OFFICE OF
GRADUATE
STUDIES
CENTRAL MICHIGAN UNIVERSITY


# 2026 Student Presentations

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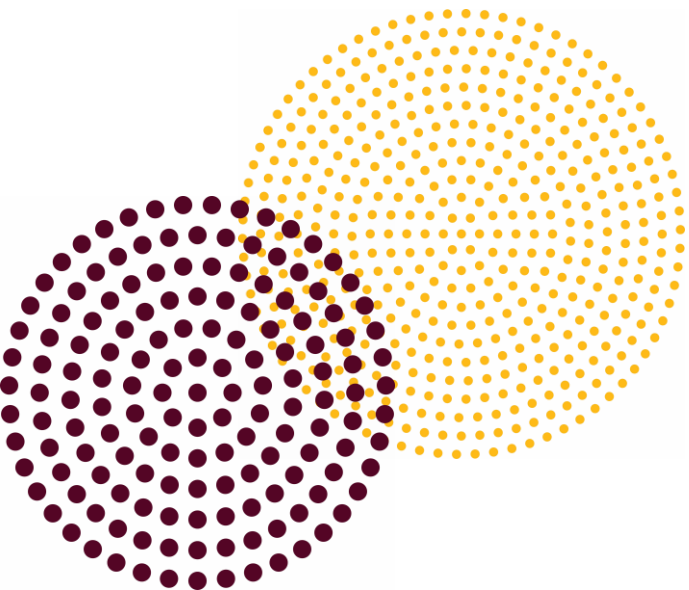

# College of the Arts & Media

## Art & Design

**"4 Goobers & A Bakery"**
Presenter: Jo Moorehead
Co-presenter: Jillian Todd
Faculty supervisor: Rose Brauner
"4 Goobers & A Bakery" is a 2-D hand-drawn animated comedy short film. The story follows four characters (dubbed “the Goobers”) in their efforts to successfully run an eccentric, but popular, bakery in a world full of anthropomorphic animals. The Goobers’ bakery happens to reside next to the town witch’s treehouse, and what starts as a mix-up in their ingredient deliveries soon evolves into a catastrophic, semi-apocalyptic event.
This 3-minute short film welcomes viewers to dive headfirst into the world of the Goobers as it opens the doors of a story about friendship and found family. Though it is self-contained, it stands as a starting point to what will hopefully grow into a larger story in the future.

**Your New Home**
Presenter: Caroline Westfall
Faculty supervisor: Rose Brauner
A mixed media animated short film about a space postal worker, Ximena, and her dog, Solovino, finding a home in an unexpected place… the inside of an Eldritch Being. They must traverse the alien environment they find themselves in, with the Eldritch Being becoming an unlikely ally.

**Intertwined**
Presenter: Emily Billinghurst
Co-presenter: Brayden Johnson
Faculty supervisor: Jeremy Catarino
Intertwined is a 2D animated character-driven short film. At about 4 and a half minutes long, the film portrays themes of friendship, grief, and healing while aiming to be visually interesting. It is being made with hand drawn digital animation, using software such as Adobe Photoshop, Toon Boom Harmony, Adobe After Effects, and Adobe Premier. Inspirations include Dante Alighieri's Inferno and the myth of Orpheus and Eurydice, with more modern influences being Alice in Wonderland, Over the Garden Wall, and Midnight Gospel. The story follows Anika, a musician, as she descends both physically and emotionally. Dealing with the grief of losing her best friend, she walks through memories in the form of museum exhibits. Guided by a firefly who she believes is the spirit of her deceased friend, Anika is eventually forced to confront the reason she stopped playing music. And, at her wits end, the firefly encourages her to play one last time.

**Mended**
Presenter: Megan Blades
Co-presenters: Ava Ciaramitaro, Cady Stalvey
Faculty supervisor: Jeremy Catarino
Mended is a stop motion short film that explores themes of grief, loneliness, and managing emotions while paying homage to traditional animation techniques.

**"Love Detective" 2D Animated Film**
Presenter: Estrella Larissa Moreira Arroyo
Faculty supervisor: Jeremy Catarino
Love Detective is a 2D animated film that aims to create a dramatic story with the help of striking color palettes and imagery. The story focuses on just two characters, the Detective and the Thief, and brings the viewer along on the Detective's journey across the city to catch the Thief, who sees the chase as a game. The chase ends in the death of both characters, and then the reveal that it's all a time loop the main characters are trapped in.
This film is being done with Toon Boom Harmony for the main animation, AfterEffects for video editing, and Photoshop for illustration work, and it is the result of almost a year of work put into both story and design development.
Love Detective means to call back to the Cat and Mouse trope from Saturday morning cartoons like Where in the World is Carmen Sandiego?, where the main character tries to catch the same villain every episode, only for any progress to be restarted by the next episode, very much like a time loop. This film is a combination of many tropes and traditions found in animation and storytelling, and it is meant to be a fresh and more mature interpretation of them and a love letter to the history of animation. This film is meant to represent a relationship, its ups and downs, and how both sides are trapped in a cycle of trying to save each other. It's meant to ask the viewer how far they'd go to save their love, knowing the cycle won't break easily.

**The Sand-Ryder: Souk Fight**
Presenter: Martha Kalumbula
Co-presenters: Diana Malla, Makayla Dixon
Faculty supervisor: Steve Leeper
The Sand-Ryder: Souk Fight is a 2D and 3D animated short film. The backgrounds and sets will be Computer 3D modeled using the computer programs Maya and Blender, and the characters will be digitally hand-drawn animated over the backgrounds using Toon boom Harmony. The story is a futuristic take of an old, spoken word Kilega fairytale my father used to tell me and my siblings growing up. This project is a retelling the story as well as a celebration African traditions and aesthetics. The general plot of the short film: a bounty hunter, Azare, is sent to find a missing woman, Sarai. Azare finds her and finds out that Sarai doesn't want to be returned home. The short film follows the Sarai exploring a city before she is kidnapped by some thugs. The Azare tries to save her, and a fight ensues. As someone born in the Democratic Republic of Congo, my inspiration as the story lead were inspired by African culture, fashion and architecture which we aim to pay homage to with this story. This futuristic tale will show

a more optimistic future for the continent of Africa which is not often portrayed in the media.

**The Coldest City On Earth**
Presenter: Haley Kershaw (ART)
Co-presenter: Michele McGraw
Faculty supervisor: Steve Leeper
The Coldest City on Earth is a four-minute 2D animated short film that acts as the origin story to its future horror video game. The controlling idea of the film is “What if a zombie apocalypse broke out in an extremely cold and isolated city?” From this, themes of fear, dread, helplessness, and morality emerge in the film. Additionally, the film is inspired by the location and culture of Yakutia, Russia, one of the coldest cities on Earth.
The film itself is set in a fictional frigid mining city called Öltal. The plot follows an experienced ER Nurse, Zhanna Morozova, making daily voice recordings documenting her care of her newest patient, Ruslan Agapov, one of three miners who were caught in a cave collapse. His symptoms are similar to those of frostbite; however, he also exhibits odd, crystal-like formations emerging from the skin. As the hospital is working on treatments, the illness begins to spread, the symptoms worsen, and patients turn aggressive. After many attempts to cure Ruslan, he succumbs to his illness, kicking off further panic within the hospital. In a frenzy, dead patients are burned to prevent further spreading, and current patients are transferred to bigger hospitals. At the end of the story, Zhanna has been infected as well, and all hope seems to be lost.

**“The Creation Poem” - Visual Development**
Presenter: Haley Kershaw (ART)
Faculty supervisor: Steve Leeper
"The Creation Poem" film project, directed by Professor Steve Leeper, is an 8-minute 2D animated film based on James Weldon Johnson’s iconic poem, "The Creation." Johnson’s poem calls attention to the beauty of our planet and its connection to humankind. Given this, "The Creation Poem" film aims to showcase the beauty of the poem through visual storytelling and to help viewers develop a deeper appreciation for our beautiful planet.
My role in this project was to focus specifically on the visual development of Act 3 as a color and background artist using Adobe Photoshop. Over the summer of 2025, I created Act 3’s color script, vectorized plant assets, and four fully colored backgrounds. The goal was to create 2D visuals of complex environments, like southern water banks and the Scottish Highlands, using a simplified style inspired by Aaron Douglas’s original illustrations. As a result of this project, I enhanced my visual development skills, strengthened my professional animation portfolio, and amplified the impact of "The Creation Poem" animated film.

**Anybody, Anytime, Anywhere.**
Presenter: Emma Corbett
Faculty supervisor: David Stairs
The goal of this project is to highlight the deception and child sexual exploitation (CSE) or abuse that occurs online. This project is a part of the senior graphic design capstone, “Growing Pains”, which studies how childhood is affected by technology. I studied how online groomers target and deceive their victims online by creating profiles known as “electronic doubles,” which have fake information. I am displaying this concept by using lenticular printing, a printing technology that creates photos with a 3D illusion; the images change when viewed at different angles. To create this illusion, I used foam core boards that I scored in equal increments on alternating sides. Doing this allows them to fold into an accordion-like shape that will create the image-flipping effect. On top of the foam core, I adhered printed images using Photoshop; these prints are a combination of alternating slices of an image. When you see the lenticular prints from straight on, you will see slices of alternating photos that do not appear as a clear image. However, as you view them from either the right or left side, you will see a clear image. The images I used are childhood photos of my classmates to represent younger children who are either victims of CSE or could be fake profiles online, looking trustworthy to children online. The other half of the photos are registered child sex offender mugshots, portraying the perpetrators who are actually behind the profiles and electronic doubles.

## Communication, Journalism & Media

**Producing A New CMU Anthem**
Presenter: Gabriel Schall
Faculty supervisor: Will Anderson
Presenting the results of a summer spent as the recording & mixing engineer for Dr. Will Anderson, an esteemed audio dramatist and songwriter for the prospective CMU anthem “Action C!,” which aims to capture the spirit and positivity within CMU students both old & new.
Audio includes electric guitar, acoustic guitar, bass, and vocals between multiple versions of the radio drama “Maggie,” the CMU song “Action C!,” and various other samples.

**GenAI Music in Music Syncronization and Ethical Practice in Media Industries**
Presenter: Emma Brown
Faculty supervisor: Heather Polinsky
Generative AI music tools are moving rapidly into music synchronization (“sync”) for film, television, and especially advertising, where they promise speed and lower costs but disrupt existing legal and labor structures. This research project examines how GenAI music alters the economics and ethics of sync, and proposes guidelines for agencies, media companies, and rightsholders that align with the marketing theories of service-dominant logic and conscious marketing.

**The Use of Deceptive Affection: An Application of the Relational Turbulence Theory**
Presenter: Emerson Lantz
Faculty supervisor: Kirsten Weber
This thesis investigates deceptive affectionate messages (DAMs), intentional expressions of affection that do not align with felt emotion, through the framework of relational turbulence theory (RTT). Deceptive affection includes both exaggerated displays of affection and the withholding of genuine affection. Although prior research has examined the prevalence and motivations behind DAMs, this study offers a theoretical explanation for when and why individuals employ deceptive affection in romantic relationships. RTT proposes that relational uncertainty and partner interference heighten emotional and cognitive reactivity, producing polarized thinking and turbulent communication patterns. This project theorizes that DAMs function as strategic responses to turbulence, helping individuals manage instability, avoid conflict, and preserve relational harmony. The hypotheses test associations among relational uncertainty, partner interference, biased cognitive appraisals, emotional reactivity, deceptive affection, and relational turbulence. A quantitative survey of romantically involved U.S. adults using validated scales and correlation tests reveals support for all hypotheses and aligns with previous research.

## Music

**John Cage's Music for Amplified Toy Piano (Live Performance)**
Presenter: Daria Batzner
Faculty supervisor: Jay Batzner
A lecture recital performed at the 9th International Conference for Contemporary Piano in Joao Pessoa, Brazil on John Cage's "Music for Amplified Toy Piano" and his frequent collaborations with modern dance choreographer Merce Cunningham.

**Synthesizing Baroque Music in a Modern Era**
Presenter: Magdalene Bauer
Faculty supervisor: Keith Clifton
This project studies the original Moog synthesizer and the influence of Wendy Carlos (the composer of works including Tron, Clockwork Orange, and The Shining) on its creation. Carlos used the classical Baroque repertoire of Johann Sebastian Bach to help people better understand and recognize the instrument's usefulness in the modern era. She created her album Switched on Bach and chose pieces including Sinfonia to Cantata No. 29, Air On A G String, Two-Part Invention In F Major, Two-Part Invention In B-Falt Major, Two-Part Invention In D Minor, Jesu, Joy Of Man’s Desiring, Prelude And Fugue #7 In E-Flat Major, Prelude and Fugue #2 In C Minor, Chorale Prelude Wachet Auf, and Brandenburg Concerto No. 3 in G Major. Not only Bach’s technical style, but also his requirement of creativity and interpretation in his music provides the perfect repertoire to showcase the original synthesizer’s strengths. The project also studies and connects the imagery of the synthesizer version of Bach’s pieces to modern era issues including radical political, intellectual, and economic uprisings o 1968. Carlos’ work Switched on Bach is a historical piece of music that changed electronic music forever.

**How the Saxophone Influenced Composers**
Presenter: Juliana Bolinger
Faculty supervisor: Keith Clifton
Since the invention of the saxophone by Adolphe Sax in the 1840s, it has become a central role in the realm of contemporary music. It had to prove itself over the eras since the full extent of its potential was not known. However, through the graces of composers just as Hector Berlioz, Georges Bizet, and Jules Demersseman, the saxophone was able to be discovered through its tonal or technical qualities. Overtime, it grew across most genres, creating a large cultural impact through jazz, but then gradually reaching into the classical world. Today, composers seek the saxophones' versatility in their compositions whether it is for extended techniques like Lauba or for its narrative properties like Stacy Garrop. The instrument has come a long way since the 1840s and has influenced composers to write more freely and explore other tonal qualities that they may not have had before.

**Crossing Melodic Borders: Latin Roots and the Impact on Western Music**
Presenter: Katie Norris
Faculty supervisor: Keith Clifton
This paper explores the significant influence of Latin American musical traditions on Western European and American music. Drawing on examples from composers such as Bizet, Saint-Saëns, Copland, and Bernstein, it argues that Latin music contributed far more than surface-level "exotic" color; it reshaped approaches to rhythm, melody, and expression. The study begins by outlining the cultural origins of Latin music, emphasizing the fusion of Indigenous, African, and European elements that produced distinctive rhythmic and melodic characteristics. It then examines how specific features, particularly the Cuban habanera rhythm and Mexican folk traditions such as the corrido, were adapted into Western classical and popular works. Through analyses of pieces such as Carmen, Havanaise, El Salón México, and West Side Story, the paper demonstrates how composers integrated Latin elements to create new musical textures and identities. Ultimately, this paper argues that Latin music played a transformative role in expanding the expressive possibilities of Western music, leaving a lasting legacy that continues to shape music today.

**Thermal Whiplash for Trumpet Septet (Live Performance)**
Presenter: Katie Norris
Co-presenters: Jacob Hamlin, Jacob Wisenbach, Rylie Schell, Lindsey Smith, Zachary Witkowski, Kathleen Padula
Faculty supervisor: Neil Mueller
The CMU Trumpet Septet will perform "Thermal Whiplash" by CMU alum Chris Evan Hass. This piece was commissioned by seven CMU trumpeters in 2019, and had been accepted to perform it at the National Trumpet Competition in March 2020. Because of the covid pandemic, the competition was cancelled. This is the first public performance of the piece by CMU students since that time and they will be performing it again in Rochester, NY at the International Trumpet Guild Conference in May 2026.

**Homoeroticism and Feminism - Queerness in the Music of Historical Female Composers**
Presenter: Lorelei Wilburn
Faculty supervisor: Keith Clifton
The existence of sexuality and gender has played an intrinsic role in the cultivation of artistic niches, including the development of classical music throughout the ages. However, some of the most famous musical works throughout history were often composed, performed, and appreciated through the scope of a heteronormative, male-dominated society. Although the works of supposedly queer female composers of the past were often overlooked and overshadowed by their male colleagues, their contributions were undeniably integral to the development of various styles and practices within the western art canon. Through their willingness to defy societal expectations through the cultivation of communities where their art was shared and appreciated, the creation of songs with deeply emotional, homoerotic subtext, as well as works that advocated for the rights of women as a whole, LGBTQ+ women composers paved the way for future female composers to come, all while creating art and cultivating a space that queer women of the modern day could see themselves in. This project examines the contributions of historical female composers such as Sappho, Hildegarde von Bingen, and Ethel Smyth, and the homoerotic, feminist subtext of their works.

**Healthy and Sustainable Singing Techniques**
Presenter: Madeline Gibb
Faculty supervisor: Keeley Stanley-Bohn
This project combines a literature review on multiple singing topics with informal interviews from industry professionals. These topics include the anatomical workings of the voice to understand how the vocal folds and surrounding muscles produce sound, historical and modern singing techniques, and healthy singing techniques that come from proper muscle engagement/relaxation, placement of sound, etc. The informal interviews are conducted with professionals who perform in shows 8+ times a week and supplement the literature review with tactics used to sing healthily/sustainably based on personal experiences.

## Theatre & Dance

**Reminiscence (Live Performance)**
Presenter: Rachel St. George
Faculty supervisor: James Wallace
This a project from Student Choreography Showcase. This student's work was selected to be part of the faculty dance concert in April.

**Antithesis (Live Performance)**
Presenter: Jaina Barden
Faculty supervisor: James Wallace
This is a choreography project from Student Choreography Showcase. This student's work was selected to perform on the faculty dance concert in April.

# College of Business Administration

## Accounting

**Budgeting Behaviors and Impact on Psychological Well-being Among Undergraduate Students**
Presenter: Brooke Essenberg
Faculty supervisor: Lori Olsen
The purpose of this study is to explore one dimension of personal money management, budgeting, and determine if there is a correlation between this practice and psychological well-being among undergraduate students. This was be done by conducting a survey that assesses the presence or absence of different behaviors associated with budgeting (i.e. tracking expenses and income) and then assessing the student's psychological well-being. It is an interdisciplinary study that draws from existing research both in the financial management field for determining budgeting practices and the public health field for measuring psychological well-being. Preliminary results indicate that budgeting has an impact on those who are responsible for more than half of their living expenses. The potential impact of this study is to help those working with undergraduate students to better understand the relationship between budgeting and well-being.

## Entrepreneurship

**MusselMineral**
Presenter: Masaki Hara
Faculty supervisor: John Gustincic
MusselMineral is an eco-innovation venture that transforms invasive mussel shell waste from the Great Lakes into sustainable calcium-rich products for agriculture and gardening. Invasive mussels cause major ecological and economic challenges in Michigan by damaging ecosystems, clogging infrastructure, and accumulating sharp-shell waste along shorelines. At the same time, farmers, gardeners, and backyard chicken owners rely on calcium sources such as oyster shells, which are often costly and must be transported from distant regions. MusselMineral addresses both problems by collecting invasive mussel shells from beaches and shoreline cleanup efforts and processing them into two primary products: an organic soil amendment and a natural calcium supplement for laying hens. The shells are cleaned, dried, and ground into calcium carbonate that improves soil health, enhances plant growth, and supports eggshell quality in poultry. Our competitive advantage is using an abundant invasive species as a low-cost local raw material while simultaneously improving shoreline safety and ecosystem health. By replacing imported calcium products with regionally sourced alternatives, MusselMineral reduces carbon footprints, lowers input costs for agricultural users, and creates value from waste that would otherwise remain an environmental hazard.

**MusselCrete**
Presenter: Violeta Martinez
Co-presenter: Masaki Hara
Faculty supervisor: John Gustincic
Concrete is the most widely used construction material globally, yet it contributes 7–8% of total carbon emissions due to its reliance on cement and limestone extraction. This project introduces an innovative, sustainable alternative by transforming discarded invasive mussel shells—an abundant and underutilized waste product—into a high-performance mineral additive for concrete. Through cleaning, processing, and fine grinding, mussel shells are converted into a calcium-rich powder capable of partially replacing limestone in cement production. This solution not only diverts biological waste from ecosystems and shorelines but also reduces the demand for carbon-intensive raw materials. Preliminary applications suggest that substituting 10–30% of limestone with mussel-derived material can maintain or enhance concrete strength while lowering emissions. By integrating circular economy principles with scalable production methods, this approach offers a practical pathway for greener infrastructure. Beyond recycling, this project redefines waste as a premium resource—positioning mussel-derived additives as a competitive, natural ingredient for the next generation of sustainable construction materials.

# College of Education & Human Services

## Fashion, Interior Design & Merchandising

**Investigating the Biodegration Rate of Abaca, Cotton, and Polyester**
Presenter: Zoë Renner
Co-presenter: Cullen Douglas
Faculty supervisor: Tanya Domina
Clothing waste has become one of the leading causes of global pollution. While some fabrics can biodegrade, some cannot or take thousands of years to do so. Finding sustainable approaches to fashion is an important aspect for the environment due to the effects it will have on the planet. Our study focused on abaca, cotton, and polyester fabrics. Cotton is known for its various uses in many industries; however, it has intense water consumption during phases of its life cycle. Our research is an expansion of our previous study presented at SCREE 2025 regarding the thermal properties of cotton, polyester, and abaca. For this study, testing was conducted following a modified version of International Organization of Standardization (ISO) 11721-1 Textiles- Determination of Resistance of Cellulose-Containing Textiles to Micro-Organism - Soil Burial Test. We were in collaboration with the International Antimicrobial Council (IAC) in Midland, along with the Center for Merchandising and Design Technology (CMDT) Lab, where testing was held. At the IAC we used a Stabil-Therm Environmental Chamber to incubate the samples in dirt, with weekly sample pullings. Although still ongoing, preliminary results show rapid biodegrading with abaca. Through this research, in addition to our thermal comfort research, we aim to further promote abaca as a sustainable fashion textile.

**Universal and ADA Design: A Review of Accessibility**
Presenter: Madison Janderwski
Faculty supervisor: Lauren Pillote
This capstone will synthesize research on the limitations of Americans with Disabilities Act (ADA) standards and compare them to principles of Universal Design with a focus on higher education environments. The project focuses on identifying accessibility barriers within selected spaces on Central Michigan University's campus and evaluating how these spaces perform when measured against both ADA requirements and Universal Design best practices. Through a combination of literature review, spatial analysis, and the resulting redesign proposals, the project aims to demonstrate how Universal Design can better accommodate users with accessibility concerns. The ultimate goal is to generate evidence-based, visually compelling design recommendations that promote a more inclusive campus, while modeling a process that can be replicated in other institutional settings.

## Human Development & Family Studies

**Lessons Learned: Early Childhood SLPs Share their Insights**
Presenter: Melina Koupparis
Faculty supervisor: Holly Hoffman
Lessons Learned: Early Childhood SLPs Share Their Insights explores the real-world experiences of Speech-Language Pathologists working in early childhood settings across Michigan. This project highlights the diverse environments where these clinicians practice, such as preschools, early intervention programs, private clinics, and pediatric healthcare settings, and examines the age groups and developmental needs they most commonly support. Through personal reflections, the study uncovers what early childhood SLPs wish they had known when entering the field, the challenges and rewards they encounter, and the practical advice they offer to future professionals. By amplifying their voices, this research provides meaningful guidance for students, new clinicians, and anyone seeking a deeper understanding of the realities of early childhood speech-language practice.

**The Joy of Noticing: Creating Child-Inspired Learning Moments in a Preschool Laboratory School**
Presenter: Madyson Swink
Faculty supervisor: Holly Hoffman
This project examines how observing a child's unique interests, strengths, and developmental cues can inspire engaging and developmentally supportive learning opportunities in a laboratory school setting. Researchers designed activities for implementation based on detailed observations in the learning environment. Families and teachers then evaluated each learning opportunity for its effectiveness, joyfulness, and alignment with the child's developmental needs. The study highlights collaborative, interest-driven, and research-informed practices that bring learning to life.

**Participatory Action Research Team with Youth**
Presenter: Elizabeth Kelly
Faculty supervisor: Gina McGovern
The Participatory Action Research Team with Youth (PARTY) project demonstrates how Youth Participatory Action Research (YPAR) empowers younger students to participate and engage in research, build leadership skills, and how youth can contribute to improving mental health awareness within schools. The goal of PARTY is to guide middle school students through a research cycle with the youth leading most aspects of the process. CMU student members of PARTY partnered with students at a nearby school to conduct a survey that focuses on middle school students' knowledge of mental health services available at the school. Middle school students participating in this project received instruction about developing a research question/topic, designing surveys and interviews, and how data can be used to inform change. Middle school students developed a survey with CMU mentors that assesses the awareness of students' mental health services available, if students understand how to access the services, and if students know where to go if they or other peers need immediate help. The long-term goal of the study is for students to present their findings to the student body and administration as well as develop a plan of action to increase awareness of these services. This poster will share the major milestones of the PARTY project and what CMU student mentors have learned about their facilitation of YPAR with middle school students.

## MSA Program

**Employee Layoffs Associated with Automation Initiatives at Amazon**
Presenter: Sheba Talluri
Faculty supervisor: Yucel Henderson
Companies in the e-commerce industry such as Amazon continue to provide online services to today's societal needs. It faces a challenge in finding ways to offer its services using automation and artificial intelligence (AI) to reduce costs without negatively affecting its employees. This research project aims to explore how Amazon can balance the efficiency benefits of automation with employee trust, job stability, and long-term organizational sustainability to ensure online services to its potential customers. Although automation helps to improve the performance to meet the rising demand for online services, at the same time it can also create a nightmare among the employees about their job security and thereby reduce employee confidence towards decision-making process by the leadership for the use of advanced technology. To better understand this, the study uses a mixed-methods approach by combining data analysis with employee perspectives gathered from existing research and real-world examples. By looking at both operational outcomes and employee experiences, the study aims to identify where automation may create stress or concerns for employees. The goal is to develop a human-centered approach that helps organizations use advanced technology while still supporting and engaging their employees. The expected findings will provide practical recommendations for Amazon to remain competitive to maintain fairness and social responsibility to provide online services.

**Strategic Leadership Responses to Visa Restrictions: Stabilizing International Student Enrollment at Central Michigan University**

Presenter: Shela Talluri

Faculty supervisor: Yucel Henderson

Visa restrictions and growing immigration uncertainty have become a serious challenge for international student enrollment at Central Michigan University, raising an important leadership question: how can the university reduce this decline while maintaining financial stability and inclusive academic excellence? This issue matters because international students contribute to tuition revenue, campus diversity, intercultural learning, and the university's broader global mission. Previous research shows that visa barriers and policy uncertainty can discourage international students from studying in the United States and can affect university enrollment patterns. However, much of the existing research focuses on national trends or broad policy impacts and gives limited attention to how a single university can respond through leadership, planning, and student support, creating a clear need for this research.A mixed-methods approach will be used to explore the problem from both institutional and human perspectives. Quantitative data will include five years of enrollment trends, visa-related patterns, and tuition revenue, while qualitative data will be collected through interviews with international students, faculty, and administrators. Statistical review and thematic analysis will be used to identify key patterns, experiences, and leadership challenges.

**Establishing Office of Educational Outreach**

Presenter: Anjela Ligal

Faculty supervisor: Troy Hicks

This project explores the development of a coordinated Office of Educational Outreach designed to support professional development, instructional guidance, and research-informed services for PK–12 educators in rural and underserved Michigan school districts. Educators in these contexts face persistent barriers to accessing high-quality professional learning, including geographic isolation, limited funding, staffing challenges, and insufficient sustained instructional support. To better understand these challenges, the project employed a multi-phase research and planning process, including comparative analysis of existing outreach models, statewide data collection, educator feedback analysis, and stakeholder engagement.

Findings indicate strong interest in affordable, research-based professional development, particularly in areas such as classroom management, literacy, and numeracy. Educators emphasized the need for ongoing, context-specific support rather than fragmented, one-time training opportunities. Results also highlight the value of a centralized outreach structure that leverages university expertise to provide coordinated professional learning, applied research, and collaborative partnerships with PK–12 schools.

Using a mixed-methods approach, this project proposes a strategic framework for establishing a sustainable Office of Educational Outreach aligned with institutional goals and responsive to educator needs. By centering educator perspectives and addressing systemic inequities in access to professional learning, this initiative demonstrates the potential of a coordinated outreach model to strengthen university–school partnerships and enhance instructional capacity across rural and underserved districts in Michigan.

**The Impact of Strategic Leadership in Organizational Turnaround: A Case Study on Mitigating Human Capital Risk in a Caribbean Banking Institution**
Presenter: Toni Grant
Faculty supervisor: Abby Mcguire
The Caribbean region has been significantly affected by high levels of skilled labor emigration, which has led to chronic staffing shortages in key sectors. These shortages have fostered various organizational problems, including employee disengagement, skill gaps, and burnout, particularly in the highly metric-driven and profit-focused banking industry. This case study examines the leadership intervention strategies of a branch manager operating within this industry. Through adaptability, strategic risk management, and a hybrid leadership approach, this manager successfully implemented staged reforms, including cross-training and structured performance alignment, that transformed operational fragility into profitability and resilience. This highlights the importance of leadership decision-making and human capital investment strategies in mitigating workforce risks. Leadership and organizational change frameworks are used to analyze the organizational issues and implications, concluding with evidence-based recommendations for future leadership practice.

## Teacher & Special Education

**How Educators can Utilize Artificial Intelligence in the Classroom**
Presenter: Skyler Siecinski
Faculty supervisor: Amy Ford
Artificial Intelligence has grown pronounced in everyday life, including in K-12 classrooms. Due to this increasing access to AI, educators must be prepared to select and utilize the best AI for the job. The objective of this study was to create a guide for new and seasoned educators comparing AI platforms and their applications to support them in capitalizing on this emerging technology in a safe, ethical, and effective manner. This research study investigated 10 different AI platforms, reviewing the AI's origin, corporate-affiliation, data sources, training methods, bias risk, privacy policies, pricing, and purpose. Each of the AI's were prompted to produce artifacts regularly used by teachers. Results found that many of the AI were focus-driven versions of pre-made AI produced by bigger corporations. When prompted similarly, AI that were tailored for teachers provide more details for educators in regards to suggestions while AI not specifically made for teachers had generic outputs that required users to fill in the blanks. To properly engage with AI in a classroom environment, teachers should be knowledgeable about their input so the AI can organize and suggest ideas accordingly.

**Not Just Bad at Math: Experiencing How Math Can Feel for Students with Disabilities**
Presenter: Madison Dougherty (TSE)
Faculty supervisor: Douglas Lapp
This project examines how secondary mathematics classrooms can unintentionally create barriers for neurodivergent learners, particularly dyslexic, autistic, and ADHD students, and how those barriers can be reduced through inclusive instructional design choices. Many difficulties in mathematics for neurodivergent students can be traced to

factors such as executive functioning, processing speed, working memory load, and anxiety rather than a lack of mathematical ability.
In response, this project develops an interactive professional development workshop for pre- and in-service mathematics teachers. The workshop uses simulation-based activities to help participants experience common classroom barriers, such as cognitive overload, ambiguous instructions, and time pressure, and to reflect on how instructional choices shape student access to learning.
The design is grounded in proactive instructional approaches, including Universal Design for Learning, neurodiversity-affirming practices, and Building Thinking Classrooms, a contemporary mathematics education framework that centers student thinking, collaboration, and problem-solving. This project invites educators to reconsider the norms of mathematics classrooms and reflect on how those norms may impact neurodivergent students. Even small, intentional shifts in design can meaningfully expand access to mathematics and, in doing so, interrupt the quiet pattern where capable students come to believe they are simply "bad at math."

# College of Health Professions

## Communication Sciences & Disorders

**Voices in Motion**
Presenter: Grace Biju
Faculty supervisor: Holly Hoffman
It is common for children with conditions such as autism, apraxia, or stuttering may have difficulty with prosody and fluency. This project explores whether theatre activities, including character-based reading, can improve these speech skills.
Individuals on the autism spectrum disorder will participate in activities such as reading a short monologue in both their natural voice and a chosen character voice for a scripted dialogue. Speech samples are recorded and analyzed using rating scales, observations, and pitch graphs to compare changes in intonation and fluency.

**Examining the Reliability of the Text Type Diversity Measure (TTDM) in Children's Writing Samples**
Presenter: Emily Starr
Faculty supervisor: Janet Sturm
This research project examines the reliability of the Text Type Diversity Measure (TTDM) when scoring students' writing samples. The primary purpose of this study is to rescore writing samples obtained from beginning writers with and without disabilities and examine interrater reliability of the measure. A secondary purpose will be to identify challenging exemplar samples for each text type (e.g., arguments). Establishing reliability is necessary for determining if the TTDM can be used as a tool that accurately captures the text types of beginning writers with and without disabilities. The outcome of this research will provide additional evidence that assists educational teams across the world in scoring text types of beginning writers.

**Loudness Perception and Aided Loudness Correlation for Different Degrees of Hearing Loss**
Presenter: Sam Bujak
Co-presenter: Adler Kolb
Faculty supervisor: Yunfang Zheng
This study examines how changes in hearing-aid amplification affect loudness perception, speech understanding, and user preference in adults with sensorineural hearing loss (SNHL). Thirty-five adults with mild to profound SNHL will be tested at prescriptive, +10 dB, and -10 dB amplification settings using the NAL-NL2 method. Measures included ratings of loudness, quality, and comfort; QuickSIN and NU-6 word scores; fitting rankings; and listening hours.
Two subjects (one with mild SNHL and one with moderate SNHL) have completed testing. Amplification level strongly influenced subjective outcomes. -10 dB was best for comfort and quality, +10 dB was loudest and least comfortable. NAL-NL2 users preferred -10 dB for recorded speech, showing gain strategies affect perceived quality. Milder SNHL increased sensitivity to loudness differences and occlusion at higher gains. Objective speech measures remained relatively stable across settings. QuickSIN and NU-6 scores were unaffected by gain changes, although noise reduced scores. Moderate deviations from target gain did not harm measured speech understanding. Prescriptive target was favored for listening hours and rankings, but -10 dB improved comfort, and +10 dB sometimes improved clarity. These results support starting at target gain and adjusting for comfort and clarity. Modest gain reductions often enhance comfort without impacting speech performance, underscoring the value of individual optimization.

**Fitting Formula Effect and Aided Outcome Correlation for Listeners with Different Degrees of Hearing Loss**
Presenter: Addy Kolb
Faculty supervisor: Yunfang Zheng
This study aims to understand how different hearing aid fitting formulas (DSL, NAL-NL1, and NAL-NL2) influence loudness perception, comfort, own-voice occlusion, and speech understanding in adults with varying degrees of sensorineural hearing loss (SNHL), using both behavioral and subjective outcome measures. Hearing aid fitting formulas guide amplification by balancing audibility and loudness. DSL prioritizes maximizing audibility, providing near one-to-one gain between input and output, whereas NAL formulas aim to optimize speech intelligibility while keeping loudness within the range experienced by normal-hearing listeners. Despite the clinical importance of these differences, limited research has examined how DSL and NAL fitting strategies affect loudness perception and aided outcomes in adults.

**Effects of Hearing Loss on Tinnitus Program Outputs**
Presenter: Kelly Kraemer
Faculty supervisor: Yunfang Zheng
Tinnitus commonly co-occurs with hearing loss (HL) and may negatively affect an individual’s quality of life. Studies have demonstrated a significant correlation between HL configuration and tinnitus perception. Hearing aids with integrated tinnitus sound

therapy are widely used to reduce tinnitus perception and associated distress; however, limited evidence exists to guide optimal fitting strategies across different audiometric configurations. This study examined the acoustic outputs of tinnitus programs from seven manufacturers and three configurations of moderate sensorineural HL to inform evidence-based and clinically verified program selection.
Tinnitus program outputs were evaluated across seven major hearing aid manufactures using three moderate (50 dB HL) sensorineural HL audiometric configurations (flat, rising, and sloping). Software-predicted output levels from more than 40 tinnitus programs for each HL configuration were recorded across frequencies and verified using a 2cc coupler in an Audioscan Verifit 2 test box via Speechmap measurements. Statistical analyses quantified differences in output across HL configuration, manufacturer, and tinnitus program from both software and Verifit system, as well as differences between the two output sources. Outputs from the flat HL configuration were also compared to those from a simulated flat 20 dB HL hearing sensitivity.

## Exercise Physiology

**Predicting Resting Metabolic Rate: A Comparative Study of Common Equations**
**Presenter: Shannon Dwyer**
Faculty supervisor: Paul O'Connor
Resting Metabolic Rate (RMR) represents the energy required to maintain homeostasis at rest. Accurately measuring RMR is essential for managing the obesity epidemic and tailoring effective weight loss programs through caloric deficits. While indirect calorimetry is the gold standard for precision, its clinical use is limited by high costs and time constraints. Consequently, predictive equations like the Cunningham and Harris-Benedict formulas are frequently employed in professional and personal health settings. This study evaluates the accuracy of these two predictive equations compared to indirect calorimetry in a sample of 21 volunteers (14 female, 7 male). Data was collected using a gas-exchange hood for calorimetry and DXA body scans to determine body composition. Statistical analysis using linear regression models revealed that both equations consistently overestimate RMR. However, the Cunningham equation demonstrated superior accuracy, yielding higher coefficients of determination (R^2) for both females (R^2 = 0.7826) and males (R^2 = 0.7107). In contrast, the Harris-Benedict equation showed significantly lower reliability, particularly in the male population (R^2 = 0.5562). These findings suggest that while both equations provide useful baseline estimates, the Cunningham equation is a more effective tool for calculating metabolic needs when indirect calorimetry is unavailable.

**A Snapshot of Dietary and Exercise Habits among College Students**
Presenter: Reece Clark
Co-presenters: Kayla Riley, Devyn Buchholz
Faculty supervisor: Naveen Sharma
College students are often perceived as having poor dietary and exercise habits due to academic stress, time constraints, and irregular schedules. In order to determine the accuracy of these negative perceptions, a survey was designed to examine dietary habits surrounding exercise behaviors of college students. Participants of the survey were mostly female compared to male (3:1), and approximately a third identified

themselves as Exercise Science Majors. Additionally, the average body mass index values (BMI) for female participants were 21.3 and for male participants were 25.3, putting our survey population in the normal and overweight categories, respectively. While exercise and nutrition knowledge were not directly assessed, reported behaviors suggest functional understanding of healthy habits. Many students in the survey reported exercising 3-4 times a week for 30 minutes to an hour per session. In regards to diet, the average caloric intake of the respondents was 1,870 kcal, and 20% of respondents reported not knowing their average caloric intake. Additionally, respondents typically chose carbohydrate-rich foods thirty minutes to an hour before exercising. After exercising, respondents typically chose mixed meals with a focus on protein. These routines support energy levels and help with muscle recovery. Results indicates that there are improvements to be made with dietary and physical activity practices based on general public health recommendations.

## Health Administration

**Understanding Academic Stress and Wellness in Pre-Health Students: Challenges, Coping, and Well-Being**
Presenter: Hisham Danoun
Co-presenters: Aaron Mabry Jr., Matthew Hughes, Brooke Mallie, Lauren Taylor
Faculty supervisor: Elizabeth Boman
Academic stress is a common experience among pre-health students, largely due to the pressure of demanding coursework, extracurricular involvement, and preparation for future careers. This study explores how often students experience stress, what causes it, and how they try to manage it. Data were collected through a survey that asked students about their stress levels, daily habits, and the coping strategies they use. The results show that many students experience moderate to high levels of stress, with academic workload and expectations being the most common sources. While students report using strategies such as managing their time, staying active, and relying on friends or family, not all methods are equally effective. Students who consistently use healthy coping strategies tend to report better overall well-being. Overall, these findings suggest that while stress is a normal part of the pre-health path, better support systems and more effective coping approaches can help improve student wellness.

**Consumer Advice on U.S. Health Insurance: A Manual and LLM-Facilitated Analysis of YouTube Comments on Health Insurance Terminology**
Presenter: Ella Kenworthy
Co-presenters: Kayla Eremia, Alexandra Balasa, Melanie Moose
Faculty supervisor: Lana Ivanitskaya
Comments on YouTube, the most popular online platform, offer advice from the perspective of patients, providers, and insurance company workers. Aims: 1) develop an automated health advice detector capable of classifying advice-seeking and advice-giving, 2) classify comments to a YouTube video that introduces and explains essential U.S. health insurance terms, 3) thematic analysis of health insurance advice offered by the commenters. We studied publicly available comments posted to the most watched YouTube video about the U.S. health insurance terminology. Using computational linguistics, we purposefully sampled 1,835 comments (14.31% of all comments) based

on these criteria: first-level posts (not replies) with at least 25 words that mention insurance, cost, or billing. We assessed two Large Language Models' (LLMs') classification agreement for advice-seeking and advice-giving, followed by manual verification and thematic analysis of suggestions by advice givers. One-third of comments in our corpus gave advice: how to choose or evaluate plans, transition off parents' insurance at age 26, and navigate insurance denials, restrictions, brokers, HSA tax benefits, and ACA marketplaces. Fewer than 3% of comments were advice-seeking. Claude Sonnet 4.6 and Haiku 4.5 reached substantial agreement, with slightly better results for advice-seeking vs. advice-givin: 98% vs. 84% percent agreement, 0.73 vs. 0.65 Cohen's kappa, 81% vs. 72% sensitivity; 99% vs. 91% specificity.

## Physical Therapy

**Longitudinal Study of the Effects of the OTAGO Fall Prevention Exercise Program on Strength and Balance in Older Adults**
Presenter: Ryann Leyko
Co-presenter: Lauryl Sullivan
Faculty supervisor: Raju Chowdhary
The risk of fall becomes greater as aging declines both strength and balance. The OTAGO Fall Prevention Exercise Program (OEP) is an evidence-based program designed to strengthen these core areas. The objective of this study is to evaluate the effectiveness of OEP in the MidMichigan area through three core assessments. The 12-month analysis consisted of 89 participants aged ≥60 years between 2019-2025, excluding assessments interrupted by COVID service suspension. Participants were given Functional Assessments on their first exercise class, then reassessed every 3-month period for up to a year. The Functional Assessment is composed of 3 parts: Timed Up and Go (TUG), 30 seconds of chair sit-to-stands (STS), and a four-stage balance test (FSBT). Descriptive statistics (means ± standard deviation) were calculated from participants' scores at each period. Linear mixed-effects models evaluated changes over time. Time was used as a fixed effect and participants as the random effect. Statistical significance was defined as $p<0.05$. Participant retention declined throughout the program from n=89 at 3 months, n=61 at 6 months, n=38 at 9 months, and n=27 at 12 months. TUG times improved from 11.49 ± 4.33 seconds at baseline to 8.78 ± 2.80 seconds at 12 months (-1.942, p=0.011). STS repetitions improved from 10.31 ± 4.19 at baseline to 14.22 ± 4.38 at 12 months (2.7, p=0.0004). Unipedal FSBT tests showed improvement from 4.43 ± 4.19 seconds at baseline to 7.90 ± 3.37 seconds at 12 months.

## Public Health

**The Prevalence of Health Education in Mount Pleasant Public Elementary Schools**
**Presenter: Alexia LaFave**
Co-presenter: Shelby Higel
Faculty supervisor: Janae Bady
Health education is a vital component of a child's life as it provides them with the foundational knowledge, they require to create healthy lifestyles and habits as they age. Schools are responsible for providing children with an education that provides them with a well-rounded understanding of our world and society. However, this education often

lacks emphasis on educating children on basic health knowledge and skills since schools are not properly equipped to teach such topics (Boguslawski, et. al., 2021). With limited access to such information, children are left without an understanding of how to properly care for themselves, which can lead to poor health and risky behaviors such as eating junk food, not exercising, smoking, not showering, and more. This research will investigate the prevalence of health education in Mount Pleasant, Michigan, and evaluate student competency on mental health, physical health, personal hygiene, nutrition, and exercise education. Researchers will conduct interviews with local teachers as well as interact with students to evaluate their health knowledge. Ultimately, this research aims to better understand the health education programs used in Mount Pleasant elementary schools, but will also hopefully identify where they can be improved.

**Increasing Hemorrhage Awareness and Bleeding Control Skills**
Presenter: Abigail Hewitt
Co-presenters: Emily Jacobs, Stephanie Cronkright, Gabe Marshall, Courtney Reisler
Faculty supervisor: Elizabeth Boman
Trauma is experienced daily through events such as motor vehicle accidents, gun-inflicted violence, and other injuries. Hemorrhage remains one of the leading causes of preventable death in the United States. According to the New England Journal of Medicine, approximately 60,000 Americans die each year from hemorrhage, though some of these deaths may be preventable through public education and early intervention. This research project aimed to increase awareness and knowledge of hemorrhage recognition and bleeding control. Our team, composed entirely of pre-health students with interests in public health and preventive medicine, delivered an educational video presentation to individuals across a wide range of ages. The presentation focused on identifying life-threatening bleeding, appropriate steps to stop hemorrhage, and essential emergency response skills. Participants completed a pre-test prior to viewing the video and a post-test afterward to assess changes in knowledge. Results demonstrated an overall increase in knowledge between pre-test and post-test scores, suggesting that community education can improve awareness and preparedness related to hemorrhage management. These findings highlight the importance of accessible public health education and suggest that such initiatives may contribute to improved emergency response outcomes and a reduction in preventable deaths due to hemorrhage.

**The Effects of Fasting on Moderate-Intensity Cardiovascular Exercise**
Presenter: Xandar Holtrust
Co-presenters: Jenna Maciejewski, Katie Cookman, Lyrik Ricketts
Faculty supervisor: Elizabeth Boman
The effectiveness of fasting before exercise is a topic that is debated among physically active individuals. Many claim that it is beneficial, and others claim it is detrimental. This study aims to determine whether moderate-intensity cardiovascular exercise feels easier in a fasted state or a non-fasted state. Participants will be randomly split into two groups; both groups will be running a mile on a treadmill, but one group will be fasting for two and a half hours prior, and the other group will be consuming some fruit twenty

to thirty minutes before running. At the end of the run, participants will be asked for their Rate of Perceived Exertion (RPE) using the Borg 6-20 scale. By comparing the RPE values between these two groups, the study seeks to understand the effects of pre-exercise nutrition on perceived effort. It is hypothesized that fasting before exercise will lead to an increased RPE compared to those that do not fast. These findings can provide an accessible and practical way to help people make more educated decisions about their pre-exercise nutritional habits.

**The Effects of Prolonged Use of Ibuprofen**
Presenter: Jazmine Nguyen
Co-presenters: Rylen Jurecko, Mya Ross, Kaylyn Sankey, Lily Szczembara, Ava Waldron
Faculty supervisor: Elizabeth Boman
This study examined the perceived effects of ibuprofen use on the digestive, nervous, cardiovascular, and musculoskeletal systems among college students. An anonymous survey of 116 Central Michigan University students collected age, sex, and physical activity level, reasons for ibuprofen usage, typical dosage, frequency of use, and any adverse side effects experienced. Most participants were aged 18-20, with a predominantly female sample (76%), and reported moderate to high physical activity levels. Ibuprofen use was generally occasional, 1-3 times per month, with 400 mg as the most common dose. Primary reasons for use included menstrual pain, headaches, and injury-related pain. Few respondents reported adverse side effects. Overall, findings suggest that ibuprofen use among these students is infrequent, symptom-based, and consistent with recommended guidelines. However, the female, self-reported sample may limit generalizability and introduce potential bias.

**Spokane Regional Health District Workplace Mental Health and Well-Being Assessment**
Presenter: Paige Weid
Co-presenters: Caleb Zimmerman, Christya Haddad
Faculty supervisor: Neil MacKinnon
The objective of this study was to understand the workplace mental health and well-being (WP-MH&WB) of Spokane Regional Health District (SRHD) employees. An online survey about WP-MH&WB (referred to as the Augusta+ Scale) was distributed to SRHD employees in August and September 2025. A mixed-method approach was adopted to analyze the data. A total of 216 employees responded to the survey, of which 179 completed the entire survey. The average WP-MH&WB score was 83.4 (SD ± 20.7) (on a scale ranging from 22 to 110), suggesting good WP-MH&WB. Domain-specific analysis revealed departmental variation within the organization. Sociodemographic characteristics were associated with differences in the WP-MH&WB mean score between those who reported feeling burned out and those who did not. Overall, 44.3% of respondents reported experiencing burnout, while 57.8% reported experiencing loneliness. Logistic regression analysis revealed, a one-unit increase in the WP-MH&WB scale score was associated with an 8% decrease in odds of experiencing burnout (OR=0.92; 95% CI: 0.89-0.95; p-value<0.001). Most participants across the divisions reported that relationships, hobbies, health, and finances were substantial

contributing factors to their fulfillment. To address the issues identified, we recommend that the SRHD establish workplace initiatives that empower employees in decision-making and utilize available resources to strengthen the organizational culture.

**Scams, Sextortion, Suicide, and Mental Health in Dating Apps: A Reddit Content Analysis (2021–2025)**
Presenter: Simon Idiagbonya
Faculty supervisor: Sergey Soshnikov
Online dating platforms have become central to relationship formation but are increasingly associated with scams and sextortion. This study analyzed publicly available Reddit posts to examine how these harms intersect with emotional distress. Posts from one platform across eight topic-focused communities were collected between January 2021 and October 2025. After de-duplication, 9,567 unique posts were analyzed, including 3,496 posts containing harm-related terms. Scam or fraud content appeared in 7.7% of posts, while sextortion or blackmail was discussed in 12.6% (approximately 1 in 8 posts). Suicide-related content appeared in 3.4% of posts and was observed across all study years, with higher counts in later years. Among posts referencing specific dating apps (n = 908), scam and sextortion narratives were distributed across ten platforms, with Tinder (13.7%), Plenty of Fish (13.2%), and OkCupid (12.3%) accounting for the largest shares. These findings demonstrate how large-scale online discussions provide quantitative insight into recurring digital harms and associated emotional distress in contemporary dating environments.

# College of Liberal Arts & Social Sciences

## English Language & Literature

**The Waking World: The Hedge Wizard's Apprentice**
Presenter: Jonathan Wittenberg
Faculty supervisor: Ari Berk
This creative project was designed to balance out my work with an Actuarial Science/Statistics Double Major. I had decided to attempt a worldbuilding project, researching real-world folklore and history to serve both as inspiration and insight into the process of creating a world.
**Personal Professional Author Website**
Presenter: Cora McLean
Faculty supervisor: Robert Fanning
A presentation of my personal author website complete with writing samples of both fiction and poetry, to include a reading of some of my work.

**In Defense of Gossip**
Presenter: Wren Ferguson
Co-presenters: Kip Gilbert, Kendal Swatosh
Faculty supervisor: Mary Wendt
Traditionally, gossiping has negative connotations, but there are situations in which gossip can have a positive impact. Previous research has outlined the positive and

negative effects of different types of gossip, especially on reputation and the formation of in-groups and out-groups. This study focused on how gossip impacts trust within relationships. We conducted a survey which asked how different instances of gossip would affect participants' trust of the gossiper and the person gossiped about, as well as in which relationships participants would engage in gossip. Our research found that participants were more likely to gossip within close relationships. Contrary to the belief that gossiping makes a person untrustworthy, when told gossip by a friend, the participants of our survey said this action generally increased their trust of the friend. Participants' responses implied that gossip can have both positive and negative impacts on one's trust with the person being gossiped about, depending on the intent of the person telling the gossip. From this, we concluded that gossip can have benefits within interpersonal relationships.

## History, World Languages, & Cultures

**An Analysis of Dialectal Differences and Social Stereotypes in Spanish**
Presenter: Hannah Snider
Faculty supervisor: Luz Marcela Hurtado
This study investigates how accurate associations between dialectal features and social stereotypes are in Spanish dialects spoken across the Americas and in Spain. Recorded speech samples of native Spanish speakers from 6 cities were evaluated and compared on the following features: age, education, sex, occupation, pronunciation of certain phonemes and sound combinations, and second-person pronoun use. These features were compared using the variable rule statistical program VarbRul. Location, age, sex, and occupation correlated with dialectal features such as word-final /s/ pronunciation, elision of /d/ in -ado and -ido word endings, and the type of second-person pronoun used. These findings corroborated certain sociolinguistic associations between demographic and dialectal features.

**Competing Language and Cultural Identities in a Michigan German-Heritage Community**
Presenter: Ethan Conley
Faculty supervisor: Daniela Richter
My project focuses on competing cultural identities in German-heritage communities in Michigan, using the example of Frankenmuth. For a century and half, the town has maintained a unique identity capturing and preserving its origins as a primarily German settlement. In contrast to other communities with German roots, such as the Amish and the Texas-German communities, only scant scholarly interest has been paid to Frankenmuth's unique cultural context. This analysis therefore seeks to remedy this gap in scholarship based on field research, interviews with local leaders, and surveys within the broader community. My project documents an apparent dissonance in the way German culture is perceived and presented both by and towards residents and outside visitors. The community's original German-Frankish heritage is evidently giving way to a more widely recognizable staging of German-Bavarian culture. Most importantly, this analysis seeks to paint a realistic picture of modern Frankenmuth's continued legacy and evaluate its connection to its German roots in the 21st century.

## Politics, Society, Justic & Public Service

**Loneliness and Solidarity in the Wake of a 500-Year Flood: The Story of Sanford Strong**
Presenter: Madison Dougherty (TSE)
Faculty supervisor: Christi Brookes
In May 2020, the failure of the Edenville and Sanford Dams triggered a 500-year flood in Mid-Michigan, displacing residents and reshaping the physical and emotional landscape of the Sanford community. Occurring during the early months of the COVID-19 pandemic, the disaster created a rare overlap of collective crises, intensifying experiences of isolation, uncertainty, and loss. This project examines how these overlapping events shaped the tension between loneliness and solidarity within the community.
Using a combination of local reporting, collective trauma research, and survey responses from residents and volunteers, this project documents how individuals navigated displacement, grief, and disruption while also participating in widespread acts of mutual aid and care. Findings reveal a central paradox: even as the disaster deepened feelings of isolation, it also fostered profound connection, as neighbors, strangers, and organizations showed up for one another in extraordinary ways.
By centering community voices and lived experiences, this project highlights how recovery extends beyond physical rebuilding to include emotional and social resilience. Ultimately, it argues that disasters not only expose vulnerability but also illuminate the strength of human connection, revealing how communities rebuild through compassion, shared responsibility, and a renewed sense of belonging.

**Global Perspectives on Alternatives to Incarceration**
Presenter: Hannah Amerson
Faculty supervisor: Thomas Greitens
This project consists of a scoping review of current international research on the prison abolition movement, compiling alternatives from 10 different countries and over 40 articles to produce a broad view of the movement globally. The purpose of this capstone is to inform future research and prison abolition activism here in the USA, using fresh perspectives and data from external sources.

## Psychology

**Testing Faking Resistance in Construct-Driven Situational Judgment Tests: Comparing Multidimensional and Unidimensional Response Formats**
Presenter: Alex Nahnsen
Faculty supervisor: Neil Christiansen
Organizations can greatly benefit from using applicant personality to inform selection decisions, given the influence of personality on workplace behavior. However, the high-stakes nature of selection assessments leads to applicants faking, thus diminishing the construct validity of these assessments. Multidimensional forced-choice (MFC) response formats and equally desirable response options have been proposed as an alternative design feature that can be used to decrease applicants' ability to fake on selection assessments. This thesis tests both of these design features within a situational judgment test (SJT) measuring personality to examine their impact on

applicant faking. This was done by administering an MFC-SJT with responses roughly equal in desirability and a unidimensional forced-choice (UFC) SJT with varying response desirability to participants randomly assigned to honest and applicant conditions. Results showed that all the SJT scales administered demonstrated moderate to strong evidence of convergent validity with IPIP scales measuring the same traits under honest responding, in addition to other adequate psychometric properties. Applicant scores showed inflation across all the SJTs; however, the inflation was smaller on the MFC-SJT scales than the UFC-SJT scales.

**Impact of I-Connect on the On-Task Behaviors for Elementary Children in General Education**

Presenter: Samantha Brand

Faculty supervisor: Michael Hixson

The purpose of this study was to explore the effectiveness of the I-Connect Self-Monitoring Intervention for improving the on-task behavior of elementary school students with attention difficulties in a general education setting. This study also investigated the maintenance of students' on-task behavior using progressively increased prompting intervals. The average time on-task was higher in the intervention condition compared to the baseline and withdrawal conditions. The increased interval lengths resulted in some deterioration of on-task behavior. Teachers' and students' perceptions of the intervention were positive, and all students chose to participate in the intervention when given the opportunity to do so. As on-task behavior is essential for accessing the curriculum, the I-Connect SM intervention may prove beneficial in helping some students maintain on-task behavior.

**Unconventional Students Ongoing Struggles for Opportunity and Recognition**

Presenter: Kelly Lett

Faculty supervisor: Sandra Kanouse

More unconventional students are returning to university each year and though they bring a high level of professionalism and dedication with them, they are often overlooked by administration and faculty leading to lost opportunities. This first-person case study examines how to fix such barriers to success improving higher education for all.

It is widely understood that unconventional students will face exceptional and unique challenges in their education. Here I will leverage my personal experience as a single-case, qualitative report on —a 43-year-old woman in pursuit of an undergraduate degree in neuroscience— and the problems that persist in academia for unconventional learners. I will detail various in-the-moment strategies I employed and evaluate their relative effectiveness.

I present my experience to help bring to light just how significant those challenges are. Such a challenging field of study humbles most students at some point, yet unlike my younger peers, who appeared to transition readily from high school hallways to university lecture rooms, I arrived to unforeseen challenges. I will elucidate on the unique barriers I faced within the established university structure and offer ways forward that will benefit future unconventional students, their mentors and, ultimately, the field at large.

**I don’t want to hear about my horoscope! Science skepticism at work.**
Presenter: Jessica Carnarvon
Faculty supervisor: Kimberly O'Brien
We probe the relationship between interpersonal conflict with science skepticism. using n = 73 participant-coworker dyads. After controlling for reading level and personality, science skepticism related to self-reported interpersonal conflict, perceived victimization, and CWB. Additionally, coworker-reports showed similar trends only for some forms of science skepticism. These results suggest that when certain (likely normative) science skeptical manifestations are visible (i.e., coworker-reported), the employee may experience more conflict and be rated as engaging in more CWB.

**Using the Health Belief Model to Design and Evaluate a Well-Being Intervention for Healthcare Workers**
Presenter: Rhiannon Grodnik
Faculty supervisor: Kimberly O'Brien
This study tests a well-being intervention on a sample of 80 to 100 healthcare workers. Healthcare workers have a high risk of burnout due to their long work hours and the stressful nature of their work. Healthcare worker burnout has negative consequences not only on the healthcare workers themselves but also on the healthcare system and society. In our study, we will test two activities that have been shown to combat burnout—mindfulness meditation and physical exercise—on a sample of healthcare workers. Our goal is to change participants’ beliefs so that they will be more likely to engage in these healthy activities. We will start with a baseline survey and follow up with another survey after four weeks. By analyzing the intervention data as compared to a control group, we will test the effectiveness of the intervention.

**Mindfulness Meditation may Increase Cognitive Control**
Presenter: Emma Kane
Co-presenter: Lauren Steyer
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.

**Shared Personality Traits in College Students and Their Biological Parents**
Presenter: Annabelle Watson
Faculty supervisor: Wiline Pangle
Personality plays a central role in shaping how individuals think, behave, and relate to others across contexts. A commonly used framework for understanding personality is the Big Five model, developed by Goldberg et al. (2006), which encompasses extraversion, openness, conscientiousness, agreeableness, and neuroticism. The purpose of the present study is to examine the extent to which college students' Big Five personality traits correlate with those of their biological parents. A paired survey was administered via Qualtrics to 45 college students with one of their biological parents. Scores were analyzed by both student and parent gender. Results indicated that mothers demonstrated greater similarity in Big Five personality traits with their college-aged children than fathers did. However, the results for fathers should be interpreted with caution due to the small sample size. Female college students had more personality traits in common with their biological parents than male college students. Our findings point to meaningful patterns in the resemblance of personality traits between parents and their children, particularly along maternal lines, highlighting the need for further investigation.

**Locomotor Activity in Sprague Dawley and Spontaneously Hypertensive Rats: Further Validation of an Animal Model for ADHD**
Presenter: Aldo E. Garcia Pajaro
Faculty supervisor: Mark Reilly
Spontaneously Hypertensive Rats have been widely accepted as an animal model for attention-deficit/hyperactivity disorder primarily due to overlapping behavioral characteristics such as hypersensitivity to delayed reinforcement, activity levels, and inattention. The present study assessed the extent to which the commonly used Sprague Dawley rat could serve as an adequate comparator strain for Spontaneously Hypertensive Rats in terms of activity levels. Six rats of each genetic strain were tested over six daily sessions, 15 minutes each. They were placed singly in polytub open field chambers, and locomotor activity levels were recorded via infrared photobeams. In the first session, Sprague Dawley rats had higher levels of activity than the Spontaneously Hypertensive rats, though both generally decreased over the session. Over the following five sessions, though, a new pattern emerged as Sprague Dawley movements were higher at the onset of each session but quickly declined, whereas the Spontaneously Hypertensive Rats' movements began comparatively lower and then increased over the session and at levels higher than the Sprague Dawley rats. This pattern was replicated in a final session that was conducted during feeding time, though the overall locomotor levels were elevated for both strains. These findings are consistent with those of Sagvolden (1992) and Sagvolden et al. (1993), suggesting that strain differences in activity levels are more complex than as shown.

**Hysteresis in Impulsive Choice of Spontaneous-Hypertensive Rats: Effects of Repeated Exposure to Delay Order**
Presenter: Katie Monske
Faculty supervisor: Mark Reilly
Spontaneously hypertensive rats (SHR) are a strain of rat commonly used as a model for Attention-Deficit/Hyperactivity Disorder. The purpose of the present study was to assess changes in preference for the larger, delayed alternative across multiple presentations of ascending then descending series of delays (0, 1, 3, 6, 12, 24 s) in SHRs. Rats were given the choice between a smaller, immediate alternative and larger, delayed alternative. Typically, when there are multiple exposures to delays, preference for the delayed alternative changes. If the delays are presented in ascending then descending order multiple times, the difference in preference between the two limbs is reduced, showing convergence. Across multiple presentations of delays, preference for the delayed alternative decreased in the ascending limb and increased in the descending limb, indicating that convergence occurred.

**Self-Work versus AI-Work Preference for Reading Summary Task**
Presenter: Isaiah Nguyen
Faculty supervisor: Mark Reilly
Generative artificial intelligence (AI) use creates concerns about ethics and student overreliance. Reports vary on how well AI can replicate student work. Little research examines the functional relationship between the accuracy of AI and students' use of it. This study explores how changing the disclosed accuracy of AI responses affects participants' decisions to use AI summaries when completing a summary writing task. Participants completed a survey and six trials with a summarization task. Each trial, participants chose to receive a ChatGPT summary with either an ascending or descending probability of accuracy. Dependent measures were reported AI use, whether they requested the AI summary, and the similarity of their summary to the AI summary. This study evaluated two hypotheses. The first was "English speaking men in disciplines with higher technological competencies, GPAs, and student status are more likely to report using AI than non-English speaking females in disciplines with lower technological competencies, GPA, and student status." The second was "Participants will have increased AI use when the known probability of a AI summary accuracy is high." The results indicated no support for hypothesis one and weak support for hypothesis two; suggesting that for academic settings where AI is predicted to be inaccurate, informing students about this accuracy could lower AI use. Future research should investigate AI use in different tasks and contexts.

**Evaluating Behavioral Recovery and Motor Dysfunction in 6-OHDA-Induced Rat Models of Parkinson's Disease**
Presenter: Ketaki Zarkar
Faculty supervisor: Michael Sandstrom
Parkinson's Disease (PD) is incurable; however, medications and surgeries may provide temporary symptomatic relief. Levodopa or (L-DOPA), a precursor to dopamine, is the most commonly prescribed oral treatment for PD, providing short-term benefits. However, it is unsuitable for long-term use, often causing adverse side effects, most

likely arising from excessive dopamine release and increased postsynaptic sensitivity with consistent use. An alternative treatment for PD is stem cell transplantation to restore dopaminergic function in the substantia nigra pars compacta. While some concerns regarding stem cell therapy include their inefficacy in integrating with host cells, our lab's primary focus is on promoting activity-dependent engagement of transplanted cells through targeted stimulation and exercise. By encouraging physical activity, we aim to train the transplanted cells to adapt to host neural circuits, thereby supporting regulated dopamine release during active engagement that resembles physiologically regulated dopamine release in intact animals. We expect that transplanted bone marrow–derived mesenchymal stem cells (BMSCs), when paired with targeted stimulation and physical activity, will integrate more effectively within host circuitry and lead to improved long-term functional motor recovery. The present study is a part of an ongoing project and will focus on behavioral tests, including swimming, ladder rung walking, vibrissae-elicited forelimb placing, and drag test.

**Mental Health Professional's Attitudes Toward Transgender People: A Study of Bias and Discrimination**

Presenter: Dennis Bulger

Faculty supervisor: Kyle Scherr

Transgender people experience bias in many areas of their social lives. A place where bias against transgender people can have large effects on health is mental health services. This study presented mental health professionals with two vignettes about a client struggling with symptoms of depression and anxiety, with the only difference between the two vignettes being whether the client is transgender or cisgender. Half of the participants received the vignette about the transgender person, while the other half received the vignette about the cisgender person. Following the story, participants were asked to give their empathic reactions and clinical judgments on the client. Measures of their social desirability and motivation to control prejudiced reactions were also taken. Results showed no significant effects of condition on clinical judgment, yet there were multiple interactions found to have impacted mental health professionals' ratings of the client's prognosis. Analysis showed that higher social desirability and empathy predicted greater perceived likelihood of a disorder other than those listed in the survey, and higher empathy predicted worse prognosis for transgender clients but better prognosis for cisgender clients. This presentation ends with a discussion of how this research can advance our understanding biases against transgender people in the world of mental health.

**Attitudes about the Criminal Legal System: Perceptions of Individuals in Law Enforcement through Political and Religious Ideologies**

Presenter: Diana Woo

Faculty supervisor: Kyle Scherr

As the political climate of the United States becomes increasingly polarized, so have attitudes towards the United States criminal legal system. Perceptions of individuals in law enforcement, as well as views on lying about evidence and the effects of the criminal legal system on perceptions of individuals in law enforcement, were studied across political ideologies and levels of religiousness. An online survey was used to

collect these data, which was analyzed using correlational approaches. As participants became more liberal or less religious, they tended to have less favorable perceptions of individuals in law enforcement. When it came to lying as an interrogation tactic, participants generally did not favor this tactic. The current study contributes to previous research on perceptions of the criminal legal system by showing how political ideologies and levels of religiousness affect people's perceptions of individuals in law enforcement and lying as an interrogation tactic. Future research should investigate how different social identities perceive individuals in law enforcement and different interrogation tactics.

**The Impact of ADHD on the Frequency and Type of Everyday Memory Errors**
Presenter: Arianna Jepsen
Faculty supervisor: Reid Skeel
Short-term and long-term memory deficits have been found within individuals diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD), but the specific deficits found varies by study design. Therefore, this study aimed to assess the frequency of memory errors in adults with ADHD compared to controls as they occur in a naturalistic context through the use of smartphone-based ecological momentary assessment (EMA). Seventy undergraduate students were recruited, participated in an initial study visit, and then completed three daily surveys for seven days, capturing the frequency of semantic, episodic and prospective memory errors. On average, participants responded to 20 of 21 surveys. As predicted, results revealed main effects for diagnosis status and memory type. Post-hoc comparisons revealed that individuals with ADHD reported significantly more memory errors than controls, and that prospective memory errors were reported more frequently than semantic and episodic errors, but there was no difference between reported semantic and episodic memory errors. Additionally, there was a significant interaction, with participants with ADHD reporting more prospective memory errors than the controls, but no significant differences in episodic or semantic errors between the groups. These findings indicate increased forgetting in individuals with ADHD may be mediated by executive dysfunction rather than an underlying memory deficit.

**MMPI-3 Item-Level Differences Between College Students Who Vape and an Unselected College Sample**
Presenter: Brittany Mitton
Faculty supervisor: Nathan Weed
The most widely utilized psychological assessments of personality and psychopathology are the Minnesota Multiphasic Personality Inventory (MMPI) instruments, the most recent of which is the MMPI-3. The MMPI-3 is a self-report measure containing 335 true/false items to assess personality and symptoms of psychological disorders. Although previous research has examined how various aspects of personality and psychopathology are related to the frequency and function of vape use, only one study to date has utilized the MMPI-3 despite its particular suitability for the task. Mitton (2025) found that MMPI-3 scales predicted hypothesized variables related to the context of vape use in a sample of college student vapers. This poster reports results of a more detailed examination of the psychological correlates of vape use in college students by comparing the MMPI-3 item responses of students who vape to those in a general

student sample. We will report on data from a combined sample of 148 Central Michigan University students (60 who vape, 88 in the general sample) to explore differences in MMPI-3 item endorsement. The purpose of this analysis was to examine if vape users endorse higher levels of psychological distress compared to general college students.

# College of Science & Engineering

## Biochemistry, Cell & Molecular Biology

**Discovery of Widespread Migrasome Formation During Amoeboid Migration in Dictyostelium discoideum**
Presenter: Bridget Plude
Faculty supervisor: Cynthia Damer
Migrasomes are newly discovered, migration-dependent organelles that form along membranous retraction fibers of migrating cells. They have been recognized as important structures for intercellular communication and maintenance of cell homeostasis. We performed localization studies on the calcium-dependent phospholipid-binding protein, copine E (CpnE), in Dictyostelium discoideum during cell migration. We observed GFP-CpnE labeled retraction fibers and migrasomes in multiple contexts: chemotaxis toward folate, random migration, and early development. The migrasome membranes were stained with WGA and a subset of migrasomes were stained with SYTO RNASelect, indicating the presence of RNA cargo. Our findings suggest that CpnE may have a role in migrasome formation or stabilization. Furthermore, these results support the idea that migrasomes play important roles in Dictyostelium development, cell communication, and maintain homeostasis in a variety of environments.

**Canine and Feline Behavior in the Veterinary Clinic Setting**
Presenter: Amelia Beswick
Faculty supervisor: Steven Gorsich
It all starts at home. The moment a pet owner reaches for a leash, collar, or kennel, many animals begin to show signs of stress and anticipation. For most pets, these cues signal an upcoming trip to the veterinary clinic, an experience often associated with fear and discomfort. Whether the visit is for routine vaccinations, wellness examinations, illness, or surgical procedures, pets frequently experience heightened anxiety before leaving home. This stress often increases upon arrival at the clinic, where unfamiliar sights, sounds, smells, and other animals can intensify their fear. Pets express anxiety through behaviors such as vocalizing, trembling, hiding, scratching, attempting to flee, or displaying aggression. These reactions vary between species. Survey data collected at a local small animal veterinary clinic were analyzed to better understand factors contributing to pet stress during veterinary visits. A total of 83 surveys were collected, including 22 felines and 61 canines. It is expected that felines are more likely to exhibit behaviors such as excessive vocalization, freezing, or hiding, while canines may be more prone to lunging, biting, or attempting to escape. Additionally, the relationship between anxiety level and reason for visit will be examined to determine whether pets

presenting for illness or injury exhibit higher anxiety than those attending routine wellness appointments.

**InSciTE Speaker Series: Created by Students, for Students**
Presenter: Morgan Mussehl (BCMB)
Faculty supervisor: Wiline Pangle
Retention in STEM majors is strongly influenced by students' first-year college experiences, including their adjustment to academic expectations, development of study strategies, and formation of professional identities. My project evaluates the implementation of a student-centered InSciTE Speaker Series and Panel Initiative at Central Michigan University (CMU), designed to increase student engagement, expand awareness of STEM careers, and connect classroom learning to real-world experiences. I measured student interaction, engagement, and interests with surveys comprising of Likert scales and various questions before and after events. I found that as students hand design events, they are likely to be extremely satisfied with the outcome. Additionally, most students do not see speakers as possible mentors or networking opportunities suggesting a disconnect in understanding the creation of professional relationships. My recommendation is to implement a stronger professional networking and mentoring systems inside of InSciTE and the College of Science and Engineering (CSE) along with, prioritizing student voices to shape university additions.

**A Bioluminescent Kinase Sensor-Based Gene Circuit for Real-Time Monitoring and Control of Inflammation**
Presenter: Osheen Dubey
Faculty supervisor: Eric Petersen
Chronic inflammation underlies many pathological conditions, including autoimmune and neurodegenerative diseases, where sustained signaling in the central nervous system worsens disorders such as Alzheimer's and Parkinson's disease. Although therapies like JAK inhibitors exist, their lack of cellular specificity often causes systemic toxicity and side effects. To address this, we are developing a genetically encoded Bioluminescent Kinase Sensor (BlinKS) platform integrated with a synthetic gene circuit for real-time detection and control of inflammatory signaling. BlinKS detects activation of key pathways, including JAK/STAT and NF-κB, by converting kinase activity into a bioluminescent signal that drives light-dependent gene expression via the optogenetic transcription factor EL222. The sensor uses split luciferase reconstitution triggered by phosphorylation-dependent interactions between a phospho-amino acid binding domain (PAABD) and kinase-specific substrates. We have engineered and validated BlinKS variants targeting JAK1, JAK2, STAT1, STAT3, and NF-κB-related kinases, showing pathway-specific responses in cells. We are optimizing luciferase variants, linker design, and PAABD–substrate pairs to improve sensitivity and range. BlinKS bioluminescence activates EL222 circuits to regulate anti-inflammatory genes such as IL-10, enabling precise monitoring and feedback control of inflammation.

**Developing and Optimizing Bioluminescent Neurotransmitter Sensors and Neurotransmitter Dependent Neuromodulators**

Presenter: Kaylee Taylor

Faculty supervisor: Eric Petersen

Many neurological diseases such as Alzheimer's Disease, Parkinson's Disease, and autism spectrum disorder have been shown to be caused, in part, by an imbalance of neurotransmitter levels. Expanding on the types of neurotransmitters that can be detected is important to study the causes and treatments of these diseases. In this study, we focus on the amino acid gamma-aminobutyric acid (GABA) and acetylcholine (ACh), which are neurotransmitters found throughout the brain and are involved in many neurological disorders. We developed a variety of genetically encoded bioluminescent GABA and ACh sensors that are an attractive alternative to using fluorescent sensors because they do not require an excitation light source, allowing deeper areas of the brain to be recorded without damaging tissue and improving signal-to-noise ratio due to the lack of autofluorescence. We created a library of bioluminescent neurotransmitter sensor variants and tested them for improved responses to neurotransmitter. Taking bioluminescence readings on a plate reader, we found that the sensors with a mutated binding domain and optimized linkers have higher responses to saturating amounts of GABA or ACh than the ones with the native binding protein. To further improve the response of the sensors to neurotransmitter with the goal of using them to image brain activity in rodents, we are using rational design and further linker optimization to improve response amplitude and signal-to-noise ratio.

**Physiological and Morphological Differences in Heterozygous GRIN2B Knockout Rats**

Presenter: Sophia Staricha

Faculty supervisor: Shasta Sabo

Pathogenic mutations of GRIN2B cause GRIN2B-related neurodevelopmental disorder, which is associated with autism spectrum disorder and other physical and developmental disabilities, but very little is known about its mechanisms in development. The GRIN2B gene encodes GluN2B, which is a subunit of NMDA receptors. GluN2B is present in synapses during prenatal development in humans and prenatal and early postnatal development in rodents. However, its expression is diminished and often relocated to extra-synaptic sites in adulthood as GluN2A expression begins and GluN2A-containing receptors are inserted into synapses. This is commonly referred to as the 2A/2B switch. Since symptoms are lifelong despite GluN2B expression decreasing during early development, we hypothesize that pathogenic GluN2B variants cause changes in brain function that persist even after GluN2B itself is no longer strongly expressed. Using a novel rat model of GRIN2B haploinsufficiency, developmental events were examined as potential origins of permanent changes in neurophysiology. The expression pattern of GluN2A in heterozygous GluN2B knockout pups was plotted through early development relative to wild type littermates to compare the timing of the 2A/2B switch. When examining brain slices, knockout pups had a marked decrease in the thickness of the motor cortex.

**New Roles for the COPII Complex in Regulating Phase Transitions of RNA-binding Proteins in Maturing Oocytes**
Presenter: Helsa Thomas
Faculty supervisor: Jennifer Schisa
The regulation of RNA-binding protein (RBP) phase transitions during oogenesis is important for proper function of RBPs in both humans and worms. Our lab recently identified two proteins associated with the Coat Protein Complex II (COPII), SAR-1 and SEC-24.1, as inhibitors of ectopic MEX-3 condensation in maturing C. elegans oocytes. The COPII complex transports cargo from the endoplasmic reticulum (ER) to the Golgi apparatus. We hypothesized that all genes in the COPII complex are required to inhibit ectopic condensation of MEX-3 in maturing oocytes. We tested 7 additional genes associated with the COPII complex using RNAi to individually deplete their expression in GFP::MEX-3 worms. Our preliminary results suggest that a subset of COPII genes are required to inhibit ectopic MEX-3 condensation. We next asked if COPII genes are required to regulate OMA-1 and LIN-41, two RBPs that repress mRNA translation in oocytes. Our results detected a role for COPII proteins in inhibiting ectopic condensation of OMA-1 and LIN-41. Therefore, we asked if the translation of spn-4, a LIN-41 target mRNA, is de-repressed, and our preliminary data suggest spn-4 is de-repressed in maturing oocytes which is known to result in embryonic lethality. We are currently exploring models to determine how this part of the secretory pathway modulates phase transitions of RBPs in maturing oocytes.

**Analyzing the Impact of Tau and Age on Climbing Behavior in Drosophila**
Presenter: Katherine Himmel
Faculty supervisor: Michelle Steinhilb
Alzheimer's disease (AD) is a progressive neurodegenerative disorder associated with memory loss, spatial disorientation, and deterioration of complex thinking. The primary pathological markers for AD are extracellular amyloid plaques and intracellular neurofibrillary tau tangles. Tau promotes microtubule assembly necessary for intracellular transport and is highly regulated by phosphorylation. In diseased states, tau becomes hyperphosphorylated, forms neurofibrillary tangles, and fails to regulate microtubule dynamics. To assess the impact of hyperphosphorylated tau on neuronal networks, the fruit fly, Drosophila melanogaster, is an effective model organism, with gene analysis studies revealing 77% of human disease-associated genes sharing homology with genes in Drosophila. This study employs a behavioral assay, specifically a climbing assay, to observe the innate negative geotaxis behavior in Drosophila that expresses human tau. We hypothesize that the expression of human tau will impair climbing ability in Drosophila, with this decline worsening progressively with age. Consistent with this hypothesis, my results reveal a clear correlation between tau-induced neurotoxicity and diminished climbing performance, with this impairment becoming increasingly pronounced with age. Given the strong parallels between humans and flies, these findings may reveal tau-related pathways to inform drug development efforts.

**Small Flies, Big Clues: Calpain Inhibition to Reduce Tau-Induced Neurodegeneration**

Presenter: Ty Nelson

Co-presenters: Blake Dishaw, Jadelena Truong (Not presenting but helped with project)

Faculty supervisor: Michelle Steinhilb

Alzheimer's disease and other neurodegenerative diseases impact millions of people around the world. These diseases are categorized as "tauopathies" because of the role that abnormally phosphorylated forms of the protein tau play in their progression. The main function of tau is to promote the building and stabilization of microtubule structures. Our lab expresses human tau in the photoreceptor neurons of Drosophila melanogaster, giving an abnormal appearance of the eye called the "rough eye" phenotype. To understand how proteolytic cleavage of tau contributes to toxicity, our lab previously found that genetically reducing the amount of the enzyme calpain suppressed tau-induced toxicity. Calpain cleaves full length (65kD) tau at two sites, creating an intrinsically toxic 17kD fragment that is also found in human Alzheimer's disease patients. This project tests the hypothesis that pharmaceutical inhibition of calpain will be as effective as the genetic suppression experiments demonstrated. We predict that administering calpain Inhibitor I (ALLN; N-Acetyl-L-leucyl-L-leucyl-L-norleucinal: MG-101) to transgenic Drosophila melanogaster lines that express human tau will ameliorate tau toxicity when examined using scanning electron microscopy.

**Quantifying Tau Toxicity: Flynotyper-based Analysis of the Rough Eye Phenotype**

Presenter: Josie Staven

Co-presenters: Ty Nelson, Jadelena Truong, Blake Dishaw, Cooper Allers, Logan Douglas, Michelle Steinhilb

Faculty supervisor: Michelle Steinhilb

Alzheimer's disease (AD) affects more than 55 million individuals worldwide, and its prevalence continues to increase in the absence of an effective cure. AD is the most common tauopathy, a class of neurodegenerative diseases characterized by abnormal phosphorylation and aggregation of the microtubule-associated protein tau. Normally, tau stabilizes microtubules, which are essential for intracellular transport and neuronal signaling. The Steinhilb lab uses Drosophila melanogaster, the common fruit fly, to study molecular mechanisms underlying tau dysfunction. The expression of human tau in Drosophila retinal cells serves as an excellent model system to assess neurodegeneration, particularly given the conservation of two key enzymes implicated in disease: tau kinases and the cysteine protease calpain. Previous work has established that genetic reduction of calpain and tau kinase expression results in a corresponding decrease in tau-induced neurodegeneration. This study tests whether pharmacological inhibition of calpain and tau kinases can similarly reduce tau toxicity in transgenic flies. We hypothesize that feeding kinase and calpain inhibitors will improve fly retinal integrity as assayed using an unbiased software platform. Flynotyper analyzes retinal organization to generate a phenotypic score based on the severity of tau-induced toxicity. This approach evaluates potential therapeutic strategies targeting tau toxicity in AD.

## Biology

### Impact of Zinc on Antibiotic Resistance Transfer in Escherichia coli

Presenter: Sarah Gardner
Faculty supervisor: Gregory Colores

Antibiotic resistance is an ongoing public health concern that leads to ineffective treatment options for bacterial infections. Bacteria can gain this resistance through conjugation, a process in which two bacteria have direct contact with each other and transfer plasmid DNA containing genes leading to resistance. One method being investigated that has been shown to reduce the transfer of antibiotic resistance is through the use of supplemental zinc. Findings to date, however, have been inconsistent, possibly due to differences in bacterial strain, bacterial species, and form of zinc used. My project investigates the effect of zinc form and concentration on antibiotic resistance plasmid transfer in Escherichia coli. I mixed a donor strain resistant to kanamycin and a recipient strain resistant to nalidixic acid at a 1:2 ratio. I supplemented the cultures with zinc gluconate, zinc picolinate, and zinc bisglycinate at concentrations of 0.1 mg/mL and 0.25 mg/mL. Results show that with increasing zinc picolinate concentration, there is a decrease in the transfer rate of antibiotic resistance genes. These findings suggest that zinc supplementation may influence antibiotic resistance transfer in E. coli. Targeted use of zinc compounds may offer a promising strategy for mitigating the spread of antibiotic resistance in bacterial populations.

### Enhancing Mosquito Surveillance and Environmental DNA (eDNA)

Presenter: Carter Hebert
Faculty supervisor: Michael Conway

This project was designed to develop a novel mosquito surveillance method that can be used to supplement conventional methods and enhance sensitivity of detecting rare species, which may slow the spread of vector-borne disease. Current methods are labor intensive and require significant expertise to identify morphological differences between species. We show here that molecular surveillance utilizing droplet digital PCR (ddPCR) can be an effective tool to identify mosquito environmental RNA (eRNA). Specifically, we tested a panel of semi-field samples obtained from Midland Mosquito Control (MMC) that had known densities of Culex restuans larvae. Field samples were also obtained from Central Michigan University's main campus, the Neithercut Woodland, and the Chippewa Nature Conservancy. Droplet digital polymerase chain reaction (ddPCR) amplitude plots displayed a clear separation in positive and negative droplets and indicated a correlation between eRNA in semi-field samples and larval density. Environmental DNA (eDNA) concentrations were too low to detect, and no field samples were positive for C. restuans eRNA. C. restuans eRNA also declined sharply after one week at room temperature, suggesting that this technique requires high larval density and a cold chain to guarantee detection. Expanding our approach to this project, we hope to have pioneered a research technique that other biologists can utilize to advance mosquito surveillance techniques across the entire planet.

**Sweet but Dangerous? How Dietary Sugars Influence Streptococcus Mutans on Canine Teeth**
Presenter: Autumn Lowe
Faculty supervisor: Michael Conway
Dietary sugars play a key role in dental caries by promoting the growth and activity of Streptococcus mutans, a cariogenic bacterium. This study examines how varying sugar concentrations influence S. mutans behavior on canine enamel. Samples were exposed to low and high-sugar conditions to model different dietary environments. Bacterial growth, biofilm formation, and acid production were measured as indicators of cariogenic potential. Higher sugar levels increased S. mutans growth, biofilm development, and acid production, while low-sugar conditions reduced bacterial activity and biofilm formation. These findings suggest that increased sugar exposure may elevate the risk of dental disease in canines. This study highlights the importance of dieting in oral health and supports limiting sugar intake to help prevent dental diseases, and is an in vitro model for human health.

**Analysis of Copine C Protein Interactions Using GFP-Based Immunoprecipitation in Dictyostelium**
Presenter: Emily Gridley
Faculty supervisor: Cynthia Damer
Copine proteins are calcium-dependent, phospholipid-binding proteins that regulate diverse signaling pathways and developmental processes across eukaryotes. In Dictyostelium discoideum, six copine genes (cpnA–cpnF) have been identified, with Copine C (CpnC) implicated in cell adhesion and streaming during early development. Previous studies demonstrated that cpnC knockout cells exhibit impaired adhesion, disrupted streaming, and reduced levels of the cAMP phosphodiesterase RegA, suggesting a potential role for CpnC in cAMP-mediated signaling pathways. Because ERK2 regulates RegA stability through phosphorylation, this study aims to determine whether CpnC interacts with ERK2. To test this hypothesis, GFP-tagged CpnC constructs will be expressed in Dictyostelium cells and subjected to GFP-based immunoprecipitation. Co-precipitation of ERK2 will be assessed using SDS-PAGE and western blot analysis. Detection of ERK2 in GFP-CpnC immunoprecipitates would support a functional interaction between these proteins and provide insight into the molecular mechanisms by which CpnC regulates adhesion and developmental signaling. This work will contribute to a broader understanding of copine-mediated signaling processes relevant to both model organisms and human disease.

**Acute Stress Disrupts Brain Redox Homeostasis in a Cichlid fish**
Presenter: Farjana Chamily
Faculty supervisor: Peter Dijkstra
Stress increases metabolic activity in the brain, elevating the production of reactive oxygen species, which are typically buffered by antioxidant systems to maintain redox homeostasis. However, how animals cope with acute oxidative insults while preserving redox balance is relatively unknown. Using Astatotilapia burtoni, we examined temporal changes in brain oxidative status following an acute stressor. Individually housed males were exposed to 3 minutes of air exposure and sampled at 15-, 30-, and 60-minutes

post-stress. Acute stress did not affect malondialdehyde (MDA, a marker of lipid peroxidation) or superoxide dismutase (SOD, antioxidant enzyme) at any time point. However, antioxidant capacity, measured as the ratio of reduced to oxidized glutathione, showed a significant interaction between treatment and time, with air exposed males showing increased oxidative stress at 60 minutes post-stress. Interestingly, stressed males with high gonadosomatic index (GSI) had significantly lower MDA and higher SOD. These findings indicate that stress disrupts brain redox homeostasis, but individuals with high GSI can regulate oxidative defenses to maintain redox balance.

**Associations of Temperature and Species Richness at the Neithercut Woodland**
Presenter: Elizabeth Martin
Co-presenter: Jessica Brosky
Faculty supervisor: Thomas Gehring
Climate, particularly temperature, is one of the most important abiotic factors in shaping ecosystem community structure. It determines species distributions, biodiversity, and overall community composition. As global temperatures are projected to rise substantially in the coming decades, establishing baseline data on local wildlife communities is important for detecting future shifts in species presence, abundance, and seasonal patterns. Long-term monitoring allows researchers to identify changes that may be associated with climate-driven responses, such as shifts in phenology or community composition. The objective of the study is to understand how community composition and wildlife activity change in response to temperature fluctuations within a mid-Michigan woodland habitat. This project is part of an ongoing long-term monitoring effort to document changes in local wildlife communities. We hypothesize that wildlife activity and species richness will increase with temperature up to an optimal range, where once it enters the upper or lower limits of that temperature range, species richness and activity will decrease. To determine community composition and activity patterns, trail cameras and autonomous recording units (ARUs) were deployed at six locations throughout the Central Michigan University Neithercut Woodland. Wildlife detections will be analyzed in relation to daily mean temperature.

**Exploring the Role of p38a in Rapid Cold Hardening and Cold Tolerance in Drosophila Melanogaster**
Presenter: Gabriella Nixon
Faculty supervisor: Jonathon Kelty
Temperature stress is a major factor affecting survival in ectotherms such as Drosophila melanogaster. One important response is rapid cold hardening (RCH), where brief exposure to mild low temperature increases tolerance to subsequent cold stress. RCH occurs without intercellular (neural, paracrine, or endocrine) signaling, although the underlying cellular mechanisms remain unclear. Stress-response pathways such as p38 MAPK may be involved. This study tests whether flies lacking the p38a isoform exhibit RCH compared to wildtype flies expressing p38a.
Flies were reared under controlled conditions at 23°C with a standardized light: dark cycle, aged to 5 days, and then subjected to one of six treatments: (i) maintained at 23°C, (ii) exposed to 1°C for 90 min, (iii–iv) exposed to -5°C or -6°C for 90 min, or (v–vi) exposed to 1°C for 90 min followed by -5°C or -6°C for 90 min. Survival was assessed

24 h after treatment, with flies categorized as alive, moribund, or dead based on movement and righting response.
Data collection is ongoing, but preliminary results indicate genotype-dependent differences in both baseline cold tolerance and RCH response.

**Assessing and Enhancing Campus Pond Ecosystems: A Pond Management Plan for Central Michigan University**
Presenter: Alexander Hyma (BIO)
Co-presenters: Jacob LeCaptain, Lashawn Perkins, Kyle Reynolds
Faculty supervisor: Kevin Pangle
Campus ponds at Central Michigan University (CMU) represent underutilized aquatic ecosystems with significant potential for ecological, recreational, and educational value. Our project evaluates the health of four of these ponds currently acting as drainage features to develop a data-driven pond management plan. We assessed and sampled fish, zooplankton, and macroinvertebrate populations, as well as vegetation and water quality to characterize overall ecosystem conditions. Zooplankton analysis revealed substantial diversity across all sites. When examining fish populations, we found that bluegill populations were overabundant and consisted of stunted fish, suggesting that conditions in these ponds are preventing the fish from reaching a healthy size. Water quality analysis indicated elevated nutrient levels, including very high concentrations of ammonium and total phosphorus, which is consistent with eutrophic conditions. Based on these findings, we recommend the introduction of a predator species to regulate bluegill populations, along with habitat improvements to support more resilient ecosystems. Together, our results inform a pond management plan aimed at improving ecological health and enhancing the value of these ponds for the university community.

**The Arc of GRIN2B Haploinsufficiency, A Synaptic Plasticity Protein Story**
Presenter: Melanie Kwierant
Faculty supervisor: Shasta Sabo
There are many genetic factors resulting in neurological disorders whose molecular mechanisms are not yet fully understood. GRIN2B-related neurodevelopmental disorder is associated with autism spectrum disorder and epilepsy. The GRIN2B gene codes for the GluN2B subunit of NMDA receptors, and mutations in this gene can result in symptoms including developmental delay, muscle tone abnormalities, and seizures. NMDA receptors are crucial to synaptic plasticity, where connections between neurons at synapses are strengthened or weakened by AMPA receptor prevalence. The removal of AMPA receptors is triggered by Arc protein, whose expression is downstream of NMDA receptor signaling. With altered NMDA receptor function from GRIN2B mutation; we examined the overall and local synaptic expression of Arc protein using a GRIN2B heterozygous knockout rat model. Western-blot analysis was conducted on homogenate and synaptosome samples. No significant difference in Arc protein expression is found comparing the GRIN2B heterozygous knockout to the wild-type control with both homogenate and synaptosome samples. These results suggest that there may be mechanisms unrelated to overall Arc protein expression resulting in synaptic plasticity abnormalities and gross symptoms associated with GRIN2B-related neurodevelopmental disorder.

**Anthropogenic Impacts on Birds in a Northern Temperate Riparian Corridor**
Presenter: Emily Guiles
Faculty supervisor: Nancy Seefelt
Urbanization is known to degrade habitats, leading to shifts in vegetation assemblages and increased noise pollution. To identify the impacts of these urban factors on resident and migratory birds, this study investigated avian diversity and abundance in relation to vegetation and noise level in a riparian corridor. Bird surveys were conducted using point counts at locations near to and distant from human infrastructure, as defined by distance from paved surfaces. In addition to bird population surveys, ambient noise level (dB) and vegetation surveys were conducted. There were no significant differences in bird diversity and abundance between sites near human infrastructure and distant from human infrastructure, nor were there any correlations between bird diversity and abundance, vegetation populations and noise levels. However, avian community structure and the percentage of non-native plants did differ between sites in relation to human infrastructure. Due to similarities across all locations, this study emphasizes the connectivity within riparian corridors despite anthropogenic factors.

**Studying Protein Modifications to Reduce Disease-Related Protein Aggregates using Fruit Flies**
Presenter: Jadelena Truong
Faculty supervisor: Michelle Steinhilb
Machado-Joseph disease (MJD), or spinocerebellar ataxia type 3 (SCA3), is the most common dominant ataxia, primarily affecting the cerebellum and impairing speech, motor skills, and coordination. The neuropathological symptoms in MJD derive from the abnormal expansion of the DNA bases cytosine-adenine-guanine (CAG), which code for the amino acid glutamine (Q) forming a polyglutamine (polyQ) protein tract that impairs key cellular functions leading to neurodegeneration. The common fruit fly, Drosophila melanogaster, provides an effective model for studying MJD, as it shares similar genes and cellular processing pathways as those in humans. We use two types of genetically modified fruit flies: one with a short, harmless version of the protein repeat, and another with a much longer version that causes clear signs of damage, including loss of pigmentation and the appearance of necrotic (dead tissue) spots. This project focuses on the role of an enzyme named calpain, that has been shown to suppress MJD and tau-induced neuronal toxicity in flies. We tested whether pharmacological inhibition of calpain can suppress MJD-induced toxicity and found promising results with Calpain Inhibitor VI. Demonstrating effective suppression of tau-induced toxicity in Drosophila would represent a crucial step toward developing effective human therapies.

**Assessing Microplastic Content in a Storm Drain System of Mount Pleasant, Michigan**
Presenter: Lindsay Uzarski
Faculty supervisor: Amanda Suchy
Microplastics, classified as plastic particles smaller than 5 mm, are an emerging environmental and health concern. Storm drain systems can transport microplastics to freshwater ecosystems without any filtering; however, catch basins installed in these systems may act as sinks for microplastics. The objective of this project is to assess the

pattern of microplastic content in storm drains and associated catch basins water as it travels through a storm drain system in Mount Pleasant, Michigan. This was done by collecting water and sediment samples from storm drain pipes and catch basins, then identifying microplastics using a dissection microscope. The concentration of microplastics did not display a clear pattern as they traveled downstream through the storm drain system. In most cases, microplastic content was higher in the catch basin than the corresponding pipe, supporting the idea that catch basins act as sinks for microplastics.

**Science Meets Storytelling: A Middle-Grade Book about the Little Brown Bat (Myotis lucifigus)**
Presenter: Emily Klish
Faculty supervisor: Daelyn Woolnough
Despite the impact Science, Technology, Engineering, and Mathematics (STEM) fields have on our lives, public communication of STEM topics remains a major challenge for scientists. Complicated jargon, lack of accessibility, and misrepresentation of data in the media make it difficult for non-experts to decipher complicated STEM concepts. This is especially true for children. This project fuses aspects of STEM and the Arts with the goal of creating an alternative method of scientific communication towards children: a middle-grade chapter book about the little brown bat (Myotis lucifugus) in Michigan. Through analyses of well-loved children's books, collection of literature on the little brown bat, and interviews with chiropterists, a story was crafted using Freytag's pyramid. Targeted towards children in grades 4-5, the book combines scientific information about the little brown bat with fantastical elements that kids know and love. The plot follows a human girl receiving a magic bracelet that transforms her into a bat. She embarks on a journey with a rag-tag group of bats to find a new roost for a colony ravaged by White Nose Syndrome. As the audience delves into the story, they learn about topics such as migration, predation, and human involvement with bats. The book concludes with a detailed back-matter containing additional educational material. Together, this project works not only to teach children about bats but also foster curiosity about STEM in future generations.

## Chemistry & Biochemistry

**NMR Analysis of Riboflavin Under Different Chemical Conditions**
Presenter: Alex Bongiovanni
Faculty supervisor: Anton Jensen
Riboflavin is the biological precursor to the redox coenzymes FAD and FMN, which assist with electron transfer in enzymatic oxidation and reduction reactions. Throughout these reactions riboflavin enters multiple different chemical states. Thus, it is very important to be able to identify riboflavin under different chemical conditions using relevant spectroscopic techniques. In this study, the oxidized, reduced, protonated, and deprotonated states of riboflavin are analyzed by NMR spectroscopy. Additionally, the reducing sugar D-glucose is analyzed in deprotonated and neutral form using NMR spectroscopy because it is used to reduce flavins in some cases. The position of the aromatic and benzyl hydrogens of the flavin shifts in each state.

**Reactivity and Molecular Orbital Calculations of Riboflavin Derivatives**
Presenter: Brylee Borgman
Faculty supervisor: Anton Jensen
Riboflavin (vitamin $B_2$) is an essential biomolecule that acts as a precursor to the enzymatic cofactors flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD) that are involved in a variety of redox reactions in living organisms. The Spartan computer program may be used to calculate molecular orbitals, which assist in understanding reactivity. However, because riboflavin is larger than the Spartan software default of 29 atoms per molecule, Spartan cannot model it. For this reason, theoretical flavins with fewer atoms (that still have the isoalloxazine ring system of riboflavin) were designed and subjected to molecular orbital calculations to give the electronic and orbital energies and symmetry properties of interest in determining the chemical reactivity of riboflavin species. To ease further study, tetracetylriboflavin, a more soluble derivative of riboflavin, was used in various reactions to study how flavins reacts under various conditions.

**Synthesis of Vanillin Through Oxidation of Eugenol**
Presenter: Allison Tewari
Faculty supervisor: Anton Jensen
The demand for a new way to synthesize vanillin from natural sources is on the rise due to the scarcity and low yield of vanilla bean crops. The natural compound eugenol, derived from clove oil, was considered due to its structural similarity to vanillin. Oxidation of eugenol in water-based cobalt was found to be unsuccessful at making vanillin. Oxidation of eugenol in ethylene glycol: water mixtures, with cobalt without heating was found to also be unsuccessful. However, when heated, the eugenol in ethylene glycol: water mixtures gave a 15 to 1 eugenol to vanillin ratio. Further research optimizing this oxidation will be reported.

**Synthesis of Questiomycin A**
Presenter: Makenzie White
Faculty supervisor: Anton Jensen
Riboflavin, more commonly referred to as vitamin B2, is an essential vitamin to the human body. It contributes to many important enzymatic functions, which are imperative to medicinal research. The structure of riboflavin includes a hydrophobic ring structure and a hydrophilic sugar, which makes it insoluble in most solvents. This insolubility makes it difficult to study how vitamin B2 reacts with other compounds, which proves as an issue for further medical research. The structure of questiomycin A closely resembles that of riboflavin and theoretically reacts in a similar manner. The key difference being that questiomycin A lacks a hydrophilic sugar chain, making it easier to dissolve and study. The purpose of this research is to synthesize questiomycin A and related compounds in order to study their reactivity and compare them to riboflavin. Progress on this synthesis will be reported.

**Developing and Validating a Mobile Spectroscopic Tool for Reliable Nitrate Testing in Local Water Sources**

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.

**Examination and Extraction of Micro- and Nano-Plastics in Water**

Presenter: Maraion Murrell

Faculty supervisor: Dale LeCaptain

The micro- and nano-plastic particles found in foods and beverages have garnered many questions on what the effects of them are on the ecosystem and human health. These micro- and nano-plastic particles have been found in many water bodies around the world, but the health risks of consuming these particles are poorly understood. Looking into the type of plastics in drinking water have revealed many polymers including polyethylene terephthalate (PET), polystyrene, and polyvinyl chloride (Contie 2024). This diversity of polymers raises challenges for detection and removal of polymers, since every polymer exhibits different physicochemical properties and behaviors in aquatic environments. Due to these physicochemical properties, plastic particles show an affinity for water immiscible liquids. Our objective is to assess the concentration and size distribution of plastic particles in water. This will be done by Dynamic Light Scattering (DLS), Thermogramietric Analysis (TGA), and Scanning Electron Microscopy (SEM). We want to help give valuable insight on the development of removal strategies of micro- and nano-plastics in drinking water.

**Synthesis of a Potent Water-soluble/Amphiphilic Antioxidant Dendrimer via Dendron Approach**

Presenter: Fati Haruna

Faculty supervisor: Choon Young Lee

The use of oxygen to generate energy in the mitochondria leads to the formation of reactive oxygen species (ROS) and reactive nitrogen species (RNS), commonly known as free radicals. Additionally, these ROS and RNS can result from exposure to ionizing radiation, cigarette smoke, certain metals, and high oxygen concentrations. When the body is overwhelmed by free radicals, they accumulate, creating a phenomenon called oxidative stress. This process contributes to the development of chronic and degenerative illnesses, including cancer, and cardiovascular and neurodegenerative diseases, as well as aging1.

There are several ways to fight free radicals, using antioxidants generated in the body and obtained through diet and supplements. Unfortunately, many natural antioxidants also behave as pro-oxidants, reacting with transition metal ions in the presence of oxygen and producing more radicals. If antioxidants are water-soluble, they tend to exhibit strong pro-oxidant activity. Conversely, those that do not have a pro-oxidant effect are not water-soluble, limiting their availability in bio-applications. This project aims to synthesize a water-soluble/amphiphilic antioxidant dendrimer with strong radical scavenging activity and no pro-oxidant effects

**Branched Polymers for Dry Proton Exchange Membrane Fuels Cells**

Presenter: Milah Curry

Faculty supervisor: Anja Mueller

While fossil fuels are a dominant energy source, their use releases a significant amount of carbon dioxide and contributes to ongoing environmental concerns. As a result, there is growing interest in sustainable energy technologies, including hydrogen fuel cells, which present a cleaner alternative. Hydrogen fuel cells produce electrical energy from hydrogen while releasing only water as a byproduct. A key component of these systems is the proton exchange membrane (PEM) which facilitates proton transport. Conventional PEMs rely on water and acid to aid proton transport and therefore cannot perform at the optimal operating range of 150 – 180°C. This work focuses on developing a dry, thermally stable PEM synthesized from a fluorinated aromatic branched polymer. To identify the optimal polymer structure, multiple syntheses were carried out with branching levels ranging from 5 to 20 percent. Characterization of the resulting polymers includes gel permeation chromatography (GPC), thermal gravimetric analysis (TGA), and differential scanning calorimetry (DSC). These tests establish molecular weight distribution, thermal stability, and the glass transition temperature, respectively, critical for efficient operation of imidazole groups, which will be attached to the polymer to replace sulfonates as the proton transport medium. Upon polymer optimization, the PEM is fabricated and evaluated to determine its stability and structural properties, critical for long-term performance.

**L-Pop – Dental Adhesive Analysis of Chemical Components**
Presenter: Helena Marietta
Faculty supervisor: Anja Mueller
L-Pop is a dental adhesive that is used as a bonding agent and self performs etching, priming, and bonding all in a one step process. L-Pop directly bonds to dentin and enamel for the simplest procedure for certain dental practices such as crowns and bridges. In order to identify this adhesive's chemical components, the mixture is separated using column chromatography, and different fractions are identified using thin layer chromatography (TLC). The fractions are then analyzed using Nuclear Magnetic Resonance (NMR), and Gel Permeation Chromatography (GPC) collectively. Together, these techniques will allow for the identification of all components of the mixture. With that knowledge, it will be possible in the future to develop an improved self-etch one-step dental adhesive for various dental procedures.

**Increasing the Scale and Scope of the Chemoenzymatic Synthesis of Trehalose using mCherry-tagged Trehalose Synthase Variants**
Presenter: Melanie Hall
Faculty supervisor: Benjamin Swarts
Tuberculosis is a disease caused by Mycobacterium tuberculosis (M.tb) that is difficult to manage and treat. This is due to the structure and composition of the mycomembrane of M. tb. One such component of the mycomembrane is trehalose. Previous research has proven that trehalose analogues can disrupt the mycomembrane. This implies that trehalose analogues have therapeutic potential against tuberculosis. Trehalose analogues can be synthesized chemically or chemoenzymatically. The chemoenzymatic approach increases the speed, scale, and scope of the reaction. The standard chemoenzymatic approach to trehalose synthesis utilizes a trehalose synthase from Thermoproteus tenax called TtTreT. Dr. Swarts hypothesized that adding a mCherry tag to trehalose synthases of different microbial sources would further increase the protein yield and substrate scope of the reaction. The mCherry tag increases protein solubility, which was expected to increase the protein yield. The enzyme active site may vary between microbial sources, which was expected to increase the substrate tolerance. The purpose of this project was to evaluate the yield and reaction scope of three mCherry-tagged trehalose synthase variants as compared to that of TtTreT. The yield was calculated after purification, and was not increased. The scope was evaluated by testing a panel of glucose analogues for conversion to trehalose analogues via the UDP-Glo™ assay. The scope was also not increased as compared to TtTreT.

## Computer Science

**Nyx: A Character-Driven AI Assistant**
Presenter: Gerrion Purnell
Faculty supervisor: Patrick Kinnicutt
While modern AI assistants can generate human-like responses, they are typically limited by short-term context and lack of persistent memory. For my capstone, I designed Nyx, an experimental AI assistant designed to explore how conversational AI systems can achieve greater context awareness, personalization, and interactivity. It

utilizes a custom-built system spanning over 1,000 lines of code. The assistant combines large language models with persistent memory, document retrieval, and external tool integrations to create a more capable and personalized assistant. The system allows users to upload documents, ask questions about their content, and interact with the assistant through a graphical interface. Nyx can also store information about the user, maintain conversational context, and access external tools such as weather services. To evaluate its effectiveness, I compared Nyx with other AI assistants across different queries. Results indicate that Nyx produces more adaptive and personalized responses. These findings suggest that combining personality and tool integration enables a more cohesive and personalized user experience. Future work includes expanding long-term memory capabilities, improving retrieval accuracy, and exploring more advanced personalization strategies.

**Improving MC:BSR User Experience by Providing Tax Calculator Program**
Presenter: Leviah Alma
Faculty supervisor: Wiline Pangle
This project focuses on the design and development of an automated tax computation tool—the MC:BSR-S2 Tax Calculator—for a Minecraft-based government simulation game. In Minecraft: Build Square Reconstruction – Season 2 (MC:BSR-S2), players participate in a structured economy resembling real-world capitalist systems. Each in-game tax period requires Elected Officials to manually calculate property values, incentives, taxable amounts, and economic adjustments for all active Citizens. These calculations currently consume roughly half of an Official's gameplay time and are prone to error. The proposed software streamlines this process by automating tax calculations, organizing property and player data, and reducing repetitive workloads. Academically, this project provides an opportunity to apply software engineering practices, modular design principles, and computational automation methods to a real simulation environment.

**LanguageVerse**
Presenter: Ali Jawed
Faculty supervisor: Sun Qiyu
LanguageVerse is a web-based language learning game designed to help users build basic vocabulary in a new language through short daily word challenges. Many people want to learn a new language, but they often lose motivation because learning vocabulary and grammar can feel overwhelming and difficult to maintain over time. This project aims to address that problem by using gamification and adaptive difficulty to make language learning more engaging and manageable.
In LanguageVerse, users select a language they already know and then learn new words in another language by solving word puzzles in a limited number of attempts. The game tracks user performance and gradually increases difficulty as the player improves, allowing for a more personalized learning experience. The goal is not to replace formal language education, but to help users build foundational vocabulary, improve word recognition, and gain confidence in learning a new language.
By combining elements of educational game design, adaptive learning algorithms, and language acquisition research, LanguageVerse also explores the effectiveness of

spaced repetition and active recall in vocabulary retention. Words will reappear over time based on user performance, encouraging long-term memory retention rather than short-term memorization. Through these methods, the project examines how interactive and gamified systems can improve motivation, consistency, and vocabulary acquisition in language learning.

## Earth & Atmospheric Sciences

### Per-and Polyfluoroalkyl Substances (PFAS) Variation across the Groundwater-Surface Water Interface at a Fish-Rearing Pond in Northern Kent County, Michigan

Presenter: Jackson Moleski
Faculty supervisor: Lawrence Lemke
Per-and polyfluoroalkyl substances (PFAS) are emerging contaminants of concern. PFAS threaten aquatic life and ecosystem health at very small concentrations. In the 1960s, tannery waste containing PFAS was placed in an unlined landfill in Kent County, Michigan, USA. The disposal site is located 3 km (2 mi) away from the Rogue River where groundwater containing PFAS is venting to surface waters. The Michigan Department of Natural Resources (MDNR) operates fish rearing ponds adjacent to the river. The MDNR suspended operations in 2023 in response to PFAS contamination. PFAS were detected in surface water and nearby groundwater monitoring wells. However, there were differences between the species and concentrations of PFAS found in the surface water compared to groundwater. We hypothesized that PFAS partitions from groundwater into sediments as it crosses the groundwater-surface water interface (GSI). To determine how PFAS was distributed across the GSI, we took a 36 cm soil core from the pond directly adjacent to a groundwater spring and analyzed it for 34 PFAS within 6 cm increments to create a vertical profile. Nine different PFAS species were detected. PFAS concentrations generally decreased with depth. Short chain PFAS ($C \leq 7$) were present in higher concentrations than long chain PFAS ($C \geq 8$) near the surface. Because PFAS concentrations are highest near the surface, where organic content is highest, the sediments pose a continuing threat to aquatic ecosystems in the pond.

### Machine Learning Approaches to Estimating Lithium in Spodumene from Color Metrics, Hardness, and Portable XRF Trace Geochemistry

Presenter: Iain Harrelson
Faculty supervisor: Mona Sirbescu
As the use of lithium (Li) in green energy technologies increases, new methods are needed to efficiently and reliably estimate the quality of Li ores. Current Li prospecting methods produce mixed results. However, machine learning could serve as a simple and reliable assessment method capable of processing large amounts of geochemical data. Here we focus on spodumene, the most important Li ore mineral. As spodumene undergoes alteration, its hardness and Li contents decrease as the atomic structure of the mineral is destroyed, and foreign elements are introduced that can cause color changes. These alterations make Li extraction more difficult and expensive. We aim to use machine learning algorithms to estimate the Li contents of spodumene based on its hardness, color, and multi-element trace geochemistry measured with a portable X-ray

fluorescence (pXRF) analyzer. Additionally, we combine the geochemical measurements from pXRF with those from scanning electron microscopy - energy dispersive spectroscopy to identify elements, alteration minerals, and primary inclusion minerals that affect hand sample coloration.
Geomechanical Investigation of Caprock Systems in the Michigan Basin: A Scratch Test

**Study of the Glenwood and St. Peter Formations.**
Presenter: Cailey Treece
Faculty supervisor: Natalia Zakharova
Carbon capture, utilization, and storage (CCUS) is increasingly recognized as a key strategy for lowering atmospheric $CO_2$. In the Michigan Basin, successful deployment depends on understanding the integrity and behavior of reservoir-caprock systems under injection conditions. This study examines two Cambrian-Ordovician units: the Glenwood Formation as a confining layer and the St. Peter Sandstone as a potential reservoir.
To address limits of sparse legacy data and conventional petrophysical methods, this project applies the scratch test, a continuous mechanical profiling technique that measures unconfined compressive strength and elastic properties at high resolution. Using this method on core samples from both formations provides a more detailed geomechanical assessment without damaging the core.
Preliminary results show the Glenwood Formation has notable heterogeneity in strength and stiffness, with localized weak zones that could affect long-term containment. Variations in grain fabric, mineralogy, and diagenesis contribute to this variability, highlighting the need for site-specific seal evaluation. The St. Peter Sandstone displays more uniform properties, though spatial differences should be compared across additional sites.
Integrating scratch test data with mineralogical analysis and refined stratigraphy improves understanding of mechanical variability in caprock systems.

## Engineering & Technology

**Photodegradation Contaminants of Emerging Concern in Aquatic Environments, using Carbon-based Materials**
Presenter: Prosper Anamanya
Faculty supervisor: Itzel Marquez
The persistent presence of contaminants of emerging concern (CECs) in water bodies poses an ecological concern due to its continuous input and potential biological effects. Caffeine is a persistent CEC not efficiently removed in conventional water and wastewater treatment. This study explores the use of carbon-based materials, Activated Carbon (AC), Graphene Oxide (GO), and an AC/GO composite - for the removal of caffeine via adsorption and solar photodegradation. Carbon-based materials were synthesized and tested using 10 ppm caffeine solutions. Degradation was monitored over 4 hours.
Notably, the AC/GO composite exhibited the highest caffeine removal, followed closely by GO, indicating the synergistic and photocatalytic potential of these materials. The results demonstrate promising pathways for caffeine mitigation and open discussions

for future regeneration strategies and mechanistic insights. Further findings will be discussed at the poster presentation.

**Rheological Insights into Ultrasound Gels: Evaluating the Impact of Additives on Flow and Imaging Performance**
Presenter: Brooke Wilcox
Faculty supervisor: Leela Rakesh
Ultrasound gels don’t just carry sound, they need to spread easily, stick to the skin, and stay stable at body temperature to produce clear images. In this study, we tested commercial gels (from Mid Michigan Hospital) and experimental gels with additives, measuring their flow and elasticity at room (25 °C) and body (37 °C) temperatures using viscosity, G′/G″, and tan δ. Our results show that adding functional ingredients, such as sodium chloride or multi-walled carbon nanotubes (MWCNTs), can improve gel spread, stability, and skin contact, which enhances acoustic coupling and imaging resolution. These findings provide guidance for designing next-generation ultrasound gels that are both comfortable and effective for medical imaging.

**Electromagnetic Transfer Case**
Presenter: Brady Tomlinson
Co-presenter: Tyler Boone
Faculty supervisor: Benjamin Ritter
Chippewa Performance is Central Michigan University's competitive off-road racing team, dedicated to designing, building, and racing purpose-built vehicles against teams from across the country. This year, we set our sights on an ambitious engineering challenge to develop a system capable of seamlessly switching our vehicle between two-wheel drive and four-wheel drive in real time during competition. Our journey began with a manual mechanical dog-clutch design, which initially seemed like a straightforward and reliable solution. However, through testing and on-track evaluation, we identified several critical flaws in this approach. It was very difficult to switch during a race and didn't work as seamlessly as we hoped. Determined to find a better solution, we went back to the drawing board. After extensive research and engineering analysis, we developed an advanced electro-magnetic clutch system powered by an onboard alternator and a lithium iron phosphate (LiFePO4) battery pack. This system is paired with a precision-engineered mechanical gear assembly that works with the electromagnetic components to deliver smooth, reliable, and near-instantaneous transitions between 2WD and 4WD modes. The result is a fully integrated drivetrain control system that allows our driver to adapt to changing terrain on the fly without any interruption to vehicle dynamics or race momentum.

## Geography & Environmental Studies

**eBird and Eagles: How Developing Technology Affects Ecological Data**
Presenter: Alexander Hyma (BIO)
Faculty supervisor: Benjamin Heumann
'In the field of wildlife ecology, occurrence data is an extremely valuable tool and can be utilized as a metric to measure population dynamics across large areas. My project aims to analyze how the development and increased use of new technology in

occurrence data records over the past century has shaped how researchers can interact with these databases. To accomplish this, I gathered point data describing bald eagle occurrences in Michigan from the Global Biodiversity Information Facility (GBIF) and performed spatial analyses using Geographic Information Systems (GIS) tools to create a map showing how the occurrence data changes over time, in relation to the development of the eBird program. The map shows three images of the state of Michigan, overlayed with a tessellation of triangles which represent density of eagle occurrences in that specific area. The three images show different time frames in accordance with significant events in the eBird program development and further shows how the occurrence data rises in density exponentially as the eBird program becomes more accessible and more widely used by the public. Along with inset maps providing further detail on locations of interest, as well as a bar graph that serves as a timeline and visual representation on the sharp spike in occurrences recorded, this map aims to show these changes in a way that the average reader can easily comprehend.

## Mathematics

**Volume Computations of Hermitian Quadrics in Complex Projective Space**
Presenter: Joyita Banerjee Ganguly
Faculty supervisor: Debraj Chakrabarti
The calculation of volumes for domains in complex projective space is an interesting problem in Kähler geometry. This poster focuses on the derivation of a closed-form volume formula for a hyper-quadric defined by a Hermitian matrix. We show that this volume is a function of the eigenvalues of the defining matrix, and this function is symmetric in the positive and negative eigenvalues. The explicit formula of the volume turns out to be a rational function of these eigenvalues.

## Neuroscience

**Investigating Expression and Activation of Transcription Factor CREB in the Context of GluN2B Haploinsufficiency**
Presenter: Morgan Mussehl (BCMB)
Faculty supervisor: Shasta Sabo
GRIN2B-related neurodevelopmental disorder results in mutations in the GRIN2B gene encoding GluN2B proteins that are associated with autism spectrum disorder. 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 signaling induces synaptic plasticity and activates a transcription factor, cAMP-response element binding protein (CREB) involved in plasticity. My study investigates the impact of GluN2B haploinsufficiency on the expression and activation of CREB. I performed western blot analysis on brain tissue samples from rats aged P18-P24. The hypothesis of this study is that GluN2B heterozygous knockout rats will have decreased expression and activation of pCREB and CREB compared to the wild type model.

**Narratives of Care: The Human Side of Medicine**
Presenter: Ashlyn Pew
Faculty supervisor: Cynthia Damer
This capstone project exhibits a short film that examines the personal experiences of both patients and practitioners in the medical field. The film will feature 6-8 in-depth interviews detailing real people's experiences with a variety of subjects related to healthcare and medicine. Through hearing these true stories that these brave individuals are willing to share, this project will illuminate the rawness and reality that exists in healthcare. You cannot look at a person and know everything they've been through, everything they've overcome, or what they are still struggling with today, but the more that people are willing to open up about their real-life experiences, the more we will be able to instill empathy, understanding, and respect for others and their stories. This short film seeks to humanize many aspects of medicine – both from the perspective of the practitioner and from the perspective of the patient. These narratives also aim to capture the nuanced realities of this field, as well as to emphasize the physical, emotional, and psychological dimensions that many of us may be oblivious to. The anticipated and desired outcomes of this project include fostering a deeper sense of empathy and understanding regarding the complexities of the healthcare experience from both ends, to educate medical students and practitioners on the importance of communication, kindness, and patient-centered care, and to increase reflection and dialogue centered around the world of health.

**Systemic versus Intrathecal Delivery of Etanercept in Modulating Functional Recovery in Experimental Spinal Cord Injury**
Presenter: Jonathan Hughes
Faculty supervisor: Gary Dunbar
The tumor necrosis factor (TNF) antagonist Etanercept has been suggested to have neuroprotective effects in the wake of spinal cord injury. However, research has yielded mixed results with respect to a systemic blood circulation delivery, or a delivery of the drug directly at the site of injury in the spinal cord (intrathecal). To evaluate the effects of Etanercept on spinal cord injury both systemically and intrathecally, Wistar rats were randomly assigned to one of the following groups: sham surgery, SCI control group, SCI and systemic Etanercept, or SCI and intrathecal Etanercept. All rats in the underwent a laminectomy at level T9, and rats in the latter three groups received 30 seconds of spinal cord compression with a 50g force. Treatment was administered 30 minutes after injury. Using the Basso, Beattie, and Bresnahan (BBB) open-field test, locomotive recovery of the hindlimbs was assessed 3 days post-injury, and weekly for six weeks thereafter. The behavior was scored and rated by blinded individuals, with higher ratings indicating a higher level of motor recovery. This data combined with data obtained from another ongoing project in this lab show that while etanercept outperformed other medications, it had no significant difference from control or saline groups. Evaluation of white and grey matter preservation in the spinal cord is ongoing.

**Evaluating PEG-600 and Photobiomodulation Therapy after Spinal Cord Injury in Male Wistar Rats**

Presenter: Negin Mojarradlangroudi

Faculty supervisor: Gary Dunbar

Spinal cord injury (SCI) causes motor and sensory dysfunction, and there is no effective treatment. Recent studies showed that combination therapies may improve outcomes by targeting multiple pathological mechanisms. In this study, we evaluated Polyethylene Glycol (PEG) and Photobiomodulation Therapy (PBMT) in male Wistar rats after a thoracic compression SCI. Immediately post-injury, 10 µL of PEG-600 was applied to the lesion in the PEG and combination groups, while saline was injected into the control group. PBMT was initiated 30 minutes post-injury and continued daily for seven weeks. Motor function was assessed using the BBB and the horizontal ladder test. BBB scores showed significant group differences (P=0.009), with PEG and PBMT groups demonstrating greater recovery than the combination and control groups from weeks 3–7. The combination treatment did not show any enhancement in motor function recovery and performed similarly to controls. No significant differences were observed in the ladder test. These findings indicate that PEG-600 and PBMT each improved gross motor recovery after SCI, but using them together did not lead to additional benefit.

**The Association between Disordered Eating and Educational Attainment and Employment Status**

Presenter: Carson Clark

Faculty supervisor: Samantha Hahn

Disordered Eating (DE) has well-documented negative health consequences. Impairment from DE may cause deficits in educational attainment and employment status. Furthermore, the negative effects of DE may disproportionately affect low socioeconomic (SES) populations who have less support. However, these associations have not been adequately studied. Therefore, the purpose of this study is to examine the cross-sectional and longitudinal associations between DE and educational attainment and employment status and if SES moderates said associations. Data comes the Project EAT 2010-2023 (n = 994) cohort. Data on unhealthy weight control behaviors (UWCB) and binge eating (BE) was collected at both 2010 (mean age = 14.4) and 2023 (mean age = 27.6). Educational attainment and employment status were assessed in 2023. Regression models were ran, and SES was tested as a moderator in longitudinal models. Results were stratified based on SES. In longitudinal analyses, engagement in UWCB ($\beta$ = -0.355, SE = 0.138, p = 0.010) or BE ($\beta$ = -0.671, SE = 0.248, p = 0.007) during adolescence was associated with reduced educational attainment in emerging adulthood. SES was as a moderator for the longitudinal association between BE and employment status with participants of low SES being more likely to be full-time employed while participants of high SES were less likely to be full-time employed. As such, DE prevention programs targeted towards adolescents may reduce the long-term burden of DE.

**Optimizing PCR Performance: An Analysis of Common Errors and Troubleshooting Strategies**
Presenter: Delaney Ray
Faculty supervisor: Wiline Pangle
Polymerase chain reaction (PCR) is a fundamental molecular biology technique used to amplify specific DNA sequences for analysis. PCR consists of three main steps, denaturation, annealing, and elongating, and is widely used in laboratory experiments to distinguish and compare genotypes of animal models. In addition to genotyping, PCR has broad implications in medical diagnostics and forensic analysis. Despite its wide usage, PCR can produce unreliable results if reaction conditions are not properly optimized. In this study, we examined both successful and problematic PCR outcomes, drawing on data from over 100 samples across more than twelve PCR experiments conducted during the 2025–2026 academic year. Common issues observed included strong primer dimers, missing bands, and absences of detectable DNA. We present strategies for troubleshooting and improving PCR performance based on these observations. Together, these findings highlight common challenges in PCR analyses and provide practical strategies for improving reliability and accuracy in future experiments.

**A Neuronal Cell Cycle Re-Entry Model for the Investigation of Alzheimer's Disease Pathogenesis**
Presenter: Shannon Croad
Faculty supervisor: Kevin Park
Alzheimer's Disease (AD) is the most common form of dementia affecting more than 7.2 million individuals in the United States, with no current treatment due to its unknown cause. The vast majority of studies investigating AD use familial AD mouse models expressing amyloid precursor protein (APP) and presenilin gene (PSEN1 and PSEN2) mutations, while only 1-2% of AD cases are caused by a familial gene mutation. With most cases of AD being sporadic, the mechanistic cause remains uncertain. AD is characterized by multiple pathologies such as amyloid beta (AB) plaques, neurofibrillary tau tangles, and neurodegeneration. A potential pathogenic mechanism is neuronal cell cycle re-entry. Cell cycle is a process by which cells replicate their DNA and divide to produce more cells. Neurons are specialized cells that are terminally differentiated and do not undergo cell cycle. However, studies have shown that cell cycle re-entry is an early event that occurs in AD brains, and precede the varying pathologies and downstream events seen in AD. This project focuses on generating an in vitro AD model of neuronal aberrant cell cycle re-entry from our in vivo model. Our in vitro system will be used to investigate the intrinsic and extrinsic effects of cell cycle re-entry on post mitotic neurons in the context of AD.

**Development of a Genetically Encoded Bioluminescent Sensor for Real-Time Monitoring of Cell Cycle in Cancer Cells**
Presenter: Andrew Kornilov
Faculty supervisor: Eric Petersen
Retinoblastoma protein (RB) is a master regulator of the G1/S cell cycle transition. RB triggers S-phase entry upon phosphorylation by Cyclin-Dependent Kinases, thus

making it a critical component of cancer biology. Current methods for quantification of RB phosphorylation for basic research in cancer models typically require lysing cell samples, which prevents real-time longitudinal studies. We have developed a novel Bioluminescent Kinase Sensor (BlinKS) to monitor RB phosphorylation states in living cells.
The BlinKS-RB design utilizes a split-luciferase system, an RB-derived phosphorylation substrate sequence, and a phosphor-amino acid binding domain (PAABD). Phosphorylation of the RB substrate results in its binding to PAABD, bringing together and reconstituting the split luciferase, allowing the enzymatic reaction of the luciferase to produce bioluminescent light.
Preliminary testing in HEK293 cells has shown the sensor to be functional; treatment with a pan-CDK inhibitor, Flavopiridol, resulted in decreased bioluminescence compared to untreated controls that were actively dividing. Though initial variants show some success, troubleshooting and optimization efforts are focused on improving the sensors further to increase the signal-to-noise ratio and total bioluminescent output. The final version of this sensor will provide a tool for high-throughput tracking of cell cycle dynamics and drug screening in real time.

**Development and Validation of a Bioluminescent Kinase Sensor for Real-Time Detection of Focal Adhesion Kinase (FAK) Activity in Living Cells**
Presenter: Sasanka Samarathunga
Faculty supervisor: Eric Petersen
Focal adhesion kinase (FAK) is a key regulator of cell adhesion, migration, and survival, and its dysregulation is strongly linked to cancer progression and metastasis. This project aims to develop and validate a bioluminescent kinase sensor for real-time detection of FAK activity in living cells by monitoring phosphorylation of the downstream target Paxillin at tyrosine 118. The sensor is based on a genetically-encoded split luciferase design containing a phospho-binding domain and a FAK-responsive substrate sequence, enabling light emission in response to FAK activity. Following transfection into HEK293 cells, luminescent output was measured under conditions of FAK activation and inhibition to assess sensor responsiveness and optimize construct performance for reporting cell adhesion signaling. To validate that the bioluminescent signal reflects endogenous FAK activity, parallel ELISA assays were performed to quantify phosphorylation of FAK at tyrosine 397, a well-established marker of FAK activation. By combining live-cell bioluminescence recordings with biochemical validation, this study seeks to establish a dynamic and sensitive approach for monitoring FAK signaling. A successful system will provide a useful platform for studying adhesion-dependent signaling mechanisms and for evaluating therapies targeting FAK in cancer.

**Combination Therapy of KIF23 siRNA and Temozolomide Delivered with G4 70/30 PAMAM Dendrimers Enhances Antitumor Activity in Human Glioblastoma Cells**
Presenter: Mikhil Das
Faculty supervisor: Julien Rossignol
Glioblastoma (GBM) is the most common and deadly form of brain tumor, with a dismal prognosis due to the treatment resistance of glioma stem-like cells. The regulation of

the KIF23 protein during cytokinesis is often dysregulated in GBM cells, contributing to the tumor's treatment resistance and proliferation. Consequently, KIF23 is a target for GBM therapies.
The efficacy of delivering KIF23 siRNA and temozolomide (TMZ) using G4 70/30 PAMAM dendrimers was evaluated on U87 glioblastoma cells in vitro. Cells were treated with KIF23 siRNA, TMZ, both combined, and Lipofectamine (control). The viability of the cells was measured using the MTT assay, migration was evaluated using wound healing assays, and the expression of the markers for migration, stemness, and apoptosis was measured with Western blot assays.
The combined treatments of KIF23 siRNA and TMZ significantly reduced the viability and migration of U87 GBM cells. Western blot analysis revealed that the combined treatments downregulated the expression of migration and stemness markers and upregulated the markers for apoptosis.
The silencing of KIF23 enhances the sensitivity of GBM cells to TMZ and downregulates the markers necessary for the survival of GBM cells. Thus, using PAMAM dendrimers to deliver KIF23 siRNA and TMZ presents a promising strategy for the treatment of GBM.

**Direct Brain Delivery of G4 70/30 PAMAM Dendrimers via the Nasal Route in C57BL/6 Mice**
Presenter: Avery Elmhirst
Faculty supervisor: Julien Rossignol
The blood-brain barrier (BBB) remains an obstacle to effective therapy for neurological disorders, despite drug delivery strategies being explored. Among new solutions, nanoscale carrier systems, particularly intranasal delivery, have shown promise as a non-invasive route that bypasses systemic circulation and reduces peripheral side effects. PAMAM dendrimers, highly branched macromolecules capable of encapsulating and transporting therapeutic agents, are well-suited for this approach, having demonstrated the ability to traverse the BBB via the olfactory nerve pathway.
This study evaluated the in vivo impact of intranasally administered PAMAM G4 70/30 dendrimers on the brains of C57BL/6 mice. Male (n=6) and female (n=6) cohorts received daily intranasal doses of CY5.5-labeled dendrimers or HBSS (control) for three weeks. Dendrimer distribution was monitored weekly via In Vivo Imaging System (IVIS), and harvested brain, lung, liver, and kidney tissues were analyzed using fluorescence microscopy. Results revealed significant accumulation in the brain, liver, and kidney, with male mice exhibiting higher accumulation than females, confirming that intranasal administration effectively facilitates dendrimer delivery to the brain.
These findings support intranasal delivery as an efficient, minimally invasive strategy for CNS targeting, and highlight the potential of G4 70/30 PAMAM dendrimers as carriers for small molecules or gene therapies aimed at treating neurological diseases.

**Targeting Glioblastoma via Co-delivery of Kif23 and Kif18a siRNAs Using G4 70/30 PAMAM Dendrimers**
Presenter: Nadia Allahyarzadeh Khiabani
Faculty supervisor: Julien Rossignol
Glioblastoma (GB) is the most aggressive primary brain tumor in adults, marked by rapid proliferation, therapeutic resistance, and poor prognosis. Overexpression of

kinesin motor proteins such as Kif23 and Kif18a contributes to tumor growth, survival, and invasion. Small interfering RNA (siRNA) offers a targeted approach to silence these genes, but clinical use is limited by instability, poor cellular uptake, and off-target effects. Fourth-generation (G4) 70/30 poly(amidoamine) (PAMAM) dendrimers provide a promising delivery platform, enhancing siRNA stability and cellular internalization. This study evaluates co-delivery of Kif23 and Kif18a siRNAs using G4 70/30 PAMAM dendrimers. Stable dendrimer–siRNA complexes formed at an N/P ratio of 1.5:1 and showed minimal toxicity in astrocytes. In GL261 glioma cells, co-delivery significantly downregulated BCL2 and upregulated BAX, indicating apoptosis. Migration was markedly reduced, with decreased expression of MMP2, MMP7, and MMP9. In vivo, an orthotopic GB model was established using GL261/luc2-tdtomato cells, with tumor growth confirmed by IVIS imaging. Intracranial administration of siRNA-loaded dendrimers improved survival and modulated markers of proliferation, apoptosis, and migration without affecting stemness. These results highlight G4 70/30 PAMAM dendrimers as an effective platform for targeted siRNA co-delivery in GB.

**Knockout of Cell Signaling Pathway in Hypoxia induced Human Primary Astrocytes using CRISPR/Cas9**

Presenter: Zainab Naaz
Faculty supervisor: Julien Rossignol

Hypoxia following ischemic injury induces astrocyte reactivity, contributing to neuroinflammation and impaired neuronal recovery. This study examined whether CRISPR/Cas9-mediated knockout of genes in the Notch, GSK-3β, and BMP pathways can alter hypoxia-induced reactive human primary astrocytes. Astrocytes were cultured under hypoxic conditions and transfected with guides targeting Psen1, Gsk3b, and Bmpr1a. Knockout was confirmed by PCR and Sanger sequencing. Hypoxia increased proliferation and GFAP expression, indicating reactivity, while elevated HIF-1α confirmed hypoxic response. CRISPR-treated cells showed reduced GFAP and increased MAP2 expression, suggesting a shift toward a neuron-like phenotype. These findings indicate that disrupting key signaling pathways can modulate astrocyte reactivity and promote neuronal reprogramming under hypoxic conditions, highlighting CRISPR/Cas9 as a potential strategy for reducing neuroinflammation and enhancing regeneration after hypoxic or ischemic brain injury.

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**Intraperitoneal Dendrimer-Progesterone Injections alleviate Behavioral Deficits and Inflammation in MCAo Rat Model of Stroke**

Presenter: Arjun Poudel

Co-presenters: Schwind, S. Uprety, A. Bolen, L., Day, N., King, M., Srinageshwar, B., Looman, C.F., Gross, J., Galvin, B., Shuhag, S.,, Swanson, D., Dunbar, GL., Rossignol, J.

Faculty supervisor: Julien Rossignol

Stroke ranks as the leading cause of long-term disability and the second leading cause of death worldwide. The blood supply to part of the brain is disrupted, depriving brain tissue of essential oxygen and nutrients leading to rapid neuronal death which result in severe neurological impairments, including paralysis, speech difficulties, and cognitive dysfunction. Progesterone has shown potential as a treatment due to its neuroprotective and anti-inflammatory properties. However, its clinical utility is limited by its inability to cross the blood-brain barrier (BBB). To overcome this, we utilized PAMAM dendrimers, which can cross the BBB and deliver progesterone directly to the brain in a middle cerebral artery occlusion (MCAo) rat model of stroke. Rats underwent stroke or sham surgeries, followed by treatment administration, behavioral testing, including the cylinder test, ladder rung test, neurological scoring, and immunohistology tests. Our results showed 39% reduction in stroke volume in MCAo rats treated with the progesterone-dendrimer complex. Additionally, GFAP and IBA-1 expression were decreased in the progesterone-dendrimer treatment group. Behavioral analysis revealed significant improvement in motor coordination. These findings demonstrate that PAMAM dendrimers can effectively cross the BBB and deliver progesterone to the brain. Furthermore, the dendrimers themselves exhibit anti-inflammatory effects, consistent with our previous findings.

**Evaluating Long-Term Host Integration of Optogenetically Modified Mesenchymal-Derived Dopaminergic Neurons in Parkinson's Disease Rats**

Presenter: Hunter Gerow

Faculty supervisor: Michael Sandstrom

Parkinson's disease (PD) is the second most prominent neurodegenerative disease worldwide. PD is idiopathic, yet thought to be characterized by the loss of dopaminergic neurons (DANs) in the nigrostriatal pathway, resulting in a reduction of DANs in the substantia nigra pars compacta (SNpc). Symptoms caused by this depletion of dopamine (DA) are dyskinesia, gait, rigidity, etc. Current therapies offer only temporary symptom relief, stem cell-based interventions hold promise for restoring functional dopaminergic circuitry. One of the most studied preclinical treatments for PD is stem cell transplantation (SCT) that can help restore movement behavior by compensating for or replacing the lost DANs. For my capstone project, I investigate the neurophysiological recovery and synaptic integration of optogenetically modified, mesenchymal stem cell (MSC)-derived DAN transplants in a rat model of PD. Specifically, emphasis is placed on visualizing long-term host-graft synaptic connectivity, axonal projections, and cellular localization using immunohistochemical markers: postsynaptic density protein (PSD-95) for glutamatergic synapses, glial fibrillary acidic protein (GFAP) for astrocytic support, and green fluorescent protein (GFP) for transplant tracing. Our laboratory endeavors, eventually, to use these discrimination techniques to highlight transplanted neuron

integration promoted by key manipulations that can directly activate transplant-derived DANs in the context of swimming.

**Dopamine and Metabolite Release Adjustments after two Months from Converted Mesenchymal Stem Cell-Based Transplants in Response to Combinations of Exercise and Optogenetic Stimulation in a Rat Model of Parkinson's Disease**
Presenter: Isabel Walton
Faculty supervisor: Michael Sandstrom
Stem cell transplantation has emerged as a promising strategy to replace DA neurons in patients with Parkinson's disease. A concern remains as to whether transplanted cells are capable of releasing dopamine in a behaviorally relevant and activity-dependent manner. We hypothesize that intentional exercise-associated stimulation will promote the functional integration of transplanted mesenchymal stem cell (MSC) derived dopaminergic neurons within the dorsal striatum. In this study, a unilateral 6-hydroxydopamine (6-OHDA) PD rat model will be used in combination with transplantation of MSC-derived DA neurons expressing luminopsin LMO3. Animals will undergo controlled swimming exercise with varying degrees of session frequency and coelenterazine (CTZ) stimulation. Dynamic dopamine release will be assessed using in vivo microdialysis during times of rest and active swimming. We will incorporate nomifensine to mildly extend dopamine reuptake and degradation for accurate sample collection of cerebrospinal fluid. We anticipate that combined exercise and targeted graft stimulation will promote behaviorally appropriate, phasic dopamine release and superior motor recovery compared to transplantation or exercise alone. The aim of this study is to further explore if exercise induced and chemoptic stimulation supports behaviorally appropriate phasic dopamine release from transplanted MSC-derived DA neurons, that corresponds with improved motor recovery in a Parkinsonian rat model.

## Physics

**Optimizing the Detrending of TESS Data for the Study of Massive Stars**
Presenter: Anna Modrzejewski
Faculty supervisor: Alexandre David-Uraz
Massive stars, with masses several times that of the Sun, are rare but play an important role in the evolution of our Galaxy. With powerful stellar winds, they shape their surroundings, and at the end of their lives explode as supernovae leaving behind neutron stars or black holes. To understand these endpoints, it's essential to study their lives and physical processes, including rotation, mass loss, and in rare cases, magnetism. While rotation and mass loss are ubiquitous, only about 10% of massive stars exhibit strong surface magnetic fields, as revealed by spectropolarimetric observations. However, such observations are time-intensive and hard to acquire. As an alternative, broadband photometry can be used to detect rotational modulation signals associated with magnetic fields. NASA's Transiting Exoplanet Survey Satellite (TESS) provides high-precision photometric data of a large portion of the sky. TESS' Science Processing Operations Center (SPOC) publicly releases reduced data, but its detrending is optimized for exoplanet detection and may not preserve variability relevant to magnetic massive stars. In this study, I compared multiple detrending methods applied to TESS data and found that rather than optimizing the detrending it's better to

use all 4 detrending methods on each star, letting those results show us the detrending method that best recovers the signal. Future work will include refining these methods to expand analysis to larger samples.

**Anhydrous Proton Exchange Membranes for High-Temperature Hydrogen Fuel Cells**

Presenter: Sithira Samaranayake

Faculty supervisor: Axel Mellinger

A key component of hydrogen fuel cells is the proton exchange membrane (PEM), which facilitates the movement of protons from the anode to the cathode. Current PEMs rely on water and acidic conditions, limiting the operating temperature to 80 °C, while hydrogen fuel cells perform best at 150-180 °C.

This research aims to develop a dry and thermally stable PEM from linear and branched fluoroaromatic polymers with imidazole groups for proton conduction, allowing the PEM to perform at higher temperatures without flooding. The structure and thermal stability of the polymers are characterized using Nuclear Magnetic Resonance, Gel Permeation Chromatography, Differential Scanning Calorimetry, and Thermal Gravimetric Analysis. Synthesis modifications are ongoing to improve thermal performance.

A locally assembled Electrochemical Impedance Analyzer (–100 to 200 °C, 10 μHz to 2 MHz), validated with lab-made and standard membranes, alongside a Dynamic Mechanical Analyzer, will assess electrical and mechanical properties.

We will present structural, thermal, conduction, and mechanical data for a linear polymer membrane, outlining preliminary structure–property relationships and strategies to enhance stability for high-temperature PEM applications.

**Neutron-Activated Production of Chlorine-36 for Mass Spectrometry Applications**

Presenter: Mosammath Fahmida Akter Chowdhury Eva

Faculty supervisor: Matthew Redshaw

The precise measurement of atomic masses can contribute to tests of fundamental physics principles, including Einstein's mass-energy equivalence relation $E = mc^2$. It also helps in nuclear physics studies of β-decay. We report on the neutron-activated production of chlorine-36 (36Cl) for applications in precision mass spectrometry and tests of fundamental physics. Using a neutron howitzer equipped with an Americium-Beryllium source, we irradiated NaCl and KCl samples to induce the reaction. $^{35}Cl + n \rightarrow {}^{36}Cl + \gamma$. (1)

High Purity Germanium (HPGe)γ -ray spectroscopy was utilized to confirm activation via detection of secondary isotopes such as (24Na) and (38Cl). Direct-decay detection of (36Cl) was conducted with a Liquid Scintillation Counter (LSC) to independently verify production yields. If sufficient (36Cl) is synthesized, high-precision mass measurements will be carried out at the FRIB LEBIT facility using a Penning trap to test the mass-energy equivalence relation, $E = mc^2$. This work contributes to advancing nuclear reaction studies and precision tests of fundamental constants.

## Statistics, Actuarial & Data Science

**Exploring Dietary Patterns and Predicting Prediabetes Status using Machine Learning Models on NHANES Data**
Presenter: Grace Osiri
Faculty supervisor: Chin-I Cheng
Prediabetes is a metabolic state in which blood glucose levels are elevated above normal but below the diabetic range. Affecting approximately 96 million U.S. adults, with over 80% remaining undiagnosed, prediabetes increases the risk of several health complications. While dietary patterns have been linked to diabetes risk, most existing research focuses on Type 2 diabetes and traditional statistical methods that may overlook complex dietary patterns.
This study uses data from the 2017–2020 National Health and Nutrition Examination Survey (NHANES) and deploys survey-weighted statistical methods and machine learning models, including logistic regression, principal component analysis, LASSO, random forest, and XGBoost. Model performance is evaluated using Accuracy, Precision, Recall, F1 score, and AUC. Results identify key dietary, demographic, and anthropometric factors that lead to an increased risk of prediabetes and include predictive models for prediabetes risk. These outcomes could be utilized to develop interventions to address this growing health concern.

**From Bias to Balance: A Data Driven Approach to Fair Recruitment Practices**
Presenter: Hairu Fan
Co-presenter: Shiyuan Wang
Faculty supervisor: Ahmet Ugur
Artificial intelligence (AI) is gaining wider usage in hiring, from resume screening through candidate evaluation. Though such systems hold out the promise of efficiency, they also understandably generate recurrent doubts about fairness and bias. This work addresses these doubts by presenting a diagnostic framework for detecting bias in AI-powered hiring. The framework combines three stages: (1) descriptive analysis of demographic distributions, (2) statistical testing of group outcome disparities, and (3) model-level fairness metrics, including selection rates, true positive rates, and false positive rates. With three extensively researched datasets: Adult Income, Job Salary, and COMPAS, this work demonstrates that gendered differences persist. Results demonstrate steady salary outcome gaps and differential error rates across demographic groups despite standardized preprocessing. These demonstrate that automated hiring tools without fairness checks threaten to escalate workplace inequalities. Proposed here is a structured and reproducible method to detect algorithmic bias that will help both researchers and users promote fairness and accountability in hiring systems.