group has previously synthesized antioxidant dendrimers with these ideal properties, but they lacked water solubility. Since the human body consists of both hydrophilic and hydrophobic compartments, it is essential to develop antioxidants with varying solubilities. As a result, antioxidant dendrimers with various solubilities were synthesized in this study. D-mannitol was used as the scaffold to construct dendrimers, while syringaldehyde (4-hydroxy-3,5-dimethoxybenzaldehyde) and pyridoxal served as the building blocks for the antioxidants. Two generation 1.0 dendrimers containing 12 phenolic antioxidant units were synthesized in this research.

Antioxidant Dendron

Presenter: Ashlyn LaPratt

Faculty supervisor: Choon Lee

Antioxidants play a key role in reducing the amount of oxidative damage to celluar materials, which is caused bt reactive, radical species. Shielding cells and tissues from radical damage is key to reducing oxidative stress and inflammation in the body. Our research focuses on making an antioxidant that carries multiple phenolic antioxidant units, which can take on multiple different reactive radical species. This Galleic Aldehyde-based antioxidant dendron is highly suitable for clinical applications. This project showcases synthesis of the dendron as well as the findings on its antioxidant activities.

Synthesis of 3, 4-Dihydroxybenzaldehyde-based Generations 3 Antioxidant Dendrons

Presenter: Nanzhu Li

Faculty supervisor: Choon Young Lee

Antioxidants neutralize harmful free radicals produced by metabolism, lifestyle, and many other environmental factors. Antioxidant dendrimers carrying multiple hindered phenolic groups on the surface are shown to have high antioxidant capabilities, particularly when stabilized by nearby electron-donating groups. Dendrimers, molecules with branching structures, are of particular significance due to their customizability and ability to have multiple functions. Many antioxidants have poor water solubility, when water solubility is an important criterion for clinical applications and function in the body. This research aims to develop 3,4-dihydroxybenzaldehyde-based G3 dendrons (a pie-shaped segment of dendron) with an aldehyde focal point that can be attached to other dendrons in the future to form various dendrimers that have clinically applicable solubility and high antioxidant activities and low pro-oxidant activity. The surface of antioxidant dendrons consists of syringaldehyde (hydrophobic), Vitamin B6 (water-soluble) molecules, and Vitamin B6 and syringaldehyde (amphiphilic) molecules.

Imprinted Polymer Nanoparticles for Membrane Synthesis

Presenter: Gabrielle Johnson

Co-presenter: Enock Cofie

Faculty supervisors: Anja Mueller, Brad Fahlman, Itzel Marquez

In water treatment, some compounds are difficult to remove with conventional methods. Molecular imprinting creates materials for water treatment with specific cavities unique to a particular molecule - perfect for the removal of ions from water that bind only weakly to conventional adsorbents and membranes. In this work, we used molecularly imprinted acrylate polymers reinforced with graphitic carbon to selectively remove a variety of molecules and ions. The cross-linker fixes the shape of the template molecule. With a planetary ball mill grinder, polymer molecules can be ground to sizes below 100 nanometers, small enough to potentially be added to previously prepared membranes. In

this presentation, preparation methods for a variety of nano-sized particles will be presented. This membrane preparation technique opens the door for the transition to commercial scale synthesis of imprinted membranes.

Synthesis of Trehalose Glycolipids and Evaluation of their Binding to Trehalose Dimycolate Hydrolase from Mycobacterium Tuberculosis

Presenter: Casey Papson

Faculty supervisor: Ben Swarts

There are significant challenges with the diagnosis and treatment of tuberculosis (TB) due to the cell wall makeup of the causative agent, Mycobacterium tuberculosis (Mtb). Much of the virulence and difficulty of treating Mtb is attributed to the protection and adaptability of the outer membrane layer of the cell wall. This mycobacterial outer membrane, referred to as the "mycomembrane," is rich in a cell surface-exposed glycolipid called trehalose dimycolate (TDM), which consists of a trehalose sugar core modified by long hydrophobic mycolic fatty acid chains. TDM is essential for Mtb survival and virulence, and it is unique to Mtb and other mycobacterial species, making it an attractive target for diagnostic and drug development. TDM hydrolase (Tdmh) is an enzyme involved in the breakdown of the mycomembrane under certain conditions. Currently, it is known that Tdmh breaks down TDM to release a free mycolic acid, however, there are knowledge gaps with regards to the precise substrate preference and physiological importance of Tdmh. Due to this, we synthesized several trehalose glycolipids and measured their binding affinities with a catalytically inactive Tdmh mutant utilizing biolayer interferometry. The results from this study may have implications for understanding mycomembrane construction and maintenance, and could provide insights for the development of novel reagents to detect mycobacterial surface components.

The Effect of Course-Based Undergraduate Research Experiences on General Chemistry Students

Presenter: Jordan Kobielus

Faculty supervisor: Janice Tomasik

Traditionally, undergraduate students enrolled in a chemistry laboratory course perform experiments in which the result is known prior to the procedure (Corwin et al., 2015). Course-based undergraduate research experiences (CUREs) bring research into the undergraduate laboratory, showing students who may not be involved in research what the process is like. Undergraduate research is an important experience for developing scientists, as the benefits of participation include exposure to scientific literature, learning and applying scientific concepts in-depth, and gaining skills with respect to various laboratory procedures (Lopatto, 2003). In the Department of Chemistry and Biochemistry at Central Michigan University, CUREs are commonly implemented in the honors section of General Chemistry II (CHM 132H), with past CUREs including experiences in organic chemistry and biochemistry. The students are surveyed after completing each CURE to provide information about their experience, including how the CURE affected their interest in research, their understanding of the scientific method, their understanding of lab-specific techniques, and

their cognitive gains. This poster will display the most up to date results from CUREs implemented into CHM 132H.

A Real-Time Fish Detection System for Partially Dewatered Fish to Support Selective Fish Passage

Presenter: Jonathan Gregory

Faculty supervisor: Jesse Eickholt

Machine learning-assisted fish surveillance and fishery management is becoming increasingly possible with improvements in deep machine learning technologies. This case study showcases a novel system for real-time fish detection and classification for partially dewatered fish passing through a deployed Archimedes Screw Fish Lift. Specifically, this system uses a lightweight object detection model trained on a custom dataset of partially dewatered fish to rapidly collect data on fish passing through a lift's video chamber. This case study also includes experiments with fish classification, which could be used in a deployed fish sorting system that enables fine-tuned control over a selective passage mechanism. Only commodity hardware and open-source software were used to build this system, enabling fishery managers to employ AI in their fish surveillance and data gathering tasks. This research provides a proof-of-concept for the potential of autonomous, optical fish sorting in a deployed, edge setting, advancing the goal of AI-assisted selective fish passage.

Computer Science

Autonomous Cyberattack with Security-Augmented Generative Artificial Intelligence

Presenter: Jonathan Gregory

Faculty supervisor: Qi Liao

Artificial intelligence and machine learning are rapidly transforming the state of cybersecurity today. Tasks that used to require highly qualified candidates with years of research and experience can now be accomplished by individuals with less experience whose knowledge is augmented by an AI assistant. In particular, large language models can now assist cybersecurity professionals with ethical hacking and penetration testing, tasks that have a high barrier to entry. This research investigates the use of a large language model augmented with security data to assist with automated penetration testing. Specifically, a locally hosted Mistral 7B model augmented with Low-Rank Adaptation and Retrieval-Augmented Generation was used to help improve offline penetration testing. This model succeeded in executing a privilege escalation attack on a Linux host, suggesting that LLM-assisted penetration testing is possible even with ordinary personal computers. These results show a path for future research in autonomous penetration testing and advance efforts to democratize research in cybersecurity.

Learner Experience Tracking and Analytics in Blackboard

Presenter: Andrew Burton

Faculty supervisor: Patrick Seeling

The Sharable Content Object Reference Module (SCORM) standard provides fine-grained tracking of learner experiences for the purpose of recommendations to learners. The Experience API (xAPI) Institute of Electrical and Electronics Engineers (IEEE) standard provides a broader ability to track actionable learning experiences in real time to analyze and recommend improvements to learners via an informative dashboard. This project utilized an implementation of a Learning Record Store (LRS) to store student learning activities through a client program imported into blackboard. A Demo xAPI compliant LRS was adapted from Yet Analytics, a United States based company who developed this open source, as an easy starting point for storing xAPI statements. A demo client was adapted from a SCORM tracking module to post xAPI statements for the purpose of beginning to track data from blackboard. This system provides a starting basis for data analysis of student performance using the xAPI system and can be introduced into a course in the future for this purpose.

Earth & Atmospheric Sciences

Metal and Trace Element Analysis of Lake Superior Sediments Near Isle Royale, Michigan

Presenter: Carmine Sabatini

Faculty supervisors: Anthony Chappaz, Wiline Pangle

The Great Lakes comprise the largest freshwater watershed on Earth with about 21% of the world's surface freshwater. Because Lake Superior is the largest and impacts the largest population, maintaining its quality is imperative. The region's long history of copper and iron mining makes mining-related metals a particular concern. Because of Isle Royale, Michigan's minimal mining and industrial activities, it is a prime location for investigating the lake's water quality over time. In this study, we collected a 30-cm sediment core off the west coast of the island and used inductively coupled plasma mass spectrometry (ICP-MS) to determine the enrichment factor of mining-related elements in the sediments. We found enrichment of elements like Cu, Fe, Mn, As, and Sb, which suggest that the offshore sediments have become more enriched with mining-related metals since the mid-1800s. Abandoned mines in the Thunder Bay region north of the island may be the source of these metals. While mining is a likely source, other non-mining industrial activities, natural weathering and erosion of enriched parent rock, and diagenesis of deeper sediments releasing metals that enriched the shallower sediments could be potential sources as well. We recommend that future studies collect more sediment cores between the mines and the island and perform an isotope analysis to provide insight into the potential role of diagenesis and redox reactions.

How are Michigan communities preparing for their climate future? Outcomes of a Document Analysis of Municipal and County Plans for Climate Change, Risks, and Priorities

Presenter: Chloe Majeske-Neal

Faculty supervisors: Wendy Robertson, Daria Kluver, John Allen, Rod Lammers, Amanda Suchy

As the effects of climate change become more prevalent in our day-to-day lives, so too does the reality that not everyone is prepared for its impacts. While regional climate impact assessments for the upper Midwestern U.S. highlight the risks and vulnerabilities that communities may face including but not limited to more annual precipitation, more frequent heavy precipitation events, and an increase in average temperature, the information is not always incorporated into community planning documents. This represents a potentially critical gap between vulnerability and awareness; these documents (such as Master Plans, Self-Assessments, and Zoning Codes) guide how communities plan for infrastructure and investments on a multi-year time frame, and in Michigan, there has not been a published systematic analysis of how communities are recognizing and addressing their vulnerabilities across the state. This study explores relationships between community demographics and their recognition of and plans for climate change, as reflected in their planning documents. We conducted a search for documents from all counties, cities, villages, and charter townships in MI and recorded the type of document (e.g., Master Plan, Zoning Code), date of publication, and whether it was in draft or final form. If the document was published or updated between 2015 and June 2024, we used it in our analysis of content and themes.

Geochemical Dispersion Halos of Lithium Pegmatites as a Potential Exploration Tool: A Comparison Study in Florence County, Northeastern Wisconsin, USA

Presenter: Joy Youngblood

Faculty supervisor: Mona Sirvescu

The demand for lithium (Li) is expected to increase over the next decade for use in electric vehicle batteries. Exploration for new Li deposits is critical to keep up with the demand for cleaner energy storage methods. But this exploration can be laborious and sometimes destructive to the natural environment around as many of these deposits are in heavily forested and secluded locations. In this study, we focus on quantifying the dispersion halo of Li and other associated elements from the Price Lake East (PE) and King's X2 (KX2) pegmatites into surrounding host rocks as a less invasive method of exploration. These intrusions are emplaced in metamorphic rocks of Proterozoic age in Florence County, Northern Wisconsin. KX2 is documented to be internally zoned and bear spodumene, the main ore mineral of Li. The newly discovered PE is not zoned and does not appear to contain spodumene in outcrop or hand sample. However, amblygonite-montebrasite, a rare accessory Li phosphate, was discovered from PE in the lab. This suggests PE may be mineralized and contain minerals of economic interest. With the use of optical and scanning electron microscopies and bulk rock geochemistry, we aim to document the mineralogy of PE and its host rock, measure the extent of the dispersion halos, and compare these

dispersion halos around KX2 and PE to assess the use of host rock geochemistry in Li exploration.

Geomechanical Characterization of the Cambrian Caprock Formations for Carbon Storage in the Michigan Basin

Presenter: Aidan Burns

Faculty supervisor: Natalia Zakharova

Carbon Capture, Utilization and Storage (CCUS) is a promising approach used to combat climate change. A key target for geological storage in the Michigan Basin is the Cambrian Mount Simon Sandstone, which has an estimated storage capacity between 26 and 109 billion metric tons of CO_2 (Leetaru et al, 2009). Immediately overlying the Mt. Simon are the Eau Claire, Dresbach, Franconia, and Trempealeau Formations, which have been considered the confining unit for the Mt Simon Formation, but their sealing capacity, mechanical stability, and spatial heterogeneity remain unknown. This project is funded by the U.S. Department of Energy under DE-FE0032368 and focuses on geomechanical properties and heterogeneity of the Cambrian caprocks in the Michigan basin. To capture geomechanical variability we utilize the new-generation instrumented scratch test that allows continuous core strength to be measured without significantly damaging the core. The strength data are then correlated to lithological and petrophysical data from the same core intervals. Preliminary data indicate significant strength variability, with much lower strength in the pink sandstone intervals than in the green-grey intervals with dolomitic cement. However, the direct strength correlation between wells is complicated by significant intraformational heterogeneity. The results of this work show the importance of detailed caprock characterization that captures heterogeneity and variability of caprock properties for CCUS.

Data-centric Species Distribution Modeling of Invasive European frog-bit (Hydrocharis morsus-ranae L.)

Presenter: Sara Hansen

Faculty supervisor: Anna Monfils

Twenty-first century ecologists have an extensive suite of analyses and data types available to answer complex questions about endangered species decline, potential consequences of climate change across ecosystems, and the progression of biological invasions. Decisions in data selection and processing could create significant downstream consequences; however, many of these decisions are hidden in modeling algorithms or not reported in literature, potentially hindering reproducibility and biological interpretations. Species distribution models (SDMs), which bridge multiple data types to model relationships between species and their environments, provide an interesting example of the interaction of data complexity with model results. We selected several points throughout the SDM process to investigate their influence on model performance, outcomes, and interpretation using invasive European frog-bit (Hydrocharis morsus-ranae L.) in North America as a case study. Concerns about the impacts of European frog-bit on native ecosystems catalyzed targeted monitoring efforts across the invasive range, which have produced heterogenous occurrence data that are well-suited to the questions addressed. Our data-centric analysis pipeline integrated data discovery throughout the modeling process to identify and account for the effects of

input data features on model outcomes, which ultimately impacted our interpretations relative to European frog-bit biology and ecology.

Engineering & Technology

Exploring the Impact of Nanostructures on Specific Heat Capacity of Molten Salt Nano Fluid through MD Simulation

Presenter: Qutaiba Altwarah

Co-presenter: Christopher Prince

Faculty supervisor: Donghyun Shin

The addition of nanoparticles to molten salts has attracted attention for its potential to enhance specific heat capacity, thereby improving thermal energy storage efficiency. While earlier research focused on nanoparticle dispersion, recent studies indicate that nanostructure formation on nanoparticle surfaces, observed via transmission electron microscopy, has a significant role in specific heat capacity enhancement. In this study, molecular dynamics simulations were used to examine the effects of adding Al_2O_3, MgO, and CuO nanoparticles into a eutectic mixture of Li_2CO_3-K_2CO_3 (62:38 mol%). The results indicated no significant enhancement obtained. However, the presence of lithium-rich solid nanostructures around the nanoparticle within the molten salt resulted in an 18-25% increase in specific heat capacity. These results emphasize that nanostructure formation, particularly dendritic growth on nanoparticle surfaces, is a key factor in enhancing the thermal properties of molten salt nanofluids.

Geography & Environmental Studies

Mapping the 2008 Russo-Georgian War

Presenter: Calvin Older

Faculty supervisor: Benjamin Heumann

The purpose of my map was to create an accessible and comprehensive story of the 2008 August War between Georgia and Russia. My target audience was the average non-expert person who may not have as much knowledge of the history beforehand. Therefore, my map should be able to deliver them the context as well as display the significance of this historical moment as well as detail exactly what happened. This project showcases the different techniques used to deliver geographical and historical information on the same medium by combining both geographical data as well as historical records to display what happened in the 2008 Russo-Georgian conflict. This project will also showcase the techniques and skills that I learned while taking Dr. Heumann's Cartography class."

Top MLB Teams and their Minor League Affiliates

Presenter: Brady Whalen

Faculty supervisor: Benjamin Heumann

This map was my final project in my Advanced Cartography course. The purpose behind it is to look for and recognize patterns in the spatial distribution of last season's top MLB teams' Minor League affiliates. The Minor League system is incredibly fascinating. Despite fans' knowledge of the Major League teams, many have little idea about their favorite team's farm system, despite several of each team's top players typically playing for these clubs at some point in their careers. The map highlights diversity in different teams' Minor League networks, with some keeping all four teams close, while others seemingly pick cities as far as possible from their base of operations. However, different distributions of these Minor League networks seem to work, as evidenced by the success of all four MLB teams on the map despite the stark differences in Minor League team distribution between them. The goal is to not only educate, but to also publicize a lesser discussed aspect of America's Pastime.

Mathematics

On the Number of Labeled Graphs on n Vertices with a k-clique

Presenter: Devon Peters

Faculty supervisors: Yeon Hyang Kim, Sivaram Narayan, Dmitry Zakharov

We consider what happens when using the inclusion-exclusion principle to find an expression for the number of graphs on n labeled vertices with a k-clique, $k \geq 3$. By enumerating the labeled cliques and the sets of graphs with a given clique, we can represent the quantity in question as a union, so we can rewrite it using the inclusion-exclusion principle. We look to various methods to condense and simplify each sum in the subsequent expansion, such as regarding unions of cliques as 2-sections of k−uniform hypergraphs and using hypergraph isomorphism classes, as well as using an equivalence relation on vertices to distinguish isomorphism classes in a way that allows us to rewrite sums numerically."

Making Math Relevant

Presenter: Gavin Salgat

Faculty supervisor: Douglas Lapp

Throughout both my personal and professional education career, I have experienced the frustration of connecting what is being taught in the classroom to what is personally important outside of the educational setting. This project will consider the research behind creating and maintaining student interest in the secondary mathematics classroom. Subsequently, the research will be applied to project-based unit plans that inspire student inquiry throughout the project as a whole. This project is dually important: to the professional field as I expect the research to show project-based learning to be extremely influential on student engagement and desire to learn and personally it will further direct and develop my teaching style to reflect what research shows as beneficial. The project will include an analysis of research, notated correspondence with established project-based learning organizations, three project-based unit plans to include fifteen lesson plans, and an analysis of the relevance and rationale of each of the units.

Secondary Preservice Teachers' Mathematical Problem Solving Knowledge For Teaching

Presenter: Brooklynn Willett

Faculty supervisor: Christine Phelps-Gregory

Problem solving skills alone are not sufficient for those who teach mathematics to be effective at fostering problem solving skills in their students. Rather, teachers also need to possess a wealth of Mathematical Problem Solving Knowledge for Teaching (MPSKT). Little research has been done to holistically investigate MPSKT on secondary pre-service mathematics teachers (PST). In this study, I investigated four secondary PSTs who had recently completed a geometry methods course. Each PST took part in a task-based interview which assessed their problem solving proficiency as they solved geometry problems and a second interview that assessed their MPSKT. I qualitatively developed cases for each PST, looking for trends across these cases. These data suggest there may be some influence between certain components of their MPSKT and their problem solving proficiency. Results have implications for any instructors with secondary PSTs in their classes as well as for the body of research on MPSKT."

Mapping Epidemic Spread with Transportation-Based SEIR Models

Presenter: Zachary Henderson

Faculty supervisor: Leela Rakesh

Since its onset in 2019, the COVID-19 pandemic has had a profound and lasting impact on the landscape of the world. During the pandemic, many hospitals became overwhelmed, highlighting the need for predictive models to help alleviate pressure on the healthcare system. In response, many variations of compartmental models have been deployed to predict COVID-19 trends, reflecting different aspects of the disease. These models partition a population into disease categories and capture the interactions between them. For instance, the SEIR model contains four categories, Susceptible, Exposed, Infectious, and Recovered, with a system of ordinary differential equations dictating how individuals move between categories. To incorporate spatial dynamics into these predictions, we develop a network-based model by linking together SEIR models across multiple locations. The system of equations is derived and converted to matrix form, with added terms to account for the effects of transportation. Using parameters from the COVID-19 literature, the model is calibrated and optimized to reflect the trends in United States COVID-19 data. The resulting outputs, in the form of choropleth maps and time series, provide insights into the spatial and temporal spread of infectious diseases across the United States.

Modeling Melting in Glasses using PDEs

Presenter: Koksal Karakus

Faculty supervisor: Leela Rakesh

When a conventional glass is heated above its glass transition temperature, its relaxation time decreases significantly. However, this transition does not always occur uniformly due to thermal gradients and local structural variations, resulting in spatial differences in relaxation

behavior. In contrast, ultrastable glasses, produced via vapor deposition, exhibit a different mechanism: a mobility front emerges at the free surface and propagates inward at a constant velocity. This velocity appears to be influenced by both the glass's thermal stability and the annealing temperature. To model this phenomenon in both conventional and ultrastable glasses, we formulate it as a solution to a nonlinear partial differential equation that minimizes the system's free energy functional. Specifically, we begin with the Allen-Cahn equation, which admits an exact traveling wave solution, and from this, we derive a potential function following the SL-TS2 model framework. We then, attempt to match the coefficients of the potential function with system parameters by running computer simulations.

Neuroscience

Photobiomodulation Therapy Optimization for Enhancing Motor Recovery After Spinal Cord Injury: Preclinical Insights

Presenter: Negin Mojarradlangroudi

Faculty supervisors: Gary Dunbar, Julien Rossignol

Spinal cord injury (SCI) can cause temporary or permanent functional impairments, presenting a major challenge in clinical management. Photobiomodulation therapy (PBMT) has emerged as a promising treatment due to its potential to promote axonal regeneration and reduce inflammation. However, standardized protocols for its application in SCI remain undefined. This study investigates daily PBMT's efficacy through three experiments in different timelines. First, we compared two-week PBMT, one-week PBMT, and methylprednisolone sodium succinate (MPSS) in male Wistar rats with moderate SCI. Two-week PBMT was as effective as MPSS in improving motor recovery and reducing inflammation, without causing weight loss or mortality, suggesting long-term PBMT as a preferable option due to fewer side effects. Building on these findings, the second experiment extended PBMT to two and four weeks, revealing superior outcomes with the longer duration, particularly in neuropathic pain reduction and motor function recovery. Finally, a third study evaluated a seven-week PBMT regimen in male and female Wistar rats with severe SCI. Daily PBMT significantly enhanced motor recovery compared to untreated groups, underscoring the therapeutic potential of prolonged treatment. In conclusion, our studies emphasize the significance of extended PBMT durations in enhancing motor function recovery post-SCI and underscore the need for further research to establish standardized treatment protocols.

An Evaluation of the Impact of Polyethylene Glycol 600 Treatment on Hind-Limb Motor Recovery in Rats with Compression Spinal Cord Injury

Presenter: Brynn Stewart

Faculty supervisor: Gary Dunbar

Spinal cord injury (SCI) results in either temporary or permanent neurological impairments, affecting sensory, motor, and urinary functions, along with sexual dysfunction. Polyethylene glycol (PEG) is a biocompatible synthetic polymer known for its membrane-fusion properties, which can aid in nerve fiber regeneration and help reduce glial scar formation. This study aimed to enhance the recovery of hind-limb motor function in male Wistar rats by

administering PEG-600 at the injury site following a compression injury at the thoracic 9 (T9) level of the spinal cord. In the PEG group, 10 microliters of PEG-600 and in the Vehicle group, 10 microliters of saline were applied directly to the spinal cord immediately after the SCI. Additionally, AAV8 viruses were bilaterally injected into the primary motor cortex to trace the corticospinal tract. Motor function recovery was assessed using the open-field BBB locomotor rating scale and a horizontal-ladder test. Results demonstrated significant improvements in motor function recovery in the PEG group ($p<0.001$) compared to the Vehicle group. However, no significant difference was observed between the Vehicle and PEG groups in the horizontal ladder test. In conclusion, PEG-600 administration significantly enhanced motor function recovery, suggesting that PEG-600 may play a key role in promoting recovery after SCI. Combining PEG with other promising therapies could potentially enhance its effectiveness in improving motor function.

Treatment Effects using Liraglutide on STZ-treated Aged C57 Mice

Presenter: Grace Tavi

Faculty supervisors: Gary Dunbar, Julien Rossignol

Recent studies have shown the anti-diabetic drug, liraglutide (LIR), can reduce deficits in rodent models of Alzheimer's disease (AD) and age-related cognitive decline. The present study aimed to see if LIR treatments could reduce deficits in aged C57 mice that were given intracerebroventricular injections of the potent toxin, streptozotocin (STZ), which is used to model sporadic AD. STZ is a toxin derived from the bacteria Streptomyces achromogenes that can produce vascular dysfunction and insulin resistance within mammalian models. In our study, aged (17-19-month-old) C57 mice received either bilateral intracerebroventricular injections of STZ or citrate buffer solution (CBS) vehicle and were subsequently treated with either LIR or Hank's buffered saline solution, intraperitoneally, once a day for 36 days. Mice were evaluated on three behavioral tests: passive avoidance, open-field, and novel object recognition tasks. Following behavior assessments, various organs, including the brain, pancreas, heart, spleen, liver, and kidneys were extracted, weighed, and processed for Western blot analyses to assess inflammatory markers, including TNF-alpha, SOD-1, and IL-6. Our findings suggest that LIR had only modest effects on the behavioral performance of the mice, which correlated with the changes observed in subsequent biochemical analyses. These results suggest that earlier interventions with LIR treatment might be needed to optimize its therapeutic effects.

Effect of Photobiomodulation Therapy on Locomotor Recovery in Female Wistar Rats Following Compression Spinal Cord Injury

Presenter: Savannah Wright

Co-presenter: Negin Mojarad

Faculty supervisor: Gary Dunbar, Julien Rossignol

Spinal cord injury (SCI) is a life-changing disability, and despite surgical intervention and medicinal strategies, neurological function recovery following SCI remains inconsistent. In recent years, photobiomodulation therapy (PBMT) has demonstrated to be a promising route for potential treatment due to its multimodal approach to SCI. PBMT has demonstrated anti-

inflammatory properties, promoted tissue repair and axonal regeneration, and provided analgesic effects, with recent studies suggesting that long-term administration enhances its efficacy in addressing neuropathic pain, motor deficits, and bladder dysfunction. For this study, we utilized a compression SCI in rat models–this type of injury is the most common mechanism of SCI in humans. Using four female Wistar rats as the control group (SCI only) and four female Wistar rats as the treatment group (SCI and PBMT), we were able to compare motor function recovery of the lower limbs over a 7-week duration. We evaluated motor function by performing weekly BBB and horizontal ladder tests. Data analysis showed the PBMT group demonstrated significant hind-limb motor function recovery over the 7-week period, which highlights the potential of long-term administration of this therapy alongside other treatments. Our ongoing studies aim to compare PBMT in both male and female rats, as well as combination therapies which include induced pluripotent stem cell (iPSC) transplantation and polyethylene glycol (PEG) injection.

Assessing Synaptic Connections with Interluminescence using TRAP2 Mice

Presenter: Elaheh Bell

Co-presenter: Alexander Silvagnoli

Faculty supervisor: Ute Hochgeschwender

We introduce interluminescence, a novel strategy for selective synaptic modulation. This approach leverages bioluminescent light from a presynaptic axon terminal, generated by luciferase, to activate an opsin in its postsynaptic target under controlled introduction of luciferin. We developed two methods to target luciferase to the synaptic cleft, each with unique features. The 'Persist-Int' strategy tethers luciferase to the presynaptic terminal with an opsin on the postsynaptic membrane, enabling sustained and activity-independent modulation. In contrast, 'Act-Int' releases luciferase into the cleft in response to presynaptic activity, providing activity-dependent modulation. Building on prior in vivo Act-Int findings (Prakash et al., 2022), we tested Persist-Int in vivo using high-throughput methods that bypass in vivo electrophysiology. We fused mNeonGreen-SSLuc to a neurexin-anchored CD4 domain (Nrxn3b) for the presynaptic emitter and used the light-sensitive ChR2(C128S) opsin for postsynaptic modulation. AAV2/9 constructs were injected into the lateral hypothalamus and locus coeruleus of TRAP2::lox-stop-lox-EYFP mice. Tamoxifen administration, followed by luciferin or vehicle injection, confirmed activation of opsin-expressing neurons via EYFP fluorescence. These results demonstrate robust Persist-Int effects, offering a straightforward approach for probing synaptic connections across the brain.

Exploring the Cognitive and Neurobiological Effects of Long-Term Δ9-THC Use in an Aged Mouse Model

Presenter: Layla Castro

Faculty supervisor: Yannick Marchalant

With increasing global cannabis legalization, both for medicinal and recreational purposes, there is a growing need for research into the effects of cannabis on the brain, particularly in aging populations. Δ9-tetrahydrocannabinol (Δ9-THC), the primary psychoactive compound in cannabis, interacts with the brain's endocannabinoid system, which plays a critical role in

neuroplasticity, memory, and cognitive function. However, the long-term neurological consequences of chronic cannabis use, especially in aging individuals, are poorly understood. This research will investigate how prolonged exposure to Δ9-THC affects hippocampal function, a brain region vital to memory and learning. Using an aged mouse model, we will simulate chronic cannabis use by administering vaporized Δ9-THC for twelve weeks. We will then assess cognitive performance, neurogenesis, and neuroinflammation within the hippocampus. We hypothesize that chronic Δ9-THC use will improve age-related hippocampal functions, offering insights into the potential therapeutic applications of cannabinoids in mitigating cognitive decline and neurodegenerative diseases.

Bioluminescent Kinase Sensors for Detection of Growth Factor and Inflammation Signaling

Presenter: Michael Chatterton

Faculty supervisor: Eric Petersen

Growth factor signaling is an important component of a large variety of cellular processes including metabolism, differentiation, proliferation, and migration. When growth factor signaling is altered it can lead to pathologies like cancer cells forming and proliferating within the body such as glioblastoma multiforme (GB). In this study, we focus on investigating and proposing novel therapeutic approaches utilizing genetically encoded Bioluminescent Kinase Sensors (BlinKS) to respond to growth factor signaling via kinases in the epidermal growth factor receptor (EGFR) signaling pathway. Specifically, this study is targeting the kinases within the MEK, RAS, and RAF signaling pathways. We developed a rational library of BlinKS variants with altered phospho-amino acid binding domains (PAABD) as well as varying kinase substrate peptides and permutations of the linker regions, either flexible or rigid at the interfaces of the protein fusion sites. We tested our BlinKS constructs in U87 glioblastoma cells expressing our candidate sensor variants, treated the cells with epidermal growth factor (EGF) and measured the response of the BlinKS sensors for light emitted by the sensor and by measuring an optogenetic transcriptional readout via a fluorescent reporter protein. Bioluminescence readings were conducted on a plate reader, and it was found that the cells treated with EGF produced more luminescence than those not treated with EGF. We also found our sensors targeting this signaling.

Development of a Bioluminescent Glucose Sensor for Blood Glucose Monitoring

Presenter: Brevin St. Onge

Faculty supervisor: Eric Petersen

The research aims to design Bioluminescent indicators of glucose sensors (BLINGs). This will produce biological light proportional to the amount of glucose uptake. The bioluminescent sensor was constructed with a split luciferase enzyme that has an N and C terminal, once in the presence of light it will bind together causing the sensor to be complete and whole. We looked to see how much light was emitted depending on the N terminal and C terminal of the luciferase-based sensor. Once this was found, it could be determined if the sensors act as a viable reporter for glucose levels concerning its created bioluminescence.

With insulin resistance and type 2 diabetes being leading factors in increased risk for Alzheimer's disease, cardiovascular disease, and dementia, it becomes important to study the effects of glucose uptake intracellularly in response to insulin resistance. Two questions were addressed in this project: (1) when the glutamate-binding domain is swapped with a glucose-binding protein, will it cause the N terminus of the split peptide ek9h luciferase to come closer to the C terminus of the luciferase pep 114, or cause it to move farther away? (2) Will adding the glucose-binding protein create enough light in response to high glucose levels for bioluminescent imaging of glucose levels? The implication of the light emitted from the bioluminescent glucose sensor would be that bioluminescent imaging could be used to determine pathological glucose levels.

Evaluating the Antineoplastic Effect of Delivering FOXM1-targeting siRNA Molecules via G4-70/30 PAMAM Dendrimer Nanomolecules on Human Glioblastoma Cells in vitro

Presenter: Claire Noe

Faculty supervisors: Julien Rossignol, Gary Dunbar

Glioblastoma (GB) is the most common and aggressive form of central nervous system tumor, with a median survival rate of 12-15 months post-diagnosis. There has never been a cured case reported, thus stressing the need for new GB treatments. One potential novel GB treatment involves the use of small interfering RNA (siRNA) gene therapy. SiRNA molecules prevent the translation of mRNA to protein, thereby silencing the target gene. We aimed to target the FOXM1 gene, which is overexpressed in human tumor cells and plays a crucial role in cell growth and cell cycle dysregulation. We complexed the siRNA molecules with Generation 4-70/30 Polyamidoamine (G4-70/30 PAMAM) dendrimer nanomolecules to combat the poor bioavailability and stability of siRNA treatment alone. We found that treatment with FOXM1-targeting siRNA molecules delivered by the positive control transfection reagent Lipofectamine RNAiMAX successfully conferred FOXM1 knockdown. This led to a reduction in FoxM1 protein expression and an increase in P21 and P53 tumor suppressor protein expression. Cell proliferation of U87 human glioblastoma cells was also reduced. Treatment with FOXM1-targeting siRNA molecules delivered by G4-70/30 PAMAM dendrimer nanomolecules was less effective, but results trended toward those produced by Lipofectamine RNAiMAX delivery. This indicates that with further optimization, FOXM1-targeting siRNA delivered by G4-70/30 PAMAM dendrimer nanomolecules may be a promising novel treatment for GB.

Targeted Delivery of Curcumin via G4 PAMAM Dendrimers in GFAP-IL6 Mouse Model of Chronic Neuroinflammation

Presenter: Sara Schwind

Co-presenters: Arjun Poudel, Bhairavi Srinageshwar, Jared Swiontek, Johnny Evers Smith, Anusha Uprety, Olivia Smith

Faculty supervisors: Julien Rossignol, Gary Dunbar, Douglas Swanson

Neuroinflammation is an innate immune response involving recruitment of activated microglia and astrocytes in response to cytokines at neural tissue injury sites. Chronic

neuroinflammation worsens cognitive decline in neurodegenerative disorders like Alzheimer's, Huntington's, and Parkinson's by overcrowding neurons and accelerating cell death. GFAP-IL6 mice, a model of chronic neuroinflammation, overexpress the pro-inflammatory cytokine IL-6 gene in astrocytes, leading to increased microglia and astrocyte activation in the hippocampus and cerebellum. Curcumin, a natural cytokine suppressive anti-inflammatory from turmeric, targets pro-inflammatory pathways but has low solubility and bioavailability. This study analyzed curcumin's effect on neuroinflammation in GFAP-IL6 mice. To enhance efficacy, generation 4 (G4) 70/30-cystamine core PAMAM dendrimer-encapsulated curcumin (D-Curc) was administered via intracranial injection. Motor function was assessed using the accelerated rotarod test, and GFAP/IL-6 expression was confirmed via Western blot. Significant genotype effects were seen in accelerod ($p<0.001$), GFAP expression in hippocampus ($p=0.005$) and cerebellum ($p<0.001$), and IL-6 expression in hippocampus ($p=0.021$) and cerebellum ($p<0.001$). D-Curc showed a trend toward reduced GFAP expression in the hippocampus and intermediate effect on motor function. Our results support dendrimers' drug delivery potential and suggest curcumin may help reduce neuroinflammation.

Investigating Expression and Activation of Transcription Factor CREB in the Context of GluN2B Haploinsufficiency

Presenter: Morgan Mussehl

Faculty supervisor: Shasta Sabo

GRIN2B disease is a gene mutation encoding GluN2B proteins associated with autism spectrum disorder (ASD). Symptoms of this disease are intellectual disability, seizures, muscle tone abnormalities, and many other behavioral and physical conditions. It is unknown how the mutations are related to the symptoms. GluN2B is a protein that induces synaptic plasticity and activates a transcription factor, cAMP-response element binding protein (CREB) involved in plasticity. The goal of this study is to investigate the impact of GluN2B haploinsufficiency on the expression and activation of CREB. Western blot analysis will be performed on brain tissue samples from rats aged P18-P24. The hypothesis of this study is that wild type rats will have increased expression and activation of pCREB and CREB whereas GluN2B heterozygous knockout rats will have decreased expression and activation of pCREB and CREB.

Spatiotemporal Analysis of Wnt Protein Expression in the Developing Cortex

Presenter: Madelyn Offer

Faculty supervisor: Shasta Sabo

Wnts are secreted glycoproteins critical for cell differentiation, migration, and synaptogenesis. Disruptions in Wnt signaling are associated with neurodevelopmental disorders such as Autism Spectrum Disorder. Expression of Wnts 2 and 5a/b is regulated by NMDA activity. NMDA signaling is critical for memory consolidation and dendritic patterning, and NMDA dysfunction is associated with neurodevelopmental disorders. This project focuses on patterns of expression and localization of Wnts 2 and 5a/b during dendrite development. Samples from three brain areas in rat brain were collected at three ages and examined using Western Blot to determine the spatiotemporal patterns of expression of

Wnts 2 and 5a/b. Although no differences in expression by brain area were found for either Wnt, both Wnt 2 and 5a/b were found to have significant increases in expression from P4 to P17. Neurons were also cultured and subjected to immunocytochemistry to determine the subcellular localization of Wnt 2 and 5a. Wnt 2 was found in early dendritic spines, while Wnt 5a appeared throughout neurons, including axons. Analysis of synaptoneurosomes (SNs) - isolated, functional synapses - showed that Wnts 2 and 5a/b were found at synapses but were not enriched. Characterization of these patterns of expression are foundational to understanding how Wnt signaling affects dendritic development and how disruptions in this signaling may lead to neurodevelopmental disorders.

Behavioral Restoration and Dopamine Release Recovery from Mesenchymal-Derived Stem Cell Transplants in a Rat Model of Parkinson's Disease

Presenter: Tommie Cammarano

Co-presenters: Maya Paytas, Noah Bond, Carissa Granum, Stefani Galik, Hunter Gerow, Kevin Anderson

Faculty supervisors: Michael Sandstrom, Gary Dunbar

Parkinson's disease (PD) is characterized by progressive nigrostriatal dopaminergic (DA) neuron loss, leading to motor dysfunction. While treatments like Levodopa and deep brain stimulation ameliorate symptoms, they lack integrated host control, limiting efficacy. Enhancing this control could improve therapeutic outcomes. Our lab investigates bone marrow mesenchymal stem cells differentiated into DA-like neurons, incorporating a transgenic construct responsive to optogenetic stimulation via DREADD-generated light (coelenterazine; CTZ). These transplants, stimulated in conjunction with active swimming, show improved integration with host networks and behavioral recovery. Early studies revealed promising short-term results, prompting further exploration of long-term viability. A pilot study indicated variable cell integration, with improvement linked to exercise, suggesting a critical interaction between swimming and transplant efficacy. This work expands on prior findings by incorporating microdialysis to measure transplant-derived DA release in freely moving subjects. Our approach aims to verify that stimulated cells integrate, regulate DA release, and support appropriate motor function. Contrary to skepticism about adult mesenchymal stem cells, our strategy demonstrates sustainable, translational, long-term stabilization of motor function without complications of traditional pharmacological treatments.

Installation to Calibration: Updating the Imaging System for the Brooks Astronomical Observatory

Presenter: Kaylee Allen

Faculty supervisor: Aaron LaCluyzé

The installation of a new camera at the Brooks Astronomical Observatory represents an advancement in both research capability and student learning for Central Michigan University. This project focuses on the establishment and calibration of astrophotography hardware to enhance the telescope's ability to capture high-quality images. This includes the configuration and mounting of a new camera and filter wheel; transitioning from a CCD

camera to a CMOS model to improve sensitivity, efficiency, and imaging performance; synchronizing with the observatory's existing software systems; and updating telescope operation and image-capturing procedures. Further testing in the characterization phase involves assessing the camera's sensitivity, noise levels, and operational parameters to ensure optimal performance for astronomical imaging. This upgrade enhances the observatory's functionality, providing students with hands-on experience in observational astronomy while supporting faculty-led research in various astrophysical studies. Future students and researchers alike will find great benefits in this new system's implementation: improving both data collection and accuracy while fostering an enriched academic and research environment.

Physics

Design and Development of an FT-ICR Analog and Miniature Penning Trap Demo

Presenter: Savannah Limarenko

Faculty supervisor: Matthew Redshaw

Penning traps, which consist of a strong uniform magnetic field, and a quadrupole electric field, have been used since the 1950's to trap charged particles and measure their properties, such as mass. These traps are used to determine key characteristics of particles, which are useful in many fields such as nuclear physics, analytical chemistry, and astrophysics. Penning traps are instrumental in many mass spectrometry experiments, due to their ability for high precision measurements. There are two main techniques used by these traps. The first is destructive measurements, which are commonly used when measuring short-lived isotopes. The second being nondestructive techniques, such as the Fourier Transform Ion Cyclotron Resonance (FT-ICR), used in the measurements of long-lived isotopes. As the ions within the trap undergo cyclotron motion, they induce image charges on the trap electrodes. The FT-ICR technique measures the frequency of ions using a Fourier analysis of these image charges. To easily demonstrate how image charges are created and the power of Fourier analysis, a tabletop Penning trap has been developed for use in future advanced labs. The miniature trap creates ions via electron impact ionization of background gases. In combination with a 0.55T Nd magnet, the ions created will undergo a cyclotron motion creating image charges that are amplified and digitized for future analysis. In addition, an FT-ICR analog has been developed using a microphone and two speakers.

Cataclysmic Variable Stars and Dwarf Novas

Presenter: Kaylie Edgerton

Faculty supervisor: Glen Williams

Cataclysmic variable stars are a specific type of variable star that has a variation in their brightness over a period. This variation is not regulated like a typical variable star. This project is aimed at developing a code to model the outbursts of the binary cataclysmic-dwarf star system. The code will present 2D model of the accretion disc from the white dwarf and allows it to evolve for a given amount of time. The disc is then divided into 300 annuluses, radially outward towards the edge of the disc which allow us to calculate how much gas is

flowing though the disc. The viscosity of the disc continuously heats up the gas and causing the energy to radiate away. Since this energy was released, the disc falls to a low viscosity state, meaning it is now cool again. More gas will pile up in the disc, causing instability, and therefore resulting in returning to the high viscosity state. This is where these outbursts begin. Gas from the disk will flow and be pulled into the atmosphere of the white dwarf, making the disc appear very bright. This is the outburst called a dwarf nova. When enough gas has left the disk, it will have low density, and then return to a low viscosity state. This is a continuous cycle. This project will also be aimed towards figuring out where in the disk these outbursts start. For instance, maybe in the center of the disc and moves radially outwards, or vice versa. Specifically we will be using the system parameters for SS Cygni for out simulations.

Statistics, Actuarial & Data Science

Modeling Adolescents Mental Health, Suicide Risk, and Academic Performance on YRBS 2023 Data

Presenter: Sujith Reddy Ganta

Faculty supervisor: Chin-I Cheng

This study discusses the different behaviors and environmental factors influence mental health, suicidal thoughts, and academic performance among teenagers in the United States. It utilizes the data from 2023 Youth Risk Behavior Survey (YRBS). Specifically, it discusses the feeling of unsafe at school, unfair treatment, sexual assault, parent trouble, alcohol consumption, drug use, and physical activity related to mental health, suicidal thoughts, and academic performance. We use logistic regression, decision tree, random forest, and Naive Bayes classifiers to identify the important predictors of these outcomes to understand the connection between the specified factors. We use logistic regression to find out the chances of having mental issues or suicidal thoughts based on these determinants. Random forest and decision trees are helpful for identifying the interaction among the variables and finding the major decision nodes. Naive Bayes also confirms the results by measuring the probability of mental health issues and academic decline from observed behavior. Given the data's class imbalance, particularly for suicidal ideation, we apply Synthetic Minority Over-sampling Technique (SMOTE) to improve model accuracy for underrepresented outcomes. This study identifies significant factors and aspires to assist in the creation of effective intervention strategies to reduce suicide risk, improve mental well-being, and support academic success in adolescents.

Federal Reserve Rate Cuts and Stock Mutual Fund Returns: A Study on Growth vs. Value Funds and Risk-Adjusted Performance

Presenter: Hairu Fan

Faculty supervisor: Min Shu

This study investigates the effects of Federal Reserve rate cuts on stock mutual fund returns, specifically comparing growth and value funds. This study explores the impact of Federal Reserve rate cuts on the performance of stock mutual funds, with a focus on comparing growth and value funds. Using an event study methodology, the research

examines the abnormal returns (AR) and cumulative abnormal returns (CAR) of these funds over short-term (30-day) and long-term (6-month and 1-year) windows. Additionally, the study evaluates risk-adjusted performance through metrics such as the Sharpe ratio and Jensen's alpha to determine whether rate cuts disproportionately benefit growth funds relative to value funds. To account for market conditions, the VIX index is incorporated as a moderating variable to assess how volatility influences fund responses to monetary policy changes. The study is ongoing, and subsequent findings will clarify the differential responses across fund types and the role of market volatility. This research aims to contribute to the literature by providing new insights into the interaction between monetary policy and mutual fund performance, offering practical implications for both investors and policymakers.

Integrating Technical and Fundamental Analysis with Machine Learning for Stock Price Prediction

Presenter: Nicholas Green

Faculty supervisor: Min Shu

Stock market prediction is a crucial aspect of financial analysis, with investors, stakeholders, and analysts relying on accurate forecasts to make informed decisions. Traditionally, stock price forecasting has been approached using two primary methods: fundamental analysis, which evaluates a company's intrinsic value based on financial statements and economic indicators, and technical analysis, which examines historical price patterns and market trends. While both methods provide valuable insights, integrating them into a hybrid framework may enhance predictive accuracy. This study explores the potential of machine learning techniques to strengthen stock price forecasting by leveraging both time-sensitive financial indicators and broader measures of a company's financial health. Machine learning has significantly advanced stock price forecasting, with prior research demonstrating its effectiveness in predicting stock groups and broader market indices. However, a key question remains: How well do these models generalize to predicting individual stock prices? Additionally, given the variety of machine learning techniques applied in financial modeling, it is important to determine whether a hybrid approach improves accuracy, and which specific models are best suited for individual stock forecasting. This study seeks to address these gaps by evaluating a hybrid fundamental-technical framework and identifying optimal machine learning algorithms for precise stock price prediction.

Exploration and Prediction of Cardiac Arrest

Presenter: Sophia Tali

Faculty supervisor: Min Shu

The goal of my research was to explore variables and data of cardiac arrest to gain more findings and insight about the condition. Within my study, I used a dataset that includes collected medical records of 299 patients who experienced cardiac arrest/heart failure. Firstly, relationships between the variables within the dataset were explored using multiple methods, both supervised and unsupervised, such as logistic regression, principal component analysis (PCA) and forward/backwards selection. Through these methods, the variables that are statistically significant predictors were found and are the variables that

were used within the prediction models. After this was determined, different prediction models were ran to find what models/methods are efficient at correctly predicting cardiac arrest. Decision tree, logistic regression, k-nearest neighbor, and other models were created and explored using training and test data. Their accuracy was calculated and compared. The results of this study highlighted different relationships and significance of variables of cardiac arrest, gave insight on variance in the dataset, and what predictive models are most effective. These findings can benefit doctors and medical professionals and their knowledge on the condition, along with helping the goal of early detection of cardiac arrest within patients.