Abdekhalek, Mustafa; Al Adawi, Salim; "Survey of Highway-railroad Grade Crossing (HRGC) Safety and Challenges in the State of Kentucky" (Kirolos Haleem)
In response to the relatively limited studies regarding road users' safety near highway-railroad grade crossings (HRGCs) in the southeast of the United States, this Kentucky Transportation Cabinet (KYTC)-sponsored research took the initiative and aimed to identify the main concerns and difficulties encountered by Kentucky residents when navigating HRGCs through an online survey. The survey contained 32 questions categorized into four different topics: socio-demographic, driving-related, HRGC-specific, and HRGC safety concerns and recommendations. The research team used different methods to distribute the survey. These methods have included flyers with a QR code placed around the WKU campus, emails sent to groups of students, and social media postings by KYTC (e.g., Facebook and Instagram). Around 120 responses have been obtained thus far, and the survey is still active and its deadline is February 28, 2025. From the preliminary analysis, the primary HRGCs' challenge is the lack of drivers' knowledge and understanding of the specific signs and messages around HRGCs. The results of this study will provide the Kentucky Transportation Cabinet with valuable information that can be used to improve the geometric design of HRGCs and road users' safety when traversing HRGCs.

Abrams, Abigail "Sustainable Lighting on Modern Structures and the Methods Used to Bring Artistic Elements to the Forefront of Sustainable Lighting Design" (Shahnaz Aly)
Sustainability in architecture is a broad subject that has been gaining popularity across the globe for the past three decades. While sustainable technologies are heavily researched, more specific methods in which sustainability blends within a building are infrequently studied. In particular, the way sustainability is integrated into the lighting design of buildings is a topic receiving limited attention from architects and researchers alike. This paper and project explore the methods modern architects use in establishing a design-centered lighting system throughout a building that reflects a new age of building materials, sustainable technology, and construction practices. Using architectural documentation, newspaper articles, secondary literature, and primary research collected across Berlin, Germany and Rome, Italy, this paper follows patterns in successful designs across multiple sustainable buildings and how to integrate them into lighting systems in newly designed buildings. The conclusions found in this paper and project show the importance of understanding the evolution of architectural design as it pertains to lighting as the growing need for sustainable living and working spaces becomes present. These conclusions are used to integrate sustainable lighting technologies into the design of an art museum proposed in Louisville, KY.

Adams, Ally "Optically Remaining: Residues of Life" (Yvonne Petkus)
Optically Remaining: the Residues of Life – Painting-based Research. This paper will exhibit and discuss findings from my FUSE-supported research, a painting series titled "Optically Remaining: The Residues of Life". The project has been structured in three parts, a photobooth, sketches and reflections, and the final, large-scale portrait-based paintings, all as an investigation of self-reflecting versus self-assumptions that coincide in public to reflect how a personality can be found in a two-dimensional, painted moment and in my memory. The self-made photobooth and a short interview process allowed for artistic collaboration with strangers, people with whom I consistently share space despite never fully interacting with them. The sketches followed and helped inform the eight final pieces, a cohesive body of work

developed as a candid glimpse into a modernity that highlights people's presence and impact on the world around them. My larger philosophical and formal questions have evolved too, to reflect perspectives both in and outside my own in the residues of humanity found throughout the process of creating this series of monumental portraits in deconstructed environments.

Adams, Leah; Clarkson, Adasyn; Wood, Michael; Young, Sonia; "Effects of Full PPE on the Balance and Stability of Firefighters" (Sonia Young)
Introduction: Firefighting is a dangerous profession that can result in musculoskeletal injuries. These injuries are commonly caused by falls resulting from disturbances in balance and postural stability. The purpose of this study is to examine the immediate effects of donning personal protective equipment (PPE) on postural stability and balance parameters using the Sensory Organization Test (SOT) performed on the Bertec system in a healthy firefighter population. We hypothesize that the immediate effects of donning PPE will lead to a decrease in equilibrium scores on the SOT compared to baseline measurements without PPE. Methods: Thirty-one full-time, active-duty firefighters aged 18 to 64 will be recruited in this quantitative, quasi-experimental, cross-sectional study with a repeated-measures approach. Following screening and informed consent, participants will complete the following protocol: practice SOT, five-minute rest, pretest SOT without PPE, five-minutes donning PPE, and posttest SOT with PPE. Participants will be assessed pretest and posttest for the dependent variables of the postural stability parameters of the SOT. Results: Descriptive analysis will be performed using demographic data. A one-way repeated measures ANOVA will be utilized to determine the changes from pre/post donning of PPE. Discussion: The study's findings will aid in understanding how PPE affects firefighters' balance.

Adamson, Morgan; Rutledge, Katelin; Polk, Jason; Strenecky, Bernie; "Enhancing Community Recycling Awareness and Participation in Prospect, Kentucky, USA" (Jason Polk)
Recycling is widely accepted as a positive activity that promotes sustainability and environmental protection; however, the associated cost and complexity of modern recycling programs may challenge smaller communities in achieving maximum participation and benefit. The City of Prospect, Kentucky, is a community of around 4,500 residents seeking to improve its environmental footprint through community participation in sustainable activities, with an emphasis on recycling. Currently, Prospect is engaged in a curbside recycling program and is working to determine how to justify the costs of the program with the ability of the community to participate, both logistically and altruistically, for the overall benefit of its citizens and the environment. The goal of this project, through partnership with the City and Rotary International, is to enhance community awareness and participation using surveys, outreach, and community programs development focused on recycling. Residents will benefit from learning more about the overall process, economics, and long-term benefits of their local program to ensure it meets their needs and overall goals as a community. The outcomes is to increase participation, awareness, and overall quality of life through motivating better waste management practices, while exploring the best options for Prospect.

Aham, Victor; Gani, Royhan; "Deep Learning Techniques for Better Geobody Delineation From 3D Seismic Data: A Case Study of the Northern Gulf of Mexico Basin, USA" (Royhan Gani)
Proper delineation of geobody from 3D seismic data is crucial for subsurface investigations and

modeling. Traditionally, experts manually analyze subsurface structures in seismic images by utilizing different seismic attributes. This method, which is both labor-intensive and subjective, poses significant challenges when it comes to defining salt bodies. Advances in machine and deep learning enable automatic geobody delineation, improving accuracy and efficiency. This study examines deep learning for geobody delineation in the Northern Gulf of Mexico Basin with complex salt formations. We propose using CNNs and U-Net architectures to automatically delineate salt bodies from 3D seismic volumes. The model uses transfer learning with pre-trained salt segmentation models from other basins, fine-tuning them on our dataset for enhanced precision. Performance was evaluated through Intersection over Union (IOU), accuracy, and F1-score as well as comparing results with conventional seismic interpretation. The findings show that deep learning significantly improves the speed and accuracy of geobody delineation, capturing subtle geological boundaries often unresolved by traditional methods. Additionally, the proposed approach shortens training time and offers a reusable data-driven model for seismic interpretation. This research contributes to advancements in AI-powered seismic interpretation and its role in efficient subsurface investigation and responsible resource exploration.

Al-Halah, Kendall; Hicks, Emma; Yoon, Young-Jae; "When Loyalty Leads to Blind Conformity: The Role of Member Loyalty, Leader Loyalty, and Leader's Mental Health in Sunk Cost Fallacy" (Young-Jae Yoon) Group loyalty, defined as unwavering allegiance to one's group, is highly valued in organizations for fostering selfless commitment to group interests (Coughlan, 2005). Since loyal members are seen as trustworthy advisors, leaders and decision-makers have been recommended to be advised by them. However, does their loyalty always help leaders make better decisions? This study examines whether loyal members would conform to a leader's sunk cost fallacy—the tendency to persist in a failing course of action despite mounting costs. In an online experiment (N = 200), we measured members' trait loyalty and their responses to a leader exhibiting the sunk cost fallacy. The leader was manipulated as either having mental health issues, being highly loyal to their group, or without additional context (control condition). Results showed that higher loyalty significantly predicted the willingness of members to conform to the leader's sunk cost fallacy, but only when the leader was described as loyal or struggling with mental health. In the control condition, loyalty had no significant effect on conformity. These findings suggest that while loyalty fosters trust, it can also lead to blind conformity under certain leader perceptions.

Ali, Ibrahim "Three-dimensional Metal-organic Framework of Zinc(II) and Histidine" (Bangbo Yan) The enzyme carbonic anhydrase (CA) boasts an incredibly high efficiency in catalyzing the conversion of carbon dioxide into bicarbonate and can be used as an environmentally friendly material for carbon dioxide capture. However, its sensitivity to pH and high temperatures prevents practical applications. In this presentation, we report a new metal-organic framework (MOF)-[Zn(HIS)] (HIS = histidine). The crystal structure of the MOF was determined with single crystal x-ray diffraction. In this structure, there are two types of Zn(II) coordination geometries, one of which has tetrahedral geometry with three nitrogen atoms and one oxygen atom from three histidine ligands, mimicking the CA active center. The other Zn(II) ion has a distorted trigonal bipyramidal geometry coordinating to three histidine ligands.

Anderson, Alexandria "Comorbidity Differences Among Rural and Urban Osteoarthritis Patients" (Natalie

Mountjoy)

Osteoarthritis (OA) is a common chronic disease and is especially prevalent in rural populations. Patients with OA are more likely to have multiple chronic conditions, or comorbidities, which reduce quality of life. This places a larger burden on rural patients, who generally have poorer health and more barriers to healthcare than urban patients. In this study, I hypothesized rural patients would have more comorbidities than urban patients, and that comorbidity types between rural and urban patients would differ. I utilized patient records data (N = 12031) from Med Center Health in Southcentral Kentucky and determined the Rural-Urban Continuum Code (RUCC) and comorbidity amount per patient. Results indicated significance ($p < .001$) in number of comorbidities, with rural patients having more, and significant differences ($p < .00385$) in 4 out of 13 comorbidity types. Correlation tests found significance between OA type, patient diagnosis location, RUCC, and number of comorbidities. These findings suggest that rural patients are impacted by higher numbers of OA comorbidities and certain comorbidity types, meaning stronger public health efforts and healthcare resources for OA are needed in rural communities. Further, determining why these differences exist in rural communities – biologically and culturally – is a vital step in preventative care.

Anderson, Austin "Qualitative Behavior of Solutions to Differential Equations in Abstract Spaces" (Lan Nguyen)

The qualitative behavior of solutions to differential equations mainly addresses the various questions arising from the study of the long run behavior of solutions. The contents of this study are related to three of the major problems of the qualitative theory developed by Henri Poincare and Aleksandr Lyapunov in the late 19th century. These problems are the stability, boundness, and the periodicity of a differential equation solution. The definitions are as follows: stability means how a system responds to a slight disturbance, boundness implies there are restrictions in a system, and periodicity means there is an interval or pattern a solution follows. Learning the qualitative behavior of such solutions is an important part of the theory of differential equations. We model the population of a bacteria type in a patient body as solution subject to a new form of treatment f(t). We look for conditions that the number of bacteria is curbed, i.e. y(t)

Annamuradov, Berdimyrat; Khuzhakulov, Zikrulloh; Terzic, Jasminka; Khenner, Mikhail; Er, Ali Oguz; "Influence of Substrate Temperature on the Morphology, Crystallinity, and Growth Dynamics Of Zr Thin Films Deposited via Pulsed Laser Deposition" (Ali Oguz Er)

Zirconium (Zr) thin films were deposited on silicon (Si) substrates via pulsed laser deposition (PLD) using a 248 nm excimer laser. The effects of substrate temperature and fluence on film morphology, crystallinity, and thickness were studied. X-ray diffraction (XRD) showed optimal crystallinity at 400 °C, with strong Zr(002) orientation. Scanning electron microscopy (SEM) and atomic force microscopy (AFM) indicated increasing surface roughness with temperature, with 3D island formation at 500 °C. Film thickness ranged from 75 to 320 nm, with the thickest films at 100 °C due to limited adatom mobility. At 500 °C, interdiffusion led to zirconium silicide formation at the interface. Computational modeling based on free energy minimization determined the critical thickness for 2D-to-3D transition to be ~1–2 nm, driven by lattice mismatch from thermal expansion. Kinetic simulations showed optimal film quality at 400 °C due to balanced adatom diffusivity, while excessive diffusion at 500 °C promoted 3D island

growth. These results highlight the influence of deposition parameters on optimizing Zr thin films for coatings and electronic applications.

Arnold, Savanna "Resolution of Temporomandibular Joint (TMJ) Sensitivity One Week after Equine Dental Procedures" (Debra Shoulders)

At the time of dental, many horses will present with TMJ sensitivity. After dental equilibration, the resolution of TMJ sensitivity was not well understood. Anecdotal evidence from owners and trainers was our only feedback. Recovery time for resolution was needed for owners to schedule dental prior to shows and other events. Therefore, the aim of this study was to evaluate if TMJ sensitivity decreases one week after the dental procedure.TMJ sensitivity resolves in horses within 7 days of a routine dental procedure. These horses have routine dental as needed therefore, the malocclusions were minor. All horses showed improvement within 7 days. Further study needs to be done to determine when the sensitivity returns. Most horses with WKU TMJ scores of 1 or 2 will resolve the sensitivity within one week post dental procedure. For best results, practitioners should recommend dental procedures no sooner than 7 days prior to a show or other event.

Arugha, Annie "Quantitative Analysis of Antimicrobial B-Defensin Proteins in Bovine Milk Using Liquid Chromatography-Mass Spectrometry" (Eric Conte)

Bovine mastitis, an inflammatory condition affecting the udder tissue of dairy cows, is a significant issue in the dairy industry worldwide. This condition, triggered by physical injury or bacterial infection, can lead to substantial economic losses for farmers. The causative organisms of bovine mastitis are diverse, encompassing both gram-positive and gram-negative bacteria, many of which are highly contagious. The impact of mastitis is enormous. It reduces milk production and compromises its quality, increasing milk discard rates. Additionally, the disease necessitates higher treatment and labor costs, often resulting in premature culling of infected cows. Understanding the cow's innate immune response is crucial to combating this persistent issue. β-defensins, an essential part of this defense mechanism, are the initial barrier against mastitis. However, reported quantitative analysis literature of β-defensins in bovine milk is limited. This study aims to develop a robust analytical method to analyze and measure β-defensins in dairy cow milk by employing Liquid Chromatography-Mass Spectrometry (LC-MS) coupled with advanced sample preparation techniques, such as size exclusion and reverse phase, solid-phase extraction. We seek to enhance our understanding of β-defensins as the first line of defense for mastitis, and a reliable method of analysis is needed to do this.

Asbell, Luna; Isaacs, Savannah; Maddox, Jeremy; "Applying Gaussian Tools for the Study of Physical and Organic Chemistry" (Jeremy Maddox)

Guassian is a Mathematica program designed to analyze the output files produced by Gaussian that describes electronic structure data of a molecule. Using this program, we have created educational tools that will model physical concepts in chemistry. The first tool is an interactive graphical tool used for studying symmetry elements (rotation axes, mirror planes, inversion centers, etc.) of various molecular point groups. Another tool we have created is a graphical representation of functional groups and the key physical characteristics. A model demonstrating conformational analysis for rotations about dihedral angles in alkanes was also created. This will show staggered vs eclipsed conformers of ethane and the

gauche, anti, and syn conformers in 1,2-disubstituted ethane. The next example is a 2D potential energy scan of the dihedral angles in cyclohexane responsible for chair-to-boat-to-chair conversions.

Ashburn, Jamie; Campbell, Canon; Cunningham, Kreyton; "Accuracy of Palpation of the Long Head of the Biceps Tendon in First Year DPT Students" (Penny Head)
Introduction: Palpation is a critical skill for physical therapists, yet accuracy varies among clinicians. Research indicates that palpation accuracy for the long head of the biceps (LHB) tendon is low. Diagnostic ultrasound is commonly used to assess this accuracy. This study evaluates first-year Doctor of Physical Therapy (DPT) students' palpation accuracy of the LHB tendon following a palpation course. Methods: A prospective, cross-sectional cohort study will include 97 first-year DPT students from Western Kentucky University who have passed a palpation course. Participants will be randomly assigned a subject's gender and limb to palpate and mark the LHB tendon using a blunt needle taped parallel over the tendon. Ultrasound will then be used to confirm or deny accuracy of needle placement relative to the location of the long head of the biceps tendon. Results: Percentage of correct palpations will be reported to determine accuracy of palpation of the LHB tendon and then a chi-square goodness-of-fit test will be performed with the data collected. Discussion: Previous studies have assessed LHB tendon palpation accuracy in medical students and clinicians. This study aims to provide insight into the development of palpation skills in first-year DPT students.

Avery, Zoe; Tolbert, Melissa; Cartwright, Kristin; Bruce, Sydney; Loshinskie, Jonathan; Tinius, Rachel; "The Impact of Prenatal Yoga on Hip Mobility and Delivery Outcomes" (Rachel Tinius)
Yoga has been shown to decrease lumbar pain, improve maternal mental health, and improve delivery outcomes. While there are many well-established benefits of yoga, the mechanism by which yoga elicits these improvements is unclear. PURPOSE: The purpose of this study was to test the effect of prenatal yoga on hip mobility and other clinically important outcomes among pregnant women. METHODS: Median hip mobility range was measured via the Thomas Test by physical therapists. Anxiety and depression were assessed via the State Trait Anxiety Inventory Survey and Perinatal/Postnatal Depression Scale, respectively. The randomly assigned intervention was a 6-week prenatal yoga program. After delivery, participants completed a survey on pregnancy outcomes. RESULTS: The intervention did impact on hip mobility (right hip flexion, $p=0.601$; left hip flexion, $p=0.629$)). There was a trending negative correlation between hip mobility and gestation age at delivery ($r=-0.385$, $p=0.085$). There were also trends among mental health variables; the intervention group showed a reduction in anxiety and depression scores while the control group's scores both increased. CONCLUSIONS: Six weeks of prenatal yoga at 2x/week may not have been enough to elicit changes in hip mobility during pregnancy. However, prenatal yoga may still improve maternal psychological status during pregnancy.

Awe, Rebecca; Nee, Matthew; "Understanding the Formation of Atmospheric Aerosols using Molecular Dynamics" (Matthew Nee)
The impact of atmospheric aerosols on air quality and climate change has been of great concern since the 90s. The early records of injury to vegetable crop grown and human respiratory health defects occurred due to an increase in sulfurous aerosols which contributed towards severe air pollution. Compounds formed by the oxidation of sulfur dioxide are major constituent of atmospheric aerosols.

Molecular Dynamics (MD) simulations is a great tool for studying the nucleation and formation of atmospheric aerosols. MD enables us to study intermolecular interactions at an atomic level. This presentation focuses on using the Assisted Model Building with Energy Refinement (AMBER) Software to study the nucleation and formation of atmospheric aerosols under the influence of factors such as temperature. A good understanding of the formation of atmospheric aerosol helps us understand the effects of atmospheric aerosols on radiation, human health, and climate change.

Baird, Jordan; Shea, Ava; "Beyond What Students Value: Investigating Perceived Dislikes in the College Learning Experience" (Lisa Duffin)
Research suggests that students participate and engage in learning when they enjoy and value the learning process (Morano et al., 2021). Recent studies have demonstrated relationships between engagement and teaching quality (Wang, 2024), instructional strategies or activities (Marks, 2000), and classroom modality (Goagoses et al., 2024). Research typically emphasizes what students value in the classroom, but fails to address student's perceived dislikes in the classroom. In this qualitative study, we explored students' perceived dislikes in certain areas of their education: professor traits, classroom experiences, assessment, and classroom modality. Since academic success is positively correlated with retention (Millea et al., 2018; Williams et al., 2018), it is important to understand what students dislike in the classroom in order to increase motivation to learn; therefore, assisting in their ability to reach academic success. The purpose of this study is to determine students' perceived dislikes of college classroom experiences. Findings from this study could provide insight into students' motivation for college classroom learning, and improve student engagement, motivation, and overall academic satisfaction.

Baker, Amelia; Marquardt, Joseph; "Investigating the Ability of an Interspecies Gene to Rescue Shape Control Defects in Budding Yeast." (Joseph Marquardt)
The shape of a cell is critical for the full functionality of that cell in an organism. Normal budding yeast cells have a slightly circular shape. The N-methyltransferase protein Hsl7 is required for yeast to yield this circular shape. Removing this gene results in elongation of yeast cells. A related fission yeast species contains an orthologous gene (SKB1) that does not appear to operate in the same cell shape control pathway. We utilized traditional yeast genetics coupled with fluorescent live-cell microscopy to investigate the ability of this fission yeast gene product to rescue an HSL7 gene deletion phenotype. Despite being nearly 40% identical, Skb1 did not rescue the normal round shape of cells deleted from the HSL7 gene. To examine if this was a localization or expression defect, we utilized two different strategies. When examining proteins tagged with either GFP (green fluorescent protein) or the brighter, more efficient mNeonGreen, Hsl7 but not Skb1 showed normal localization. Western blot analysis leads us to believe that Skb1 may not be expressed, prompting the need to examine the biochemical capacity of Skb1 to function similarly to Hsl7 in budding yeast in the future.

Barkley, Hayden; Woosley, Austin; Patterson, Caitlyn; McPherson, Ashton; "Inter-rater Reliability of Human and Artificial Intelligence Assessment of Student Proficiency in Clinical Documentation" (Ashton McPherson)
Introduction: The expanding use of AI in education and clinical training offers new opportunities for

assessing student performance and documentation. This study examines the inter-rater reliability between AI (ChatGPT-4.0) and faculty assessments of student proficiency in clinical documentation within a Doctor of Physical Therapy (DPT) program. Methods: This prospective, cross-sectional exploratory study will include third-year DPT students at Western Kentucky University who have completed at least one clinical rotation. Participants will complete a SOAP note based on a standardized video orthopedic case from the ICE Learning Center. SOAP is a generalized clinical documentation format highlighting the subjective, objective, assessment, and plan portions of the evaluation. A faculty investigator will assess documentation using a predefined rubric, and compare to AI assessment of student performance using ChatGPT-4.0. Results: Inter-rater reliability between AI and faculty assessments will be analyzed using interclass correlation coefficient (ICC). Discussion: Findings will inform best practices for AI integration in clinical education, potentially enhancing grading consistency and reducing instructor workload. Additionally, the study may provide insights into AI's role in ensuring documentation quality for insurance compliance.

Beck, Brooke "Dental Health for Mental Wealth: A Comprehensive Analysis of the Underexplored Impact of Oral Health and Behaviors on Neurobiology and Psychological Well-being" (Terry Dean)
A review of current research literature was conducted and studies interpreted within the scope of oral health's impact on psychological health and detailing some of the pathways proposed. The literature search was limited to the English language from well-known databases from mostly 2015 to 2025. A few outliers are present to include foundational information. The effects of oral disease and oral self-care behaviors were dissected through a biochemical perspective and furthered using the same psychological measures that relate to emotion, behavior, cognition, social fluency, will, and resiliency. Connections are drawn from the existing, usually separate bodies of research. Some subjective viewpoints contained in this essay result from my academic and employment backgrounds as a Psychological Sciences Alumna and an Expanded Functions Dental Assistant. The behavioral practice of good oral hygiene should be consistent with psychological models of well-being while mitigating the many negative effects of poor oral health care - directly within the mouth and beyond. This could potentially extend to various constructs of life, demonstrating the need for research combining the psychology of well-being and dentistry. More holistic and effective care of an individual may arise from continued study into the dental to mental health connection as it unfolds.

Bentley, Alexander "Using Guanine Derivatives To Ring-open Platinum(II) Tridentate Ligands" (Kevin Williams)
Selected platinum(II) complexes have shown to hinder the formation of cancer growth, similar to cisplatin. Typically, complexes with a triamine ligand can react only with a single guanine; however, we have reacted chloro[2-(4-Methyl-1,4-diazepan-1-yl)ethanamine]platinum(II) chloride, [Pt(L)Cl]+, with guanine derivatives such as guanosine 5'-monophosphate (5'-GMP) and 9-ethylguanine (9-EtG) and have found that at a low pH, two guanines can react and form sterically hindered products. Thus, reactions with 9-EtG will lead to simpler NMR spectra that can be analyzed. At a pH of 4, ([Pt(L)Cl]Cl) with 5'-GMP produces both [Pt(L)(5'-GMP)]+ and [Pt(κ2L)(5'-GMP)2. Using molecular mechanics, [Pt(L)Cl]+ and potential products with 9-EtG have been modeled. Our molecular mechanics results suggest that the tertiary nitrogen cis to the chloride would be the most likely to be displaced by guanines. These results

indicate that [Pt(L)Cl]Cl could react with DNA in a bidentate binding mode (almost identical to cisplatin) under the right conditions.

Bigham, Stephanie; Chelf, Emma; Hagewood, Natalie; Mancini, Anthony; "Examining the Impact of Clinical Instruction on Burnout Levels Among Practicing Physical Therapists: Stressors and Emotional Impact" (Vance Pounders)
Introduction: Burnout among physical therapists (PTs) is increasing due to factors such as loss of personal achievement, emotional exhaustion, and depersonalization in the workplace. This study aims to examine the impact that serving as a clinical instructor (CI) has on burnout levels among practicing clinical PTs. Methods: Using a prospective cross-sectional descriptive survey distributed via email to 1,277 practicing PTs in the United States with a desired response number of 383 completed surveys. The ten-minute survey includes questions about participant characteristics and the Oldenburg Burnout Inventory (OLBI). It will assess their experience as a CI and their burnout levels. Data will be collected through Qualtrics and analyzed for trends and correlation. Results: Descriptive statistical analysis will be used to organize the raw data, identifying trends in burnout levels among PTs. We will then conduct inferential statistical tests, including correlation analysis, independent t-tests to compare burnout between CIs and non-CIs, and one-way ANOVA to examine differences across groups based on setting and years of experience. Discussion: Findings will provide insight into whether clinical instruction contributes to burnout in PTs. Identifying factors that exacerbate burnout can inform future interventions aimed at improving clinician well-being while reducing role strain.

Bizzell, Makayla "Secondary Agricultural Mechanics Instructors Adaptations when Integrating Special Needs Students into the Laboratory Environment" (Thomas Kingery)
The integration of special needs students into secondary agriculture mechanics laboratories presents challenges due to the hands-on nature of instruction and safety concerns. However, inclusion is essential for education and peer interaction. The agricultural mechanics laboratory offers a unique active learning environment that differs from traditional classroom settings in agricultural education. In 2019, the U.S. Department of Education reported that 64.8% of students with disabilities, ages 5–21, received special education services in inclusive classrooms, a substantial increase from 46.5% in 2000 (Cole, et. al, 2021). While inclusion benefits both students and teachers, much of the responsibility for successfully accommodating students with disabilities falls on teachers (Giffing, Warnick, Tarpley, and Williams, 2010). This study aims to examine how agricultural mechanics teachers modify lessons, prepare the physical environment, and implement teaching strategies for special needs students. A Qualtrics survey was distributed across three regions in Kentucky. Findings indicate teachers modify lab spaces, instructional delivery, and curriculum to support inclusion. Strategies include Individualized Education Plans (IEP), differentiated instruction, extended time, guided notes, and peer support. Teachers focus on safety, ensuring students demonstrate proficiency before entering the shop. Some use specialized tools for students with physical disabilities, though significant shop modifications are rare.

Blackledge, Ava; King, Rodney; "Analyzing the Function of A Bacteriophage Gene Toxic to Mycobacterium Smegmatis" (Rodney King)
Antibiotic resistance is a critical global health challenge, with the UN estimating that drug-resistant

infection deaths will surpass cancer deaths by 2050. Bacteriophages offer a potential alternative to traditional antibiotics, which are becoming increasingly ineffective due to resistance. MooMoo is a mycobacteriophage that is genetically distinct from all known phages, exhibiting

Brewer, Abby "Cannabidiol and Exercise: A Systematic Review" (Whitley Stone)
Active individuals are increasingly seeking non-pharmacological options for acute pain, with cannabidiol (CBD) emerging as a promising natural remedy due to its anti-inflammatory properties. Before launching a clinical trial to evaluate CBD's effectiveness in reducing pain associated with physical activity, we conducted a systematic review to assess the current state of research on this topic. Our comprehensive literature search identified 259 unique articles; after a thorough screening of titles, abstracts, and full texts, 13 studies met our stringent inclusion criteria. These studies involved both human and animal models, employed CBD, Epidiolex, or Dronabinol with formal dosing schemes, and provided original research data. Articles were excluded if they lacked an exercise or physical activity component, solely focused on THC, were meta-analyses or reviews, or addressed only physical therapy interventions. This project is significant as it consolidates existing evidence on CBD's potential to alleviate inflammation-related discomfort during or after physical activity, thereby laying the groundwork for more targeted clinical investigations.

Brion, Brandon; Gonzalez, Thomas; Holt, Aubry; Neupane, Shreya; "Effect of Photodynamic Treatment on Survival of Legionella Pneumophila" (Simran Banga)
Legionella pneumophila is a gram-negative aerobic bacterium first identified during a fatal outbreak at an American Legion Convention in Philadelphia in 1976. It is known as a causative agent of respiratory illnesses such as Legionnaires' disease. This study investigated the effectiveness of Photodynamic Treatment (PDT) in inhibiting the growth of Legionella pneumophila. Photodynamic Treatment is the method of using light-sensitive drugs known as Photosensitizers, combined with light to induce bacterial cell destruction. In this study, we used Methylene Blue as a photosensitizer and red-light to expose two different strains of Legionella pneumophila, a wild-type strain and a dotA mutant. The main difference is that the wild-type, Lp02 can establish an infection in experimental models while the dotA mutant lacks the ability to infect. We exposed these strains to PDT and tested the difference in the growth of these strains of Legionella pneumophila. A standard plate count was performed before and after the treatment and the colony-forming units were used to interpret the data. We found that this treatment was effectively inhibited the growth of Legionella pneumophila. In future work, we plan to determine the optimum exposure time for PDT that can effectively limit Legionella pneumophila growth.

Brown, Jamison; Cassity-Caywood, Whitney; "Telehealth Use in Victims' Service Settings" (Whitney Cassity-Caywood)
This study explores the use of telehealth by service providers in Kentucky's Children's Advocacy Centers (CACs) and Sexual Violence Resource Centers (SVRCs) during the COVID-19 pandemic, focusing on differences between licensed and unlicensed providers. These organizations play a critical role in supporting survivors of child abuse and sexual violence, making the effective use of telehealth in these settings especially important. Data was collected through an online survey completed by 118 providers, of whom 88 had used telehealth. The study assessed providers' preparation, usage, and perceptions of

telehealth, including perceived benefits, challenges, and professional impacts. Findings reveal that licensed providers were more likely to engage in formal training and use video-based telehealth, while unlicensed providers relied on phone and email. However, both groups reported low barriers to telehealth and reported opportunities for professional growth. Analysis showed that positive perceptions of telehealth were linked to perceived provider growth, while barriers were associated with negative perceptions. This study includes case managers, advocates, and prevention specialists to provide a broader perspective on telehealth implementation in victim services. This work offers critical insights that can transform how telehealth is utilized in victim services, ensuring that survivors receive the support they need no matter the circumstances.

Brown, Zoe "Exponential Stability Preserving Semi-Discretized Model Reduction for Two Interconnected Strings with a Dynamic Interior Mass" (Ahmet Ozkan Ozer)
We present a coupled partial differential equation (PDE) model for a clamped-free transmission line system consisting of two connected strings with a dynamically evolving interior mass at the junction. Unlike standard lower-order control designs, e.g., (Hansen & Zuazua, 1995; Littman & Taylor, 2002), we introduce a novel higher-order feedback controller at the interface, incorporating angular velocity feedback alongside two velocity-based lower-order controllers. While earlier works have focused more on spectral approaches (Conrad, Morgül, Rao, 1994), our approach is inspired by (Ozer, 2024), where a Lyapunov-based strategy establishes exponential stability with an explicit decay rate. This method provides a cohesive framework for both PDE and discrete approximations. We establish exponential stability by constructing a carefully designed Lyapunov functional, from which decay follows naturally via semigroup arguments. Next, we propose a structure-preserving semi-discrete approximation of the PDE using Finite Differences. This discretization retains the exponential stability of the continuous system as the parameter approaches zero. Using a discrete Lyapunov analysis that mirrors the PDE framework, we prove the semi-discrete system exhibits the same decay rate. These findings will be verified numerically. This work is part of an ongoing Fulbright Research grant, contributing to the broader study of stabilization in transmission line systems.

Brula, Hosamulhaq; Kim, Moon-Soo; Shumway, Rylan; "Novel Diagnostic Application Of Crispr-dcas9 and Graphene Oxide for Sensitive Antibiotic Resistance and Genetic Disease Detection" (Kevin Williams)
The rise of genetic diseases and antibiotic resistance demands rapid, cost-effective diagnostic tools surpassing traditional methods like PCR and cell culturing. Early molecular detection of disease-specific DNA is crucial for timely treatment. At the Kim Lab of Western Kentucky University, a novel method using the DNA-binding nature of deactivated CRISPR-associated protein 9 (dCas9) complexed with fluorescein-labeled single-guide RNA (sgRNA) in conjunction with the fluorescence quenching properties of graphene oxide (GO) was developed. sgRNA strands were designed to target a 20-nucleotide sequence from the tetracycline resistance (tetM) gene. It is predicted that the dCas9-sgRNA complex interacts with GO's surface, bringing fluorophores into its quenching proximity. Upon binding to target DNA, dCas9 undergoes a conformational change, disrupting this interaction and restoring fluorescence, which is measured via a plate reader. With a lower limit of 1 nM of genomic DNA restoring 42% of the fluorescence signal, there is considerable potential in expanding the DNA range to lower levels of sensitivity and becoming highly competitive with other biosensors. This system's versatility makes it

extremely adaptable for diagnosing diverse genetic diseases by merely redesigning the genetic sequence of the sgRNA, paving the way for rapid, personalized medicine with this simple diagnostic tool.

Bryant, Bailey "Emotional Exposure of Method Acting" (Tiffany Bostic-Brown)
Method acting, also known as the Stanislavski Method, is a tool used among actors to create authentic and grounded performances by pulling from their own personal emotional reservoir. When first taking a glance at method acting, it seems simple and easy. In reality, it can be emotionally and physically taxing on the actor, and can even invoke harm to the actor. In this showcase, the project goal would be to analyze the mechanics behind method acting and see the effects in live performance of a scene. I will record a performance - provide visuals of "as if" scenario training, using the script "Stay" by Dagner Kerr Through exercises like de-rolling, packing documents, and script analysis documents, actors will be able to label their circumstances, character emotions, and begin to have an "as if" mindset. With this mindset, they will be able to safely portray the characters with true emotion and give an authentic performance. Method acting is an acquired skill, and it is not meant for every actor. Through this study, inquiring minds will learn of the benefits and repercussions that can be caused by the Stanislavski Method.

Brzezicki, Julia "Understanding the Behavioral Variation of Asian Elephants (Elephas maximus) as an Indicator of Human Elephant Conflict" (Bruce A. Schulte)
Human-Elephant Conflict (HEC) is an increasingly common event that arises from resource competition between humans and elephants. Using a conservation behavior approach, studies of elephant behavioral variation can enhance efforts to mitigate HEC by better predicting which elephants engage in HEC. My project examined the behavioral patterns displayed by Asian elephants (Elephas maximus) in Sri Lanka. I collected demographic, location, and behavior data on adult elephants to determine individual differences in five behavioral categories: Affiliation, aggression, dominance, submission, and social contentment from May to August 2024 at Minneriya National Park in Northeast Sri Lanka. Behavioral observations were conducted by recording state and event behaviors per adult during a 10-minute focal observation period. My main questions were 1) Do individuals differentially display the five behavioral types? and 2) Are these displays consistent or flexible in different environmental gradients as a function of sex, number of vehicles and elephants present, and habitat type? To examine these questions, linear mixed-effect models were utilized for each behavioral category to investigate variation. Understanding what influences an Asian elephant's behavioral type within populations that live in close proximity to human populations is another step towards alleviating HEC in Sri Lanka.

Burrell, MaKayla "A Comprehensive Study of How Indirect and Direct Market Opportunities Influence Consumer Interest for Locally Produced Agricultural Products" (Dominique Gumirakiza)
I will be presenting an oral paper accompanied by a PowerPoint. This study will answer the following questions: (1) Are consumers in South Central Kentucky interested in purchasing locally grown agricultural products? (2) What factors influence their buying preferences? (3) What specific types of local products are most preferred? (4) How can these insights assist local agricultural producers in developing targeted market strategies? As well as to determine the extent to which direct and indirect market opportunities influence consumer interest. And to analyze survey results on consumer interest to

identify how local agricultural producers can effectively market their products to meet consumer needs. Some objectives are: (1) To assess/analyze consumers' interest in purchasing locally grown agricultural products. (2) To identify factors that have a significant impact/influence on consumers' interests in purchasing local ag products (4) How can these insights assist local agricultural producers in developing targeted market strategies? This study is developing and not to a point where survey answers have been analyzed for results.

Burton, Caroline; Watson, Carrigan; Hess, Alaina; Miller, Madison; "Creating Safe Spaces: Evaluating Residential and Day Facilities for Vulnerable Populations" (Shahnaz Aly)
For our senior capstone, we designed facilities to offer therapy services and residential facilities to marginalized groups. These projects consisted of a school that serves Deaf children, a juvenile rehabilitation center for criminal offenders, and two additional rehabilitation centers: one for domestic violence survivors, and one for substance abusers. Each facility's design intentionally optimizes access to services and creates a feeling of safety and community. We researched how visual cues were tied to the psychological sense of safety and created a more accessible means of communication. We incorporated design aspects that reinforce familiarity and a home-like environment. We incorporated universally understood accessibility features in these facilities as they serve a wide range of age groups. We corresponded with individuals with first-hand experience with the typology of the facility that we created. This ensured that they had the proper effect in aiding the individuals who interacted with our facilities. Without access to these facilities and services, these marginalized groups are forced to continue in the situation they are in which has the potential to negatively affect them educationally, developmentally, and emotionally. The lack of proper accommodations could result in a myriad of psychological issues which we combatted through the design of our facilities.

Carden, Mykah; Gani, Nahid; "3D Mineralogy: Teaching in New Dimension of Learning" (Nahid Gani)
This CITL-funded project seeks to modernize and transform the Mineralogy and Petrology course (GEOL 350) by introducing cutting-edge educational strategies designed to enhance student engagement and comprehension. We achieve this by integrating advanced technologies, including a high resolution handheld 3D scanner that enables the creation of detailed 3D mineral models. These models allow students to explore complex crystal structures, habits, and key properties through an interactive and visually engaging approach, significantly enhancing their learning experience. In addition to 3D modeling, we incorporated interactive learning technologies and real-world case studies that connect course content to pressing societal challenges. Students examine issues such as health hazards related to mineral exposure, environmental sustainability in resource extraction, and the critical role of minerals in advancing clean energy solutions. By linking theoretical knowledge to practical, real-world applications, the course fosters critical thinking and problem-solving skills. As a teaching-focused initiative, this project improves instruction and student learning. By integrating innovative pedagogical tools, it not only enhances technical expertise but also prepares students to address contemporary geoscience challenges. It promotes active participation, collaboration, and scientific communication, ensuring that graduates are well-equipped for future academic and professional endeavors. Additionally, it modernizes geoscience education with technology-driven, student-centered learning.

Carter, Grace; Stone, Whitley; "Enhancing Injury Prevention and Management: Developing a Standardized Injury Screening Survey for WKU's Dance Program" (Meghen McKinley)
Collegiate dancers face a high prevalence of injuries, often exacerbated by limited access to medical resources, rigorous training schedules, and reluctance to seek medical care. This study aimed to develop a standardized injury screening survey within Western Kentucky University's (WKU) Dance Program to identify at-risk dancers for the purpose of improving injury prevention and management strategies within the resident dance company. The survey collected data on training load, injury history, pre-existing conditions, risk factors, and recovery practices. By analyzing survey responses, the research identified common themes through use of central tendencies and correlation analyses associated with injury risk. Findings were be used to educate dancers on their survey responses and the correlations unique to their circumstances. Additionally, the survey results support advocacy efforts for increased funding toward medical resources for collegiate dancers and programs. The proactive approach of this research sought to enhance dancer health, performance longevity, and injury prevention strategies within the WKU Dance Program and resident company.

Chafin, Spencer; Suriano, Zachary; "Spatial Analysis of Rain-on-snow Ablation Events in the United States" (Zachary Suriano)
Snow ablation serves as a major contributor to hydrological resources across the world. However, rapid events can lead to a major risk to lives and property, which is particularly amplified during rain-on-snow (ROS) events. This increased threat is resultant of both the rainfall itself onto the snowpack and increased runoff of the snowmelt. This study aims to investigate spatial variability and identify potential temporal trends of events across the contiguous United States. With use of Python, multiple datasets will be compiled to investigate the frequency, spatial variability in magnitude, and notable temporal trends of ROS ablation events. The University of Arizona SWE (UA SWE) dataset provides snow depth and snow water equivalent (SWE) values at a gridded resolution of 4 km. This particular dataset has greater resolution and was built around different interpolation techniques not used in previous gridded datasets. This allows for both more accurate and detailed analysis of snow hydrology. Additionally, PRISM 4 km gridded precipitation and temperature data will also be used in this analysis.

Chapman, Ashleigh "Promoting Black and African Classical Composers In Vocal Studies" (Tiffany Brown)
The inclusion of Black and African Diaspora classical composers in vocal studies is vital for fostering a sense of connection and belonging for students of color. I will demonstrate this through my research on Undine Smith Moore, focusing on her speeches and journey as a woman of color in classical music. I will create a slideshow to highlight her work and experiences, performing one of her pieces to raise awareness of her contributions. Additionally, I will discuss other Black and African composers to show how their stories have shaped music and can enrich the field. By integrating these composers into curricula and repertoires, we not only honor their contributions but also provide students with the opportunity to see their cultural heritage reflected in the music they perform. This inclusion is a powerful tool for promoting diversity and inclusivity, broadening perspectives on classical music. It is crucial for educators, institutions, and performers to prioritize the integration of Black and African composers, ensuring all students feel represented, valued, and inspired in their artistic journeys. Embracing this diversity should be viewed as a cultural responsibility that strengthens the future of

classical music.

Chhabra, Trisha; King, Rodney; "Bacteriophage Gingery, a Novel Mycobacteriophage Isolated from Icelandic Soil" (Rodney King)
Bacteriophages are viruses that infect bacteria, and the bacteriophage population represents the largest reservoir of undiscovered genetic information in the biosphere. This project was conducted as part of the SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) program. The goal was to isolate and analyze a novel bacteriophage from a soil sample collected from Selfoss, Iceland. The newly discovered phage, named Gingery, infects the host Mycobacterium smegmatis, a nonpathogenic soil microbe related to Mycobacterium tuberculosis. After the presence of bacteriophages in the sample was verified, a homogeneous population was generated through several rounds of serial dilutions. The phage particles were then examined under an electron microscope. This analysis revealed that Gingery is a member of the Siphoviridae family of phages. The genomic DNA from Gingery particles was isolated and analyzed by restriction enzyme digestion and gel electrophoresis. The pattern of digestion generated by two of the tested enzymes (HaeIII and DraIII-HF) was unexpected. Our results suggest Gingery is a novel mycobacteriophage. To determine how Gingery relates to other mycobacteriophages, it will be necessary to sequence its genome. Our results show that mycobacteriophages are widely distributed geographically, and this analysis has added to the growing database of characterized phages.

Christensen, Meg "Women's Neighborhood Gym "Haven Fitness"" (Sheila Flener)
Welcome to a sanctuary of strength and serenity—a neighborhood gym designed exclusively for women, where luxury meets comfort and empowerment. Our space transcends traditional fitness environments, creating a warm, inviting atmosphere that encourages every woman to embrace her unique journey, regardless of background or fitness level. Drawing inspiration from the tranquility of a monastery, the interior harmonizes wood tones and natural materials to evoke a sense of home. Sleek, minimal details convey sophistication while softening the overall aesthetic, ensuring that intimidation is left at the door. This design encourages women to engage with their surroundings, inviting them to unwind after a long day and find solace in movement. With a layout that promotes openness and flow, every corner of the gym embodies a nurturing environment, while high-end finishes and amenities reflect a luxurious home-away-from-home. This is a place where strength is celebrated, and the community is fostered, free from the constraints of typical gym culture. Here, we redefine the fitness experience for women, creating a supportive haven where active living is intertwined with holistic well-being, empowerment, and a deep connection to nature. Welcome to your personal retreat—where every visit feels like a step toward strength and serenity.

Cline, Averi; Wininger, Steven; Savage, Savannah; Palummo, Sofia; Williams, Riley; Hunter, Matthew; Cole, Christine; "Performance Anxiety across Sport Categories" (Steven Wininger)
The study's primary purpose is to analyze the difference in performance anxiety across different sports categories using related variables, performance anxiety, and theoretical variables. A theoretically driven performance anxiety inventory (PAIn) was administered to 131 collegiate athletes from various sports and NCAA divisions. Members of the research group email or text them, and after they complete the

PAIn, they have the opportunity to win one of 36 $75 Amazon gift cards. Significant results were found for the categories of team and individual differences in excitement and importance. There was a higher importance and higher excitement for team sports. In addition, there were differences in their cognitive and somatic anxiety. Individual sports reported higher cognitive anxiety days before and higher somatic anxiety days before. Significant results were found for the categories of unlimited versus timed sports were cognitive anxiety and preferences. Timed-limited sports athletes report higher cognitive anxiety. Time-limited sports athletes reported a preference for moderate and high somatic anxiety. These findings showed that there are differences in certain areas of performance anxiety across sports categories. This information can be used by both coaches & sports psychology consultants to better anticipate and meet athletes' mental preparation needs.

Cole, Lynnsey "The Association Between an EEG Biomarker of Language Abilities and Mental Health Symptoms in Survivors of Childhood Traumatic Brain Injury" (Patrick Ledwidge)
Prior research indicates that children who experience childhood brain injury are at higher risk for poorer mental health in adulthood, such as internalizing symptoms (e.g., anxiety, depression). The purpose of this study is to test the hypothesis that childhood TBI survivors with greater internalizing symptoms will tend to have (H1a) smaller N400 event-related potential (ERP) amplitudes and (H1b) poorer verbal reasoning. The sample included 18 childhood TBI survivors between the ages of 18 and 40. Brain activity was recorded using 128-electrode electroencephalography (EEG) while performing a sentence verification task (SVT): participants read an incomplete sentence and then determine if the sentence-ending word (presented after) made sense or not. The N400 ERP, a component of the EEG, is an electrophysiological marker of lexical-semantic retrieval. The Wechsler Abbreviated Scale of Intelligence-IV evaluated full-scale IQ and verbal reasoning, including the Similarities subtest. The Adult Self Report Form assessed the participant's internalizing behaviors. We found no significant correlation between internalizing symptoms and N400 amplitude, $r(17) = .210$, $p = .402$, or Similarities test performance s, $r(17) = .278$, $p = .264$. At this point, internalizing symptoms in adult childhood TBI survivors cannot be explained by verbal reasoning abilities nor its neural correlates.

Coles, Hayden "Leveraging Predictive Analytics to Mitigate Employee Attrition: A Data-Driven Approach to Workforce Retention" (Lily Zhuhadar)
Employee attrition presents a major challenge for organizations, leading to financial losses, operational inefficiencies, and decreased workforce morale. This study utilizes machine learning techniques to predict employee attrition, allowing organizations to identify at-risk employees and implement targeted retention strategies. Using a structured business analytics framework, we analyzed an employee dataset and employed predictive modeling through RapidMiner's auto-modeling feature. The study involved data cleaning, feature selection, and model evaluation, testing multiple machine learning algorithms. The Gradient Boosted Trees model demonstrated the highest accuracy (66%) and recall for predicting attrition. Key factors influencing turnover included job satisfaction, work-life balance, performance ratings, and compensation. Beyond predictive capabilities, this study highlights ethical considerations, such as data privacy and bias mitigation, ensuring fairness in model implementation. The findings offer HR professionals actionable insights to develop proactive retention strategies, improving workforce stability and engagement.

Colvin, Christian; Thompson, Katherine; "The Testimony of Sir Gareth" (Sara Thomason)
The Testimony of Sir Gareth was the opportunity to tell a story larger than anything Katie and I had ever done before. A script that would demand a lot of time and extracurricular learning unlike anything else. Katie, the Production Designer, climbed steep learning curves and solo managed her teams. As for myself I wrote a story about accepting mortality. That the revelation that we all die someday can fall into your lap like an evil macguffin. We can try whatever means possible to deny this very fact of existence but it's all in vain. How I wanted to tell this story was always going to be a large task and having FUSE allowed this project to be made.

Concannon, Isabel "Abstract" (Shahnaz Aly)
This project focused on the design and construction of a sustainable hunting lodge, strategically located in the serene environment of Pegram, Tennessee. The hunting lodge aimed to provide an immersive experience for outdoor enthusiasts, blending rustic charm with modern amenities. The facility has catered to hunters, nature lovers, and families looking to enjoy a secluded retreat in the wilderness. The design incorporated eco-friendly materials and practices, ensuring minimal environmental impact while maintaining comfort and luxury. The lodge itself features private rooms, communal spaces and dining areas. As well as a large outdoor area in the middle for conversation and hanging out. The goals for this project were to provide a place where people from all over could come and stay in a comfortable space, while still being able to hunt and feel in the woods. The main focuses were comfort, blending into the surrounding area, and providing a safe area. For the materials we sourced local oak and hickory, as well as fieldstone for the majority of the building. Accompanied by a solid wood frame, the overall feel of the building is designed to feel right at home in the surrounding woods and not stick out too much.

Conger, Macie "Predicting Uptake Of New Pharmaceuticals Based On Perceptions Of Credibility And Risk Beliefs" (Jacob Byl)
A person's thoughts on the credibility of advertisements about pharmaceutical products, their risk beliefs about side effects of those products and demographic variables are all statistically significant factors when predicting who is willing to get a medical intervention. Being able to use these factors to predict a person's response to receiving a medical intervention is important because it shows how changes in credibility of government and pharmaceutical advertisements impact uptake of new drugs and vaccines, which is important with proposed major changes in federal policies. Our model suggests that perceptions of government credibility explain 30% of the vaccine uptake during the COVID-19 pandemic, so any major drop in credibility will cause a big change in willingness to engage in new medical interventions. Our model predicts that 40% of people would be willing to try a new drug that has been recommended to them by medical professionals, with their perception of credibility of the professionals being the most important predictor, along with risk beliefs about the drug's side effects, age, education, income, political beliefs, and whether they regularly take prescriptions drugs.

Cook, Caroline; Hanel, Marlowe; "Comparing the Performance of the Baltimore and Pratt Truss Bridge Designs" (Kirolos Haleem)
Two truss designs were analyzed: the "Baltimore" and "Pratt" types. The first step in the study involved

building the bridge frames using MDSolids software. This software allowed to add the specific loads at particular joints and calculate the magnitude of compressive or tensile force in each truss member. Two loading scenarios (or two case studies) were used. The first case study involved adding equal loads at the upper joints with the exception of 50% loading at the edges. In the second case study, equal loads were added at the lower joints. For both case studies, the Baltimore truss design consistently allowed for higher magnitudes of axial forces in the truss members compared to the Pratt truss design. When comparing the two loading case studies, it was concluded that loading the lower joints allowed for larger magnitudes of axial forces compared to the upper joint loading. When deciding which truss design to execute, it is important to account for both load and cost requirements. In the case of higher load-carrying demand, Baltimore is the best design. However, if the analyst is looking for a more cost-effective design, the Pratt truss can be the one to consider.

Costa, John "Predicting Hazardous Near-earth Objects Using Machine Learning for Planetary Defense" (Lily Zhuhadar)
This research develops a machine learning model to classify Near-Earth Objects (NEOs) as hazardous or non-hazardous based on their physical and orbital characteristics, leveraging NASA's dataset of certified NEOs. NEOs, including asteroids and comets, often pass within close proximity to Earth, and while most pose no threat, some have the potential for catastrophic impacts. By using predictive models such as decision trees and random forests, this study aims to prioritize resources for monitoring and mitigation of high-risk objects. The model incorporates key features like velocity, diameter, and proximity to Earth to assess potential hazards. The results demonstrate the efficacy of machine learning in planetary defense, providing data-backed insights that help space agencies and planetary defense teams identify which NEOs require closer monitoring. This research is crucial to share as it highlights the potential for leveraging machine learning in planetary defense strategies, ensuring the safety of communities worldwide. With increased monitoring of NEOs and early hazard identification, states can contribute to global efforts in mitigating the risks posed by these objects. This data-driven approach can be used to guide funding and resource allocation for planetary defense programs, emphasizing the importance of supporting innovative, cost-effective solutions that can protect Earth from potential threats.

Crutcher, Wyatt "The June 2013 Yarnell Mountain, Arizona Wildfire and its Upper-atmospheric Meteorological Causes" (Joshua Durkee)
In June 2013, a period of strong high pressure and dry conditions in Arizona, combined with a zonal upper-level height ridge, created an environment conducive to severe wildfires in the central-western part of the state. These large-scale atmospheric conditions led to warm, dry, and stable weather, suppressing precipitation and increasing fire risk. Meanwhile, monsoon season developed over Mexico, creating strong thunderstorms, gusty winds, and high lightning density, which ultimately ignited the Yarnell Hill Fire. This wildfire burned 8,400 acres and tragically claimed the lives of 19 firefighters. To analyze this event, I utilized data from NOAA's Nomads, maps generated through the Integrated Data Viewer (IDV) from UCAR, and records from the SPC Mesoscale Archive Page. Additionally, insights from Brian Klimowski of the National Weather Service in Flagstaff provided further context. Quasi-Geostrophic (QG) Theory offers a valuable framework for understanding the atmospheric dynamics that contributed

to this fire. By examining upper-level wind patterns, temperature fields, and vertical motion maps, this paper identifies how QG processes played a role in shaping the fire-prone conditions. The persistent high-pressure system and upper-level ridge limited vertical motion, reducing moisture availability and precipitation, while local influences such as strong convective winds intensified fire behavior.

Cruz-Rodriguez, Alexis "Cumberland Distillery: Where Bluegrass Meets Modern Bourbon Whiskey" (Shahnaz Aly)
For my Senior Capstone project, I designed a two-story multi-use distillery, and event center in Burkesville, KY. The distillery contains a retail space, a restaurant, a small outdoor event space and a tasting booth, as well as the distilling process for people over twenty-one to tour and the event center will be for special events like weddings. I chose Burkesville, Kentucky because I was raised there, and the county has recently joined the bourbon-whiskey family. Currently, Burkesville has one distillery beside its dry neighboring county, Albany. Cumberland County is slowly growing and intends to expand in new ideas to bring in more tourists. I designed a sustainable distillery and applied modern aesthetics to resemble whiskey-bourbon. The distillery uses natural resources mixed with modern materials to give it a feeling of a natural environment since it's located in a rural area. The event center has a modern appearance for people to gather and celebrate. The distillery will give the chance for visitors to dine inside but can choose to experience the fresh air during the spring and summer in the outdoor area. Visitors can also relax on the second floor while looking through the distillery.

Dant, Sophia "Elysian Wellness: A Nature-inspired Wellness Sanctuary for Women" (Sheila Flener)
Elysian Wellness is an upscale gym, yoga, and Pilates studio designed exclusively for women, where the essence of nature meets holistic wellness. Our mission is to create a tranquil environment that empowers women to nurture their bodies, minds, and spirits through mindful movement and connection to the natural world. Elysian Wellness features biophilic design elements, including lush greenery, natural light, and organic materials, fostering a sense of calm and rejuvenation. Our thoughtfully curated spaces include state-of-the-art fitness equipment, tranquil yoga studios with views of outdoor gardens, and Pilates areas adorned with natural elements, all designed to enhance the workout experience. Elysian Wellness offers a diverse array of classes led by experienced instructors who focus on the mind-body connection, from invigorating workouts to restorative yoga and Pilates sessions. To complement our fitness offerings, our on-site juice bar serves a variety of fresh, nutrient-rich beverages and wholesome snacks, providing members with the perfect post-workout nourishment. This sanctuary is a place where women can escape the hustle of daily life, find their balance, and cultivate a deeper connection to themselves and the natural world around them. Join us at Elysian Wellness, where your wellness journey blossoms in harmony with nature.

Daugherty, Trenton; Wichman, Aaron; "Bipartisan Party Attribution Eliminates Negative Effects of Need for Chaos on Political Policies." (Aaron Wichman)
Previous work has examined Need for Chaos (NFC) as a predictor of spreading damaging rumors about both major political parties. NFC is thought to be based on lack of status and dissatisfaction with the political status quo. Rather than achieving conventional status, those higher in NFC believe in "burning it all down", to start a new system. Understanding NFC thus has importance for anyone with a stake in the

rule-based political order. This work examined NFC as a predictor of policy liking when identical policies were attributed either to Democratic, Republican, or Bipartisan groups. NFC negatively predicted liking for these policies unless they were presented as Bipartisan, where the effect of NFC was nonsignificant. These relationships between NFC and policy liking as a function of policy attribution remained when controlling for Political ideology, Political Identity Fusion, and Right Wing Authoritarianism. It appears that NFC may be uniquely related to attitudes toward existing partisan policies, but not when identical policies are attributed to a bipartisan group. NFC may be less dangerous to the extent that policies enjoy a modicum of bipartisan support.

Deckard, Taryn "Rhetorical In/Exclusivity in Church Welcome Messages" (Jessi Thomsen)
English studies—and rhetorical studies more specifically—focuses on how language impacts the way people understand and navigate the world around them. The central question for my research is: To what extent does Queer-inclusive language appear in church welcome statements, and how does this inclusive language—or lack of it—impact understandings of welcomeness within the churches? Inclusive language is not only an academic exercise but a tool for creating safe spaces for Queer individuals. My sample includes approximately thirty churches from a city with mixed political affiliations. Through digital Queer archival research (VanHaitsma), I analyze language practices in public welcome messages on church websites to uncover explicit inclusivity, implicit indications, and gaps where exclusivity may go unstated (Ratcliffe). Using an inductive coding scheme and the qualitative research program Dedoose, I examine these messages for themes such as inclusivity, individuality, and Us vs. Them language

Dedic, Tyler; Houle, Jean-Luc; "Ritual Landscapes on the Periphery of the Turkic Empire: A Spatial Analysis of Monuments in the Zuunkhangai Region, Mongolia" (Jean-Luc Houle)
This study examines the spatial distribution of Turkic period (6th–8th centuries AD) ritual monuments in the Zuunkhangai region of northwestern Mongolia, comparing their placement with Late Bronze Age (ca. 1200–700 BC) monuments to assess their role in shaping territorial landscapes. Using Geographic Information Systems (GIS), the analysis mapped and evaluated monument locations, considering topography, visibility, and inter-visibility. While Late Bronze Age ritual monuments in this region have been interpreted as territorial markers for early complex societies, this research investigates whether Turkic monuments served a similar function. Fieldwork involved pedestrian surveys and GPS mapping to document monument characteristics and locations. The results offer insight into the ritual construction of landscapes and territoriality among mobile pastoralists on the periphery of the Turkic Empire – an important nomadic tribal confederation that controlled a major swath of Inner Asia. By focusing on the organization of peripheral communities, this research contributes to a broader understanding of how ancient nomadic polities managed vast territories and structured their landscapes.

Delaney, Michael "Predicting Body Fat Percentage Using Machine Learning: A Cost-effective Approach for Health & Wellness" (Lily Zhuhadar)
Body fat percentage is a critical measure of overall health, with elevated levels linked to an increased risk of cardiovascular disease, diabetes, and metabolic disorders. Traditional methods for measuring body fat, such as underwater weighing, dual-energy X-ray absorptiometry (DXA), and bioelectrical impedance

analysis (BIA), are highly accurate but present significant cost, accessibility, and logistical challenges. These methods require specialized equipment, trained personnel, and clinical settings, making them impractical for routine health monitoring. This study investigates the use of machine learning (ML) models to develop a predictive framework for estimating body fat percentage using easily obtainable physical measurements, such as height, weight, body circumference, and demographic factors. By leveraging AI Studio™, various machine learning algorithms are trained and validated to assess their predictive accuracy, generalizability, and real-world applicability. The study focuses on optimizing model performance while ensuring interpretability, making it practical for healthcare providers, fitness professionals, and individuals seeking a low-cost alternative for body fat estimation. The findings suggest that ML-based predictive models can serve as an effective, non-invasive, and widely accessible alternative to traditional body fat measurement techniques. The implications of this research extend to preventive healthcare, fitness tracking, and remote patient monitoring, demonstrating the potential of data-driven health assessments in reducing healthcare costs and improving individualized wellness strategies.

Denney, Jessye "Perceptions Of Crime: How Influencer and Celebrity Status Affect Blame and the Role of Media Outlets" (Christopher Peters)
Previous research indicates that celebrities often receive less blame and punishment than non-celebrities. In modern media, the definition of a celebrity has evolved to include "social influencers" who have achieved celebrity status. These influencers, however, are not viewed in the same category as a "traditional" celebrity like a movie star or television actor. Furthermore, news consumption has shifted between generations, with more Gen Z individuals favoring social media over news outlets. This study will examine if previous research regarding celebrity blame applies to social influencers and if the medium of news broadcasting will change opinions.

Derrick, Aaron "A Large and Small-scale Evaluation of the Factors That Led to the June 29, 2012 Derecho Across the Midwest and Mid-Atlantic" (Joshua Durkee)
As the Earth continues to warm, adaptation will need to take place in multiple fields, including in meteorology. Unusual temperatures can wreak havoc on weather forecasts, since forecast models won't have any previous events to compare a record-breaking, temperature-driven event to. One example of unusually warm temperatures leading to anomalous weather patterns impacting millions of people happened in June 2012. Across the continental United States, 2012 was one of the warmest years on record up to that point, especially in June. June 2012 remains one of the warmest months on record in the Continental United States. The record warm temperatures were the result of a persistent ridging pattern across the South-Central US, which led to warm air and a relative lack of precipitation. This paper will explore how the abnormally warm temperatures (and other large-scale and local scale factors) led to the formation of a historic derecho on June 29, 2012, leading to billions of dollars in damage and over a dozen fatalities. Large-scale factors will be analyzed via ERA5 reanalysis data in the upper, mid, and near-surface levels of the atmosphere.

Dickerson, Dalton "The Impact of a Trauma-informed Brief Intervention on PTSD, Depression, and Anxiety" (Matthew Woodward)

Mobile-based brief interventions (MBBI) are interventions delivered via phone that offer significant advantages in dissemination efforts. MBBI's have demonstrated in research to be a useful tool for substance use prevention and treatment, especially in younger populations. However, MBBI's for substance use have often omitted components aimed at improving mental health, often choosing to only focus on substance use and prevention. The goal of the current study was to examine the impact of a MBBI incorporating mental health tools and peer coaching on improving depression, anxiety, and PTSD. Participants (N=83) were young college aged adults with a history of interpersonal trauma exposure who also engaged in heavy drinking. Participants were randomly assigned to a trauma-informed brief intervention consisting of feedback about substance use, psychoeducation of mental health tools, and monthly peer coaching sessions. Participants showed significant reductions in symptoms of PTSD, anxiety, and depression from baseline to 3-month follow-up and from baseline to 6-month follow-up. This study highlights the effectiveness and potential of adapted MMBI's in addressing both substance use and various mental health difficulties in trauma survivors, while also showing that adaptation can improve impact. Future investigations should identify aspects of the intervention that were linked with mental health improvement.

Duarte, Haley "Art Appropriation Within Europe" (Eric Reed)
Art appropriation was integral to war and imperialism in modern times. War victors and colonial powers appropriated art from their conquests and colonial subjects as a matter of course and claimed appropriated art as their own. As challenges to ownership arose, appropriators often ignored or denied the circumstances in which artifacts were stolen. Who has the right to claim ownership of appropriated art? My project explores coverage from the London Times of two different examples of art appropriation, the Guelph Treasure and the Benin Bronzes. Coverage of the controversies over their ownership differs vastly. The Guelph Treasure was taken by Nazis in 1935 from a group of Jewish art dealers. The London Times covers this as an act of illegal art appropriation and characterizes it as an attempt to erase the Jewish community. The British Empire removed the Benin Bronzes from Nigeria in the 1890s during its colonization of west Africa and claimed them as part of Britain's art heritage. The London Times has maintained its stance that the Benin Bronzes belong to the British and argues that they were taken to preserve the artifacts. This study examines why the London Times cover these two instances of art appropriation so differently.

Dukes, Evie "Effects of Accessibility on Quality of Cenotes in the Mexican Yucatán Peninsula" (Chris Groves)
The term cenotes refers to natural sinkholes or pits found in the Mexican Yucatán Peninsula that exposes the underground aquifer at the surface, that is, a cenote is an entrance to an underwater cave. Numerous cenotes have had their accessibility enhanced and/or restricted by man-made infrastructure and management practices, largely for the sake of tourism and preserving cenotes for local communities. The purpose of this research is to determine the relationship between accessibility and quality across nine cenotes in the Mexican states of Yucatán and Quintana Roo. Accessibility is defined using two parameters: visitor access model and infrastructure. The term visitor access model refers to the means by which visitor access is or is not limited, while infrastructure refers to physical structures and facilities that regulate cenote access. Cenote quality is also defined by two parameters: water quality and

perceived quality. Water quality includes measurements of temperature, pH, specific conductance, dissolved oxygen, turbidity, and phosphate. Perceived quality refers to the observation of trash, graffiti, broken speleothems, and/or foul smells at a cenote. Preliminary analysis indicates that water quality is consistent across various access models, while perceived quality generally increases among cenotes with more restrictive access. Research is ongoing.

Duvall, Grayson; Kircher, Madison; "Characterization of the Telomeric DNA Damage Response Pathway" (Jason Stewart)
Telomeres are repetitive DNA sequences that protect the ends of the chromosomes from being recognized as DNA damage. A protein complex, CTC1-STN1-TEN1 (CST), is instrumental in helping maintain telomere length. In our lab, we removed, or knocked out (KO), the CTC1 subunit of the complex to determine its role in telomere protection. When CTC1 is absent, we find that the ends become very long and mostly single stranded, which leads to the binding of several damage repair proteins, such as RPA and ATR. Although the ends are now recognized as damage, we see little increase in unnecessary repair that lead to chromosome fusions in the CTC1 KO cells. We hypothesized that ATR, a DNA damage response kinase, and 53BP1, a protein important in blocking repair at regular DNA damage, are stopping unnecessary repair when these telomeres are marked as DNA damage. In agreement with this hypothesis, we determined that 53BP1 colocalizes with RPA-bound telomeres and discovered that 53BP1 colocalization was dependent on ATR activity. Therefore, we concluded that ATR recruits 53BP1 to inhibit chromosome fusions. We are currently analyzing whether chromosome fusions occur in the absence of ATR/53BP1.

Eaton, Jerica "The Effects of Two Common Herbicides on the Growth and Development of Two Anuran Species (Boreorana Sylvatica and Dryophytes Chrysoscelis)" (Jarrett Johnson)
Amphibian populations have been declining globally since the 1950s. Many species that have experienced declines are viewed as 'environmental indicators' that reveal habitat degradation. Declines can be attributed to several factors, including chemicals used in agriculture, such as Roundup and Atrazine. Agrochemicals contaminate water bodies through runoff or leaching and cause alterations to aquatic ecosystems. This study evaluated the effects of herbicide usage on wild populations using wood frogs (Boreorana sylvatica) and Cope's gray tree frogs (Dryophytes chrysoscelis) as a model. We determined the effect of the herbicides at two concentrations, a high concentration that simulated a pulse dosage during a runoff event and low concentration that simulated a background level of exposure and identified synergistic effects resulting from the mixture of both herbicides at the high or low concentration. Effects of herbicide on larval growth and development were measured by recording variation in survival-to-, size-at-, and time-to-metamorphosis across treatment levels. Differences between treatments were assessed using a two-way factorial analysis of variance (ANOVA) with Roundup and Atrazine concentrations as factor levels. We determined that these agrochemicals induce negative effects in amphibian taxa, including metamorphic size and mortality. This research provides a better understanding of the environmental implications resulting from the effects of combined stressors on wild populations.

Egan, Nathaniel "Impact of Basic Physics Skills Quizzes on Student Success in an Introductory Physics

Course" (Scott Bonham)

Standard based assessment, a form of mastery learning, has been implemented in the first semester algebra-based physics course (Physic 231), a gateway course that enrolls many pre-health students, and which enrolls students with a wide range of backgrounds. The instructor had observed that many students were not achieving their desired level of success on the exam questions due to errors with basic skills like units, vectors, interpreting the questions, etc. To address this, automatically graded Blackboard quizzes targeting those individual skills have been implemented which students can retake to improve their level of mastery. I am studying the students' use and interaction with the quizzes and quiz retakes, their increased mastery of the material, and the impact this pedagogical intervention has on their success on exam questions. Records of the students' quizzes and exam questions are being analyzed to determine the utilization of the quizzes and retake opportunities, increased level of mastery, areas of difficulty, and impact on exam question success. Preliminary results will be presented.

Elmore, Jo; Peak, Frankie; Shaw, Andrea; "Distinguishing Between Flat Spectrum Radio Quasars and Bl Lacertae Objects Using Optical Variability" (Michael Carini)

The blazar class of radio loud AGN are those oriented such that we are looking nearly down the throat of the relativistic jet, resulting in the observed emission being dominated by processes at work in the jet. A principle defining characteristics of blazars is large amplitude continuum variability (with frequent episodes of transient flaring behavior) at all wavelengths, on timescales ranging from minutes to decades. Blazars are subdivided into BL Lacertae objects (BLL) and Flat Spectrum Radio Quasars (FSRQ). Multi-wavelength observations indicate that the emission in BLLs is jet dominated, whereas in the FSRQs, the emission contains additional contributions from the accretion disk and/or torus. An unresolved question is whether or not these differences manifest themselves in the optical variability properties of blazars. Using one of the most common tools to characterize blazar optical variability, the slope of the power spectral density (PSD), we constructed PSDs for a sample of blazars to see if there is a difference in the slope of the PSD between FSRQs and BLLs. The PSD is determined via three methods (periodogram analysis, the Power Spectral Response method and Continuous Autoregressive Moving Average modeling) for a sample of blazars observed by NASA's K2 and TESS missions.

Epperson, Paige "Form Follows Function: Applying Modern Design Principles to a Fun Center" (Shahnaz Aly)

For my entertainment complex, I focused my design on a mixture between the Bauhaus and Modern styles of architecture, while ensuring a sustainable environment was achieved as well. I accomplished this through incorporating the styles' shared use of geometric and abstract design, as well as accompanying rounded walls, on the exterior façade and throughout the interior of the complex as well. As the basis of the Bauhaus style is "form follows function," I used the variety of abstract design features to add to the immersion and entertainment value of the complex. I integrated sustainable materials throughout the structure to add to the sustainability of the complex, while achieving characteristics of the Modern style. Additionally, my intention was to focus on keeping the site as natural and untouched as possible to add to the sustainability. In the end, this complex achieved a unique mixture of these architectural styles, showcased sustainability features, as well as demonstrated entertaining and unique design both inside and out.

Er, Alper; Khuzhakulov, Zikrulloh; Ben Yosef, Justice; Majidov, Inomjon; Allamyradov, Yaran; Kylychbekov, Salizhan; Er, Ali; "Formation of Picosecond Laser-induced Periodic Surface Structures on Steel" (Ali Er)
The formation of laser-induced periodic surface structures (LIPSS) on mirror-polished 304-grade stainless steel sheets with dimensions 25 mm × 25 mm × 0.8 mm upon irradiation with picosecond laser pulses in air and water environments at different wavelengths, number of pulses, and laser energy densities was investigated. Atomic force microscopy (AFM) and scanning electron microscopy (SEM) were used to characterize the LIPSS. Tunable periodicity of the LIPSS was observed in both media at different wavelengths and fluence. Fluence was shown to be the main formation parameter of LIPSS; however, the medium was also demonstrated to play an important role. Our results show that LIPSS can be successfully generated on stainless steel in a single-step process and that they can be easily modified by adjusting laser parameters.

Er, Sena; Song, Qingfang; "Blood Pressure Stress Reactivity Moderates the Association of Racial Discrimination to Ethnic Minority Youth's Conduct Problems" (Qingfang Song)
Racial discrimination is a well-documented stressor for ethnic minority youth and is associated with psychological maladjustment. This study examines blood pressure reactivity to a cognitive stress task as a potential moderator. A sample of 83 African and Latino adolescents (48 girls; M = 12.29 years, SD = 1.61) completed an unsolvable puzzle task in a lab visit while their blood pressure was monitored continuously. Adolescents also completed questionnaires to report on their previous racial discrimination experience and conduct problems. Racial discrimination experience was found to significantly be associated with conduct problems (B = 3.06, p < .001), qualified by a significant interaction effect between racial discrimination and blood pressure stress reactivity (B = -0.16, p = .03). When blood pressure reactivity was at low or moderate levels, the association between racial discrimination and conduct problems was highly significant (p < .001). At high reactivity levels, the relationship remained significant but was notably weaker (p = .02). The findings suggest that high blood pressure reactivity may reflect a more adaptive physiological response to stress, helping mitigate discrimination's negative impact.

Faulkenberg, Lily; Ratcliff, Camille; McPherson, Carly; Heckler, Jamie; Hisler, Isaiah; Ledwidge, Patrick; "Planting with the Non-Dominant Limb during an Unanticipated Sidestep Maneuver Produces Higher Vertical Tibial Accelerations: Preliminary Findings" (Patrick Ledwidge)
Background: This study examined the effects of anticipation, stimulus congruency, and limb dominance on vertical tibial accelerations during the plant phase of a sidestep run-to-cut maneuver. Unplanned sidesteps produce higher vertical tibial accelerations than planned sidesteps. In traditional Flanker tasks, incongruent flanker stimuli elicit higher conflict monitoring than congruent stimuli. Hypothesis: Vertical accelerations will be highest in the unplanned-incongruent condition. The effect of limb dominance was explored, but no hypothesis was formed because of inconsistencies in the literature. Methods: Right-leg dominant athletes (n = 19) wore bilateral tibial accelerometers to measure peak vertical tibial acceleration. Participants completed 192 trials, jogging (4.5 mph) before cutting based off a flanker stimulus. Trials randomly varied based on anticipation, congruency, and flanker direction. Results: There were no interactions between anticipation, congruence, and direction (p's > .10). Vertical accelerations

were higher in anticipated than unanticipated cuts, $F(1,18) = 3.41$, $p = .081$, and were higher when planting on non-dominant limb (right cuts), $F(1,14) = 4.90$, $p= .044$. Conclusion: Vertical accelerations were greater for non-dominant plants, likely due to unfamiliar movement patterns. Although failing to reach statistical significance, anticipated trials produced greater accelerations, which may reflect increased focus on the plant step and confidence in the anticipated condition.

Fey, Madeline; Lawson, Grace; Raaf, Josie; Adams, Kyler; "Bridging the Past and Future of Equine Architecture in Kentucky" (Aly Shahnaz)
Equine architecture in Kentucky plays a vital role in preserving the region's culture while modernizing horse care, training, and competition. The aesthetics of Kentucky's equestrian buildings—barns, stables, and racetracks—reflect a deep connection to the pastoral landscape and the craftsmanship of Southern architecture. This research aims to establish a design language that revitalizes craftsmanship, embraces future-ready design, and balances minimalist nostalgia. As equine architecture evolves, it incorporates advanced technologies and sustainable principles, shaping the future of the horse racing industry. Modern stables are designed for horse welfare, featuring climate-controlled environments, advanced ventilation systems, and smart monitoring technologies. The integration of innovative materials, such as composite wood and steel, with traditional elements like timber frames, steep gable roofs, and open spaces preserves the region's architectural identity while enhancing functionality. In Kentucky, where horse racing and breeding are cultural cornerstones, equine architecture must balance heritage and innovation. Future designs focus on improving the horse-human relationship through adaptable, responsive environments. By maintaining historical roots while embracing modern advancements, Kentucky ensures its equine facilities remain sustainable, humane, and enduring—bridging past and future to create a lasting architectural legacy.

Fischer, Lindy "Harmonizing Artistry: The Interplay of Gaga Movement and Classical Ballet in Dance Performance and Choreography" (Meghen McKinley)
My project focused on the relationship between classical ballet and the Gaga movement language through physical and movement analysis. Gaga is considered an emerging experimental form of dance, a genre that contrasts with the long-established structure and refinement of classical ballet. The practice aims to expand the dancer's capacity for unique movement through multi-layered, sensation-based tasks. These concepts stand in contrast to the codified ballet technique, which places a strong emphasis on precise lines and shapes. I traveled to Sorrento, Italy, for the Staibdance contemporary dance intensive to study under professionals certified in Gaga, classical ballet, contemporary ballet, and modern. Throughout the creation of my choreographic work, Zugzwang, I collaborated with my cast to implement findings from Italy. I further shared them through teaching an open level movement exploration masterclass to anyone at Western. Exploring the fusion of these techniques opened new avenues for artistic sensitivity, versatility, access to new layers of movement, and joy as a student, performer, choreographer, and pedagogue. Joy in movement, stillness, failure, exertion, rest, empathy, and community defined this process. Beyond my own growth, this study highlights the significance of movement exploration and redefining how dancers approach technique.

Foster, Rachel; Walker, Luke; "Investigating the Interactions Between Elm1 and Hsl7 in the

Morphogenesis Checkpoint of Saccharomyces Cerevisiae" (Joseph Marquardt)
Studying cell shape is essential to understanding the normal regulatory processes that occur within the cell. The morphogenesis pathway couples cell division to the timely formation of a daughter bud in Saccharomyces cerevisiae. This pathway consists of two protein kinases, Elm1 and Hsl1, and a methyltransferase Hsl7, each of which when deleted from the cell results in an abnormal elongated morphology. The morphogenesis pathway proceeds linearly from Elm1 to Hsl1 to Hsl7, however preliminary data from ourselves and others suggests the capability for Hsl7 to interact with Elm1. It is not known if Hsl1 is phosphorylated by Elm1 in the pathway but from the preliminary evidence there is an opportunity for Elm1 to phosphorylate Hsl7. Therefore, we are investigating if the morphogenesis pathway of S. cerevisiae can proceed in a nonlinear fashion with Hsl7 and Elm1 interacting with each other. Utilizing Bimolecular Fluorescent Complementation (BiFC), in vitro interaction assays, and phosphorylation assays we will be able to see if and where these interactions occur. Currently, there has been an observed interaction between Hsl1 and Hsl7 in BiFC in vivo, confirming BiFC's ability to identify interactions. Being able to determine if the various kinases and proteins interact within the pathway will be essential for understanding morphogenesis pathways in other eukaryotes regarding development.

Fugatt, Alexis "A Synoptic and Mesoscale Analysis of the January 27-31, 2014 "snowpocalypse" in Atlanta, Georgia" (Joshua Durkee)
On January 27, 2014, an Arctic air mass from Northern Canada pushed southward, with its cold front reaching north-central Georgia by evening. By the morning of January 28, temperatures in northwest Georgia had dropped below freezing, and by the afternoon, freezing conditions extended across the region. Snowfall accumulations of 1-3 inches in Atlanta, combined with sleet and freezing rain, led to treacherous road conditions, stranding thousands of vehicles for up to 20 hours. Over 1,500 winter storm-related accidents resulted in 180 injuries and two fatalities. Synoptically, a deep upper-level trough extended into the Southeast, with strong mid-level height falls accompanying the system. A 300mb jet streak placed Atlanta in the right entrance region, enhancing upper-level divergence. This, along with cold air advection and moisture at 700mb, contributed to widespread precipitation. Positive vorticity advection in the mid-levels further supported vertical motion, aligning with Quasi-Geostrophic forcing. These dynamics resulted in snowfall across northern Georgia, while central Georgia experienced a wintry mix. Additionally, mesoscale features played a critical role in localized snowfall enhancement and ice formation, further worsening travel conditions. These aspects will be explored in greater detail.

Fugatt, Alexis "A Large and Local-scale Investigation Of The January 27-31, 2014 "snowpocalypse" In Atlanta, Ga" (Joshua Durkee)
On January 27, 2014, an Arctic air mass from Northern Canada pushed southward, with a cold front reaching northcentral Georgia by evening. By the morning of January 28, temperatures in northwest Georgia had dropped below freezing, and by the afternoon, freezing conditions extended across the region. Snowfall accumulations of 1-3 inches in Atlanta, combined with sleet and freezing rain, led to treacherous road conditions, stranding thousands of vehicles for up to 20 hours. Over 1,500 winter storm-related accidents resulted in 180 injuries and two fatalities. On the large scale, a deep upper-level trough extended into the Southeast, with strong mid-level height falls accompanying the system. An upper atmosphere jet streak placed Atlanta in a region that was favorable for upward vertical motion.

This, along with cold air advection and moisture at the mid-level of the atmosphere, contributed to widespread precipitation. Enhanced horizontal rotation in the mid-levels further supported vertical motion, aligning with large-scale forcing equations. These dynamics resulted in snowfall across northern Georgia, while central Georgia experienced a wintry mix.

Gachagua, Chealsea "General Perception of Drug Effectiveness" (Jacob Byl)
In a world where medication decisions are shaped by marketing as much as by medical expertise, the question arises: What truly influences public perception of drug effectiveness? Pharmaceutical advertisements promise life-changing results, physicians' recommendations carrying professional authority, or attorney advertisements highlighting legal battles over drug risks. Prior research suggests that direct-to-consumer advertising (DTCA) can drive patient demand while sometimes leading to misconceptions about efficacy (Mintzes et al., 2003). Similarly, physician recommendations though highly trusted can be influenced by industry relationships, affecting prescription patterns (Spurling et al., 2010). Meanwhile, legal advertisements often highlight drug-related risks, potentially damaging trust in medications, even when risks are minimal (Frosch et al., 2010). This study examines these influences through an analysis of existing literature and an original survey on public perceptions of drug effectiveness. The survey, distributed to a diverse population, measures attitudes toward pharmaceutical advertisements, physician endorsements, and legal campaigns. Statistical analysis of the responses identifies correlations between trust levels and exposure to different sources. This research also evaluates the incentives driving pharmaceutical companies, healthcare providers, and legal firms. The findings have significant implications for patient decision-making, regulatory policies, and the ethical responsibilities of key stakeholders. Understanding these dynamics is crucial for balancing consumer awareness with medically accurate information.

Gangumolu, Himani; Willmes, Lydia; Marcum, Mitchell; Williams, Adriana; "Herbaceous Plant Diversity and the Effects of Forest Age" (Martin Stone)
Herbaceous plants are vascular plants that have non-woody stems or no true woody tissues. At the CloudBridge Nature Reserve in Costa Rica, we measured the diversity of herbaceous plants in forests from 3 to 200 years old. The five sites were between 5000 and 6500 feet above sea level in the cloud forest. Our hypothesis was that herbaceous plant diversity increases as forest age increases. We used the quadrat method to determine the understory diversity index in these forests. We supported the diversity index measurements with measurements of the solar radiation spectrum, light intensity, and tree basal area factor in these forests. Our data supports the hypothesis that herbaceous plant diversity increases with forest age.

Garg, Vedant "Predicting Covid-19 Severity: A Machine Learning Approach Using Patient Symptoms" (Huanjing Wang)
Identifying risk factors for COVID-19 lethality is crucial for ensuring timely and personalized treatment. In this study, we developed COVID-19 severity models based on patient symptoms using a publicly available Kaggle dataset on COVID-19 cases in Mexico (April 14, 2020). We used Shapley Additive Explanation (SHAP) feature selection method to remove five less important features and identify "age", "sex", "pneumonia", and "diabetes" as top predictors. We applied MinMaxScaler to normalize the "age" feature

to a range of 0 to 1 and applied Synthetic Minority Oversampling Technique to sample our data. We trained an ensemble model combining Extreme Gradient Boosting and Random Forest and evaluated it using the accuracy. Our model achieved 58% accuracy. Partial Dependence Plots revealed that middle-aged persons were most subject to moderate COVID-19, and older persons were more susceptible to severe COVID-19. Males were at higher risk of severe COVID-19, whereas females were more prone to moderate or no infection. Pneumonia proved to be a factor for moderate and severe COVID-19, along with diabetes. Understanding key severity factors can help optimize patient care and improve treatment strategies.

Garrett, Shayna; Burton, Jenny; "Descriptions of Black Autistic Girls' Social Communication Skills" (Jenny Burton)
Autism spectrum disorder (ASD) is marked by early deficits in social communication and repetitive behaviors (American Psychiatric Association, 2013). One in 36 children is diagnosed with ASD, with males four times more likely than females (Maenner et al., 2023). This sex disparity has led to limited research on ASD in girls, particularly Black autistic girls, despite evidence that cultural factors influence symptom presentation (Jarquin et al., 2011). This study examines social communication skills in Black girls with ASD without intellectual disability, as described by their mothers or grandmothers.

Gibbs, Barrett; Gani, Nahid; Lunday, John; "Mapping Karst and Slope Hazards in Pulaski County, Kentucky Using High-resolution Lidar and Petrographic Analysis" (Nahid Gani)
This FUSE-funded study utilized high-resolution (1.5-meter) Light Detection and Ranging (LiDAR) Digital Elevation Model (DEM) data to identify and assess karst hazards and mass wasting events in Pulaski County, located in Kentucky's Appalachian region. By integrating advanced LiDAR analysis with targeted field investigations, we aimed to uncover critical hazard zones, informing both public safety measures and local infrastructure protection. A mosaic of LiDAR data tiles was generated for Pulaski County, including downtown Somerset. From this dataset, hillshade and slope maps were produced. Enhanced with color visualization, these maps revealed numerous slope hazards and an abundance of sinkholes, pinpointing areas of concern near homes, businesses, and transportation corridors. Field investigations were strategically guided by LiDAR-derived hazard maps, facilitating the collection of soil and rock samples for petrographic analysis, as well as soil compaction and moisture assessments. Preliminary findings from petrographic microscopy indicate varying degrees of slope instability and landslide potential, influenced by the composition of slope-forming materials. These results highlight significant risks to property and public safety. Ultimately, this research contributes to safeguarding critical assets, enhancing rural Appalachian resilience, and fostering community awareness. By bridging geospatial data analysis with field-based geology, our project promotes sustainable hazard management and improves the well-being of residents.

Gledhill, Ashley; King, Rodney; "The Discovery, Characterization, Sequencing, and Annotation of the Novel Mycobacteriophage Xandras" (Rodney King)
Bacteriophages, viruses that infect bacteria, play a key role in microbial ecosystems and have growing biotechnological applications. This study focused on the isolation, characterization, sequencing, and annotation of Xandras, a novel bacteriophage that infects Mycobacterium smegmatis. Xandras was

isolated from an enriched soil sample, and a homogeneous population with uniform plaque morphology was established through multiple rounds of plaque purification. A high-titer lysate was generated and examined by electron microscopy, revealing that the particles have a Siphoviridae morphology with characteristic long, non-contractile tails and icosahedral heads. Phage genomic DNA was purified and initially analyzed by restriction digestion and gel electrophoresis. Sequencing of the purified genomic DNA revealed that Xandras is a member of the "E cluster" of mycobacteriophages. Various bioinformatics programs including PECAAN, Starterator, Phamerator, BLAST, and HHPred were used to annotate the genome. Plaque phenotype and annotation confirmed that Xandras can adopt a lysogenic life cycle. Surprisingly, Xandras encodes a cGAS antagonist. This function assists phage persistence by interfering with the host's immune response, inhibiting the cGAS-STING pathway. This study expands our understanding of bacteriophage biology and reduces viral "dark matter" by identifying potential functions of bacteriophage genes. Future studies may reveal therapeutic applications of novel phage gene products.

Gobin, Jared; Decker, Evan; O'Daniel, Sarah; Furgal, Karen; "Demystifying Assistive Devices for Older Adults" (Elizabeth Norris)
Many older adults are not educated on proper assistive device (AD) use. In addition to the lack of knowledge, there is also a negative connotation regarding AD utilization due to societal norms. The purpose of this project is to educate older adults on proper assistive device usage with a goal to minimize the current stigma associated with assistive devices and increase the willingness and confidence of older adults in using assistive devices. Approximately 20 older adults without acute musculoskeletal or neurological injury or who have not used an assistive device in the past five years will be recruited. The education session will provide the older adult with instruction and practice in using the following assistive devices: straight cane, quad cane, front-wheeled walker, standard walker, and rollator. The older adult's willingness and confidence in using the assistive device will be assessed using the QUEST 2.0 before education, immediately post-education, and 3 months post-education. One-way repeated measures ANOVA will be used to measure confidence and willingness to use assistive devices before and after education. The study's findings will contribute to understanding how educating older adults on usage of assistive devices affects their confidence and willingness in using them.

Goodin, Abigail; King, Elijah; Ali, Areej; Dunlop, Drew; King, Elijah; Ali, Areej; Im, Sungjin; "Arousal Regulation in Vigilance Task Among Patients with PTSD" (Sungjin Im)
Post-traumatic stress disorder (PTSD) is a debilitating mental health condition that arises following exposure to traumatic events. It is characterized by persistent symptoms of avoidance, intrusive re-experiencing of the trauma, and heightened arousal, which can significantly impair daily functioning. Neurophysiological research indicates that individuals with PTSD exhibit distinct brain activity patterns, including increased activity in the posterior region and frontal alpha asymmetry. These patterns suggest dysregulation in arousal and attentional control. The proposed study seeks to investigate differences in EEG power spectrum between individuals with and without PTSD during a vigilance task, focusing specifically on the alpha and high beta frequency bands. Given the heightened arousal and hypervigilance observed in PTSD, we hypothesize that individuals with PTSD will demonstrate increased beta power in the frontal region compared to controls, reflecting elevated neural activation associated

with stress and attentional demands. Additionally, we will explore variability in alpha and high beta power to assess potential dysregulation in arousal modulation. Understanding these neurophysiological differences can enhance our knowledge of arousal regulation in PTSD and inform targeted interventions, such as psychotherapy and neurofeedback training, aimed at restoring adaptive neural functioning and improving clinical outcomes.

Goss, Logan "The American Belle" (Shahnaz Aly)
The American Belle is an architectural project in Paducah, Kentucky, located on the historic downtown riverfront where the Ohio river meets the Tennessee river. This Building will serve as a cultural and economic hub, celebrating the region's nautical history while also enhancing tourism. By repurposing the city's riverfront, the project aims to create a vibrant destination that attracts visitors beyond Paducah's existing casino-related tourism. Currently, the Delta Queen cruising company's steamboats dock in Paducah to ferry passengers to a casino in Metropolis, Illinois, with limited engagement in the city itself. The American Belle will transform this transit hub into a landmark attraction, offering museum exhibits, event venues, dining, and hotel spaces that highlight the region's rich maritime heritage. Key design challenges included zoning regulations, environmental considerations, accessibility, and flood management. Situated in a flood zone, the project incorporated resilient design strategies to withstand fluctuating river levels. Elevated structures, flood-resistant materials, and adaptive site planning were considered. Through thoughtful architecture and strategic planning, The American Belle provides a historically significant and economically beneficial addition to Paducah's riverfront, reinforcing the city's identity as a premier river destination.

Gray, Kaitlyn; Schafer, Mark; Crandall, Jason; "Exploring the Role of Bingocize®: Workshops in Enhancing Health and Well-Being in Older Adults" (Mark Schafer)
As the population of older adults grows, effective strategies for healthy aging are necessary. (CDC, 2024). This study evaluates the effectiveness of the Bingocize® Workshop, a program combining bingo with exercise, in improving the physical health of older adults. Eleven (11) participants aged 68.55 ± 6.235 attended a ten-week workshop focused on exercises tailored to age and ability. The primary objective was to assess changes in physical function using standardized measures: Timed Up and Go (TUG) test, grip strength test, 360 turn test, and 30-second Chair Stand test. Paired sample t-tests analyzed pre-and post-intervention data. All data analyses were performed using SPSS software (29), with statistical significance set at $p < .05$. Results showed significant improvements in all physical measures (Right Hand Grip Strength Test $t(10) = -3.29$, $p = .008$, Left Hand Grip Strength Test $t(10) = -4.28$, $p = .002$, Sit-To-Stand Test $t(10) = -5.36$, $p < .001$, Timed-Up and Go Test $t(10) = 4.218$, $p = .002$, 360 Turn Test $t(10) = 3.24$, $p = .009$). These findings suggest that older adults engaging in a program like Bingocize® can significantly improve physical health. The results highlight Bingocize®'s potential as a cost-effective, engaging intervention for aging populations. Further research is warranted to explore long-term effects and scalability.

Greenidge, Ashlee; East, Ashley; Greenidge, Ashlee; East, Ashley; Basta, Tania; Macy, Gretchen; Burch, Katrina; Taylor, Ritchie; "Ergonomics Assessment to Meet the Needs of Employees' Health and Wellness" (Gretchen Macy)

Musculoskeletal disorders (MSDs) are a commonly reported injury at the workplace. Musculoskeletal disorders are injuries which occur when motions are continually repeated, particularly while utilizing faulty posture. Proper education on workplace ergonomics can prevent and/or reduce the incidence of MSDs. This study utilized the Rapid Office Strain Assessment (ROSA) to conduct an ergonomics assessment of staff at WKU. The aim of the study was to identify common issues with workstations that could be modified to fit the work to the worker and reduce the incidence and prevalence of musculoskeletal issues in the workforce, an identified priority issue among this population. The sample for the research study was convenience sample of staff members in CHHS at WKU. Outcome measures included the prevalence of MSD, % of time spent on various tasks, job functions, job processes related to workstation, discomfort levels in arms, back, shoulders, neck, eyes, and lower body. Additionally, outcomes were determined via the checklist such as whether the workstations are positioned correctly. Based on the findings, a collegewide education program will be developed that details the importance of properly fitting the work to the worker. Additionally, recommendations for workstation equipment that promotes ergonomics of the workstation will be provided.

Groth, Madelyn "Pas de Deux Past and Present: Examining the Future of Partnering Work in the Study of Teaching and Performance of Professional Ballet." (Anna Patsfall)
This research explores the historical evolution and future direction of partnering in ballet, focusing on its technical, aesthetic, and pedagogical progress. Traditional pas de deux, found in classical ballet, adhere to strict gender roles, and aesthetic traditions, but contemporary choreographers are reimagining partnering dynamics and movement patterns to reflect a more inclusive and diverse approach. By conducting a historiographical study of ballet history and an ethnographic investigation through direct observation at the Miami City Ballet and the Dutch National Ballet, this project examines how companies approach the teaching, choreographing, and performing of pas de deux in the 21st century. Through observation of dancers, choreographers, and company directors, the study has analyzed how innovative partnering techniques are shaping professional ballet. The findings will inform both choreographic practice and ballet pedagogy, culminating in a performance piece that illustrates the evolution of ballet partnering while integrating contemporary trends. This research aims to contribute to the ongoing conversation on inclusivity and innovation in ballet, preparing future dancers and educators to embrace a broader, more expansive definition of partnering.

Grover, Vidhi; King, Rodney; "Discovery and Analysis of Mycobacteriophage Saranya" (Rodney King)
Bacteriophages, viruses that infect bacteria, are the most numerous biological entities on the planet, with an estimated 10^{31} phage particles distributed worldwide. However, relatively few have been characterized. The purpose of this project was to isolate and analyze a bacteriophage capable of infecting Mycobacterium smegmatis, a common soil microbe. Mycobacteriophage Saranya was isolated from a soil sample collected in Bowling Green, Kentucky. The soil was enriched for mycobacteriophages by culturing in the presence of M. smegmatis cells. A pure population of Saranya was produced through repeated serial dilutions of isolated plaques. A highly concentrated sample was generated and the morphology of the viral particles was analyzed using electron microscopy. Other characteristics such as the optimal growing temperature and the ability to lysogenize a host cell were also tested. The viral genomic DNA was purified and analyzed by restriction digestion and gel electrophoresis. Our results

indicate that phage Saranya has a Siphoviridae morphology, grows optimally at 30 degrees C, cannot form lysogens, and its DNA is susceptible to cleavage by the restriction enzymes HaeIII and AhdI. Saranya appears to be a unique mycobacteriophage but DNA sequence analysis is needed to establish evolutionary relationships.

Grover, Vidhi; Arrollo, Alaina; Mendez-Cano, Jaime; "Carbon Storage in Old and New Growth Cloud Forests" (Martin Stone)
Cloud forests play a significant role in carbon storage and may help mitigate climate change due to their high moisture content which supports the growth of various tree species. The type of forest growth can influence both the species and amount of carbon stored within the area. In this study we compared carbon storage between new growth and old growth. We collected data from twenty trees in each plot and calculated carbon storage by species, height, and diameter at breast height (DBH). Our findings show that while old growth stores more carbon because of its longer growth period, new growth forests have the potential to sequester more carbon because they are still growing. These insights are crucial in addressing issues like greenwashing and exploring more effective solutions for reducing the carbon levels within the atmosphere.

Guercio, Harmony "An Analysis of the Multiscale Atmospheric Contributions to the May 23, 2024, Eldorado, Oklahoma Ef2 Tornado Event" (Joshua Durkee)
Severe weather events often result from a combination of synoptic-scale (continental) and mesoscale (regional-to-local) atmospheric processes. With that, tornadoes kill and injure hundreds of people in the United States each year, with the severe season being March-June. The purpose of this study is to analyze the multiscale atmospheric contributions to the May 23, 2024, Eldorado, Oklahoma tornado event, which produced three tornadoes, including an EF2 tracked by Western Kentucky University's 2024 storm chase team. Beginning at 7:04 pm, this tornado continued eastward for 53 more minutes. With peak winds of 120 mph, this tornado traveled 14.9 miles. This case study applies meteorological theories to assess synoptic-scale influences while using data from the Storm Prediction Center (SPC) Mesoscale Analysis Archive to examine boundary interactions and localized storm-scale dynamics. Results indicate that while synoptic-scale features such as warm air advection contributed to the development of the storm, mesoscale processes, such as the development of a dry line, played a primary role in tornado development. These findings underscore the importance of assessing both large-scale and localized atmospheric conditions to better understand tornado formation and improve forecasting methodologies.

Gurbandurdyyev, Begench; Annamuradov, Berdimyrat; Street, Carli; Whipple, Hadley; Er, Alper; Allamyradov, Yaran; "Enhancing Photodynamic Therapy: Reserpine-mediated Efflux Pump Inhibition for Improved Pathogen Deactivation with Methylene Blue and Nanoparticles" (Ali Er)
Efflux pumps are crucial membrane proteins in bacteria that actively expel toxic substances, including antibiotics. This study evaluated reserpine, an efflux pump inhibitor (EPI), in combination with silver nanoparticles (Ag NPs) and methylene blue (MB) to enhance photodeactivation of pathogens. Our results showed that reserpine significantly increased pathogen deactivation, achieving a 40% greater reduction in colony-forming units (CFUs) when used with MB alone, and a 90% reduction when combined with Ag NPs/MB. This indicates that reserpine disrupts bacterial mechanisms for expelling

toxic agents. We also investigated singlet oxygen production, finding that reserpine did not affect it. Different sizes of Ag NPs consistently showed improved deactivation rates with reserpine. Molecular docking calculations revealed that reserpine binds more strongly to the AcrB protein of the AcrAB-TolC efflux pump, with a binding energy of -9.4 kcal/mol, compared to MB's-7.2 kcal/mol. These findings suggest that reserpine effectively enhances photodynamic therapy (PDT) by blocking efflux pumps. Future research will explore its use with other nanoparticles and photosensitizers to combat multidrug-resistant infections.

Hamilton, Syntyah "Our Space" (Aly Shahnaz)
We are trees, rising by the roots of the seeds that were planted in our communities, extending our branches outward into other communities, in a cycle that will not stop. This community center was inspired by creations from around the world, but also ignited by personal tragedy, a drive to be better than I was, and a hope to better the community and people around me. The center featured amenities such as an aquatic center – as well as a rehabilitation pool – a basketball court, walking track, study rooms, communal spaces for each age group, and studios for multipurpose use. The main purpose for the center was to provide a safe third space for adolescents, and to foster communion with people in the community, which is why the center was located across the street from South Warren Middle and High School, and situated at the opening of a subdivision, in the cusp of what will be a blossoming neighborhood. Much of myself is intertwined with this project, whether its personal philosophies, or memories; I wanted to give young people what I had as a child – a place to be a kid and make friends that become family.

Hanel, Marlowe; Cook, Caroline; "Comparing the Performance of the Warren and Pratt Truss Bridge Designs" (Kirolos Haleem)
As part of an honors project for the EM 222 (Engineering Statics) class, three different steel truss bridge designs were analyzed under differing loading scenarios. The following bridge truss designs were analyzed: Warren, Pratt, and Baltimore. The first step in the study involved building the bridge frames using MDSolids software. This software allowed us to add the specific loads at particular joints and calculate the magnitude of compressive or tensile force in each truss member. Two loading scenarios (or two case studies) were used. The first case study involved adding equal loads at the upper joints with the exception of 50% loading at the edges. In the second case study, equal loads were added at the lower joints. For both case studies, the Baltimore truss design consistently allowed for higher magnitudes of axial forces in the truss members compared to the Warren and Pratt truss designs. When comparing the two loading case studies, it was concluded that loading the lower joints allowed for larger magnitudes of axial forces compared to the upper joint loading. When deciding which truss design to execute, it is important to account for both load and cost requirements. In the case of higher load-carrying demand, Baltimore is the best design. However, if the analyst is looking for a more cost-effective design, the Pratt truss can be the one to consider.

Harner, Jenson; Marquardt, Joseph; "Investigating Mechanisms of Polarisome Regulation by the Kinase Elm1" (Joseph Marquardt)
A cell's shape is often indicative of and critical for its function. In the budding yeast Saccharomyces

cerevisiae, cell growth is a tightly controlled process. Elm1, a key player in this regulation, controls the shape of the growing bud in part by regulating the septin cytoskeleton at the mother-bud interface. When its gene is removed from the genome, cells missing this kinase are highly elongated. Proteomics data has suggested there may be more downstream effectors for Elm1 than previously thought. Four of these potential substrates – Spa2, Bni1, Bud6, and Msb3 - are members of the polarisome, a complex which helps direct polarized cell growth. Here we attempt to uncover novel interactions between Elm1 and polarisome components that contribute to cell shape development and growth using classical yeast genetics and fluorescent microscopy. We postulate that any potential genetic interactions might be the result of direct protein-protein interactions through binding and phosphorylation, or indirect regulation of the polarisome by Elm1 through activity modulation. Preliminary data suggests that Bni1 exhibits a strong, temperature-sensitive negative genetic interaction with Elm1, and cell shape data collection is still underway. Together these data will elucidate new pathways for regulation of a critical cellular process in eukaryotes.

Hauber, Alyssa "Investigating the Twin Prime Conjecture" (Dominic Lanphier)
A prime number is an integer greater than 1 with no divisors other than 1 and itself. Twin primes are pairs of primes that differ in value by exactly two, including 5 and 7, 11 and 13, and 17 and 19. The Twin Prime Conjecture suggests an infinite number of twin primes exists. This has not yet been proven. Using Wilson's Theorem we give a method for counting twin primes. However, the factorial function's complexity makes it impractical for efficient calculations. Brun's Theorem states that the sum of the reciprocals of twin primes converges. Our study advances our understanding of the Twin Prime Conjecture by applying mathematical functions such as logarithmic and exponential functions to Brun's Theorem. We demonstrate that a sum over twin primes of a larger function than the reciprocals of the primes, converges. By refining these formulas, we take steps toward better understanding the Twin Prime Conjecture.**Hauschild, Benjamin**; Polk, Jason; "Investigating Groundwater Dynamics and Aquifer Recharge Patterns in Barbados Using Forensic Hydrology" (Jason Polk)
This study investigates water resource management challenges on the small, karstic island nation of Barbados, located in the North Atlantic Ocean bordering the eastern Caribbean Sea. The island's vulnerability to changing climate and storm patterns and sea level rise is compounded by its reliance on karst aquifers for its freshwater supply, which highlights the urgency for sustainable water resource management on the island. Through a multifaceted approach, including water level and precipitation monitoring, forensic hydrologic tracers (stable isotopes and dye tracing), and remote sensing analysis, this study endeavors to enhance the understanding of the groundwater dynamics, recharge patterns, contamination sources, and water resource availability in Barbados' karst environment. Through a collaboration with the Barbados Water Authority, this research seeks to provide valuable insights for improved water resource management approaches, addressing critical questions regarding groundwater-surface water interactions, recharge dynamics, and the influence of human activities on the islands' karst hydrology. This research contributes to a broader understanding of coastal karst islands and offers valuable insights for water resource management in similar regions around the world.

Heckler, Jaime; Faulkenberg, Lily; McPherson, Carly; Ratcliff, Camille; Hisler, Isaiah; Ledwidge, Patrick; "Accuracy In Performing A Run-to-cut Sidestep Maneuver Is Poorer When Planting On Non-dominant

Limb: Preliminary Findings" (Patrick Ledwidge)
Understanding cognitive-motor interactions is important for interpreting accuracy in run-to-cut sidestep movements, especially when movements require rapid decision-making. This study examined how direction, anticipation, congruence, and limb dominance influence performance. Specifically, the study assessed if accuracy in performing a sidestep cut will be lower when cut direction is unanticipated than anticipated, particularly for incongruent flanker stimuli. The research team hypothesized that accuracy will be lower when planting on non-dominant limb. To conduct the study eighteen right-limb dominant athletes completed a run-to-cut maneuver, performing a sidestep cut at the end of a 12-foot runway. A flanker stimulus appeared halfway, with a congruent or incongruent middle arrow indicating a left/right cut. 50% of trials had a pre-cue to manipulate anticipation (unanticipated v. anticipated) of cut direction. Correct trials consisted of appropriate pace, cut direction, no gait errors, and contralateral plant limb into cut zone. Results of the study showed that accuracy did not vary between anticipated and unanticipated conditions. There was not an interaction between congruence and anticipation ($p > .05$). Accuracy was lower when planting on the nondominant than dominant limb. $F(1,17) = 13.41$, $p = .002$. There was no significant interaction between limb dominance and anticipation ($p > .05$). In conclusion, tt is more challenging to plant on the non-dominant limb, regardless of anticipation or congruence.

Hendrickson-Brown, Gracie; Polk, Jason; "Prevalence and Source Tracking of Perfluoroalkyl and Polyfluoroalkyl (PFAS) Substances In Urban Karst Groundwater Systems" (Jason Polk)
Emerging contaminants, such as perfluoroalkyl and polyfluoroalkyl substances (PFAS), are persistent synthetic chemicals in the environment. They are known to cause threats to human health, including cancer, organ damage, and reproductive issues. Research questions for this project include: 1) What are the prevalence and occurrence of PFAS and associated water quality parameters in karst groundwater systems in different basins under varying landuse types, and 2) Is it possible to conduct source tracking of PFAS from existing groundwater maps combined with federal and state databases based on water quality results. Water sampling will occur in three karst areas in and near Bowling Green, Kentucky. Basic analyses will be conducted in the field, but the samples will still be taken to WKU's HydroAnalytical Lab for further analysis to determine results and findings. This will be the first study to provide a dataset on standard methods for PFAS collection from karst groundwater sites.

Hennessey, Hannah; Cross, Ashley; Shea, Ava; Clark, Jenna; Hennessey, Hannah; Peters, Christopher; Cross, Ashley; Shea, Ava; Clark, Jenna; "Safety in Numbers? An Experimental Exploration of the Effects pf Police Force Size as Moderated by Legitimacy" (Christopher Peters)
This current research explores the relationship between police force size and feelings of safety (FOS), considering the moderating role of police legitimacy. While larger police forces might intuitively enhance safety perceptions, findings reveal inconsistencies. Participants were told local police force size was either smaller, equal to, or larger than average, and their perceptions of FOS and police legitimacy were assessed. Results indicated that while there was a direct effect of a smaller police force size on FOS, the effect of a larger police force was moderated by the participants' view of police legitimacy.

Hennessey, Hannah; Peters, Christopher; Denney, Jessye; Hennessey, Hannah; Peters, Christopher; Denney, Jessye; "Reevaluating Perlin's Nine Insanity Myths: The Influence of Demographics and Political

Orientation in Modern Society" (Christopher Peters)
The current research reexamined Perlin's nine insanity myths to assess their relevance in today's society, particularly in regard to demographics and political orientation. Participants completed the Knowledge of the Insanity Defense Scale (KIDS), measuring misconceptions surrounding the insanity plea and provided demographic information including political orientation. Results indicated that only participant age's effect on KIDS scores was significantly mediated by political orientation. Surprisingly, Female and Non-White participants exhibited greater false knowledge than their Male and White counterparts. These findings highlight the complex interplay of factors shaping perceptions of the insanity defense, challenging current assumptions about demographic influences on legal knowledge.

Hensley, Remi; Silva, Luiz; Shoulders, Debra; "Impact of Temporomandibular Joint (TMJ) Sensitivity on Ridden and Ground Behavior in Horses" (Debra Shoulders)
Previous research by Koostra and collaborators demonstrated that young horses in training showed increased responsiveness to trainer cues when exhibiting mild temporomandibular joint (TMJ) sensitivity (WKU TMJ score 1). However, the relationship between TMJ sensitivity and behavior particularly in older, fully trained horses remains unclear. This study aimed to evaluate the correlation between TMJ sensitivity score, and both ridden and ground behavior in an established herd of well-trained horses. Forty two horses from the Western Kentucky University herd were evaluated in this study. The herd consists of mixed-breed Arabian and Quarter Horses with an average age of 10 years (ranging from 2 to 25 years). All horses were regularly ridden in classes and selected for their gentle temperament and training level. Dental procedures were performed annually or biannually based on individual needs. Each horse was scored for TMJ sensitivity using the WKU scale from 0 to 3 (0 no touch reaction – 3 Violent Flinch head away from the stimulus). The trainer was asked to assign a riding attitude score of 1, 2, or 3, as well as a ground attitude score of 1, 2, or 3 (1 = Better than average, 2 = average, and 3 = worse than average). The correlation was estimated using PROC CORR of SAS.

Hinds, Caitlin "Gender, Victimization and Substance Use" (Justin Smith)
The intersection of gender, crime, and victimization is a critical area of study within criminology, particularly as it relates to understanding the differing pathways men and women take into criminal behavior. Historically, crime statistics have shown a significant male predominance, particularly in violent offenses. Feminist criminology has played an essential role in reframing the narrative around gender and crime, emphasizing the need to examine the social structures that shape male and female experiences differently. While men may employ violence more overtly, women often rely on more subtle strategies to navigate criminal activities, avoiding physical confrontation when possible. Feminist criminologists argue that this dynamic reflects broader social structures governing how gender is performed in both legal and illegal activities. A vital area of research in terms of gender and crime is adolescent substance use, because the influence of gender becomes readily apparent and prominent. For this project, data from the Michigan Alcohol and Other Drugs School Survey were utilized. This survey includes 8th, 10th and 12th graders in different schools across three urban school districts to evaluate their attitudes and usage of alcohol, cigarettes, and other drugs.

Hnem, Zing; Patterson, Kellen; Nee, Matthew; "Development of Polystyrene Beads with Titanium Dioxide

Photocatalyst" (Matthew Nee)
Organic pollutants including dyes and pesticides are harmful contaminants that persist in the water. Organic pollutants can be oxidized and broken into non-toxic compounds such as carbon dioxide and water using a photocatalyst under visible light to promote the reaction. The photocatalysts, titanium dioxide, were embedded in polystyrene beads. Many polystyrene beads were synthesized to have the highest surface area-to-volume ratio to maximize the amount of titanium dioxide inserted on the surface of the beads. The absorption rate of methylene blue, a synthetic dye, in the presence of the titanium dioxide on the polystyrene beads is measured to find the degradation rate of the pollutant. Optimizing the bead size, the photocatalyst loading, and the light exposure are essential focus of the research. This research contributes to recent development regarding the efficacy of photocatalytic degradation.

Hoppes, Ericka "The Effects of Replication Crisis Instruction on The Development of Skepticism" (Amber Giacona)
Within the past decade, there has been growing concern regarding the Replication Crisis in psychology. The crisis has called into question the credibility of psychological research by highlighting the field's difficulty in reproducing findings (Open Science Collaboration, 2015), as well as the prevalence of questionable research practices amongst psychologists (e.g., p-hacking, falsifying data, incomplete reporting of measures, etc.). Given that the crisis presents psychology research through a critical lens, we suspect it can be a useful pedagogical tool for helping students develop a healthy sense of skepticism regarding scientific studies. In the present study, we investigate how teaching about psychology's replication crisis, via brief videos, affects the development of skepticism in undergraduate students. We explore skepticism as students' ability to detect a study with a low or high chance of reproducibility, as well as their sensitivity to pseudo-profound statements. We hypothesize that participants that receive information about the replication crisis will be able to discern the difference between high and low quality studies; however, there is a chance that it induces overall skepticism instead. We believe this study helps provide vital information about how students consume information about replicability and has implications for how these topics are taught to both college students and lay populations.

Hug, August "A Meteorological Breakdown of a Notable High Wind Event Across the Ohio Valley Region" (Joshua Durkee)
The purpose of this research was to analyze the large and local-scale meteorological processes that contributed to a unique yet damaging non-convective high wind event that impacted parts of Indiana, Kentucky, and Ohio on February 9, 2023. The study incorporated fundamental theories of classical meteorology that are known to dictate the behavior of mid-latitude weather systems. For the duration of the event, weather maps were analyzed from archived radar, satellite, and numerical model data to display variables of high importance. Through the analysis, it was determined that the progression of the event was explained well by large-scale factors such as geopotential height falls and changing baroclinicity. This showed that the event was a result of a compact, fast-moving upper-air disturbance that forced the development of surface low pressure, which brought high winds and unseasonally warm temperatures to the focus region. These findings were then analyzed on a more local scale, connecting to the concept of ageostrophic wind and its components. It was then concluded that the isallobaric wind was a driving factor behind the prolonged period of high winds that occurred locally. Potential influences

from smaller-scale circulations within the larger storm system were also analyzed.

Hydol-Smith, Brandon; Boyd, William; Boyd, Grant; Dixon, Thomas; Dolic, Adam; Mills, Travis; Umarov, Aziz; Vaughn, Elijah; "Autonomous Robot for Mining Mayhem: IEEE Southeastcon 2025" (Mark Cambron)
For the IEEE SoutheastCon Mining Mayhem competition, our senior project team created an autonomous robot for navigating caves, collecting objects, and sorting materials. We chose ROS 2 Jazzy for its flexibility and community support. The robot uses a Raspberry Pi 4B as its main processor, with Arduino Nanos and a Teensy 4.1 for sensor integration and motor control. Turbo Worm DC Gear Motors, BTS7960 motor drivers, and high-power MOSFET controllers ensure precise movement. A compact Archimedes Screw system is used for object collection, and an inductive proximity sensor assists with sorting. Currently, key subsystems are being integrated and tested, with successful trials validating functions like localization with AprilTag markers. Future work will focus on optimizing navigation and improving sorting accuracy for better competition performance, showcasing our problem-solving skills and expertise in robotics.

Hyman, Emma; Browder-Seguin, Jamie; "Unconscious Political Messaging in Children's Films: An Analysis of the Nut Job (2014)" (Dorothea Browder)
This study seeks to analyze the extent of unintentional political messaging in children's animated films, arguing that even non-political, critically unacclaimed media can reflect ideological biases. Using the principle of slow looking, we perform a content analysis of the animated children's film "The Nut Job" through multiple weekly viewings. "The Nut Job", a 2014 animated film about squirrels attempting to rob a nut store, lacks both political intentions and widespread acclaim. Focusing on character and societal interactions, we identify implicit political themes that parallel contemporary discourse, despite the screenwriters' lack of overt political intent. Our findings suggest that audiences can derive deeper messages from films—even those dismissed as trivial—revealing ideological messages that creators may not have consciously created.

Ismail, Jade "Dating While Trans: A Conjoint Analysis of Men's Romantic Preferences" (Aaron Wichman)
Transgender women's dating experiences have received increased attention in academia as cultural understanding of gender identity develops. This project proposes an empirical examination of attitudes toward transgender women using a conjoint analysis approach. Transgender women frequently navigate difficult dating relationships, encountering unique hurdles that define their romantic and sexual experiences (including objectification and fetishization). Transgender women often express that they are mostly approached for their identification instead of their true selves. Their pursuit of romantic and sexual relationships, as well as their self-esteem, is influenced by this dynamic. Examining attitudes toward transgender women in a context where other personal attributes are systematically varied will help give more insight into the meaning and relative importance assigned to gender identity.

Jaber, Lara; Krishnani, Sanam; Krishnani, Sanam; "Co-attention and The Autism Spectrum" (Gordon Baylis)
Co-attention, the phenomenon where individuals focus on the same stimuli, is critical for social interaction and communication, and likely even language development. This study explores whether a

lack of co-attention, indicated by not looking in the same direction as a cue, is associated with high scores on the Autism Quotient Scale (AQ) (Baren-Cohen et al., 2001). Participants performed a cueing task based on Posner (1980), using images of individuals looking left or right to direct attention. The study aimed to determine if participants with high scores on the AQ exhibit different patterns of co-attention compared to neurotypical individuals. Initial results suggest that high AQ scores lead to a reduced likelihood of co-attention to the same stimuli, highlighting potential differences in social attention mechanisms.

Jackson, Andrew "Analyzing Patterns of Genetic Structure In Leuctra Stoneflies" (Jarrett Johnson) Many aquatic insect species, such as stoneflies found in the genus Leuctra, have experienced population declines due to their sensitivity to habitat alteration. Accurate species identification is crucial to delineation of imperiled populations and taxa. Traditionally, taxonomists have relied on male morphological differences to classify species, leading to partial and preliminary classification of females and difficulty assessing abundances of species assemblages. Molecular sequencing for purpose of species identification can enhance conservation efforts by including female stoneflies and individuals in the nymph stage, potentially clarifying classifications. This study builds upon previous efforts to classify Leuctra using mtDNA and explore variation in DNA markers. We constructed genomic DNA libraries using 3RAD strategy and obtained next-generation-sequences to identify tens of thousands of SNPs across sequenced individuals. We used population genetic strategies to reveal patterns of population structure and identify species boundaries. We compared our data to current understanding of Leuctra taxonomy and a recent mtDNA study of the same samples. Our findings using nuclear genomic DNA suggest that modification to existing Leuctra taxonomy is warranted and support the conclusion of the mtDNA study that cryptic and synonymous species exist. Continued testing should be furthered to shed light on complexities of stonefly genetics.

Jennings, Noah; Sileo, Logan; Desloge, Adam; Hauschild, Ben; "Karst Groundwater Flow Profile for Jennings Creek, Kentucky for Flood Management" (Jason Polk)
Jennings Creek is located in Bowling Green, Kentucky and is a spring-fed tributary to the Barren River. Flooding along Jennings Creek is a concern in part due to development and urbanization throughout the city, as well as the various groundwater inputs that can activate during large storm events. The karst landscape underlying the city contributes flow through groundwater and springs to the Creek, which can enhance flooding. The creation of a gaining stream discharge profile using the U.S. Geological Survey standard methods allows for the identification and quantification of the many surface and subterranean tributaries of Jennings Creek. A Global Flowprobe and Sontek Acoustic Doppler Current Profiler (ADCP) were used in conjunction with Onset water level loggers to measure discharge and water level, respectively, at multiple sites along the main reach of Jennings Creek and its tributaries and spring inputs. Data collected will establish recharge inputs via the contribution of major springs that could influence flooding and water quality and the prediction of flood occurrences and magnitudes. Additionally, this research will inform the EPA 319 Watershed Plan being developed for the Jennings Creek watershed.

Jerome, Sophie; Barrett, Cassie; Gehring, Alex; Sulejmanovic, Amina; Dickerson, Dalton; Woodward,

Matthew; "Problematic Smartphone Use Is Associated With Posttraumatic Cognitions" (Matthew Woodward)
With growing smartphone usage among young adults, problematic smartphone use (PSU) has become a forefront issue and research suggests PSU may be associated with trauma-related mental health outcomes. However, little research has examined the relationship between PSU and posttraumatic cognitions (PTC), which are a system of core beliefs following trauma exposure relevant in shaping trauma recovery. The goal of this project was to examine the relationship between PSU and PTC. The study consists of previously collected data including self-reports from 565 undergraduates with potential trauma exposure. Responses from the Posttraumatic Cognitions Inventory and Smartphone Addiction Scale were collected. The findings showed that PSU was positively correlated with more negative PTC about the self, world, and self-blame, as well as overall PTCs. In a linear regression analysis examining all PTC domains jointly, only PTC about the self was associated with PSU. Results indicate that PSU and PTC are related. It is possible that excessive smartphone use may exacerbate negative beliefs following trauma. However, future research should examine this relationship more in-depth and the specific factors that account for their association.

Johnston, Gillian; Johnston, Gillian; Newberry, Ally; Cartwright, Kristin; Perera, Madhawa; Tinius, Rachel; "Water Intake During Pregnancy Has A Favorable Association With Infant Anthropometrics" (Rachel Tinius)
Water intake contributes to favorable adaptations in body composition for adults. Although the clinical and scientific communities value water consumption during pregnancy, few studies have studied the relationships between water intake and infant anthropometrics. The goal of the study is to determine the impact of maternal intakes of water on infant health outcomes with a focus on infant adiposity. Women in this study are part of a larger ongoing clinical trial. Participants were given a survey about beverage intakes during each trimester via electronic surveys on REDCap. Neonatal outcomes were collected by the study team within 48 hours of delivery (including infant skinfolds and body fat composition, measured via the PEA POD, an air displacement plethysmography system, the gold standard). Results of the study showed that water intakes were similar from one trimester to the next (p=0.469). The American College of Obstetricians and Gynecologists recommends pregnant women consume 455-672oz of water per week. Average water intake for women in the study was ~289 ounces per week in the 1st trimester and ~315 ounces/week in the 2nd and 3rd trimesters, suggesting women during pregnancy are not drinking enough water throughout the pregnancy. Higher water consumption appears to lead to the delivery of leaner infants, but a larger sample is needed. Outcome data on maternal protein intake and maternal outcomes are forthcoming.

Jones, Lily "Proposing A TMJ Sensitivity Scoring System in Horses" (Debra Shoulders)
The assessment of temporomandibular joint (TMJ) sensitivity in horses has historically been subjective, limiting the reliability and reproducibility of clinical evaluations and research outcomes. Here we are proposing an easily implementable scoring system for TMJ sensitivity assessment. ``A standardized protocol was developed to evaluate TMJ sensitivity prior to sedation. Digital pressure was applied bilaterally across the facial nerve, and responses were categorized using a 4-tier scoring system as follows: Score 0: No reaction Score 1: Leaning away from pressure Score 2: Mild flinch response Score 3:

Violent flinch response In this system, each horse should be scored on each side of its head and an average of the scores can be calculated to describe the horse's TMJ sensitivity. This 4-tier scoring system has been used by practitioners and demonstrated consistent and reproducible results across evaluators. This scoring is an easily teachable and implementable protocol. While the scoring system showed promising results, some variables on reaction were noted, and the horses that exhibited these variables were disqualified from the test. Extremely head-shy horses and extremely nervous horses may be more prone to false positives.

Kazmaier, James "Experimental Design Unit for Middle School Students" (Martha Day)
This poster session presents the development of a middle school science unit on Experimental Design, designed to equip students with a strong foundation in the experimental and engineering design process. This unit is being created to ensure students grasp key scientific inquiry concepts and address potential gaps in their understanding of Kentucky Science Assessment (KSA) standards. The instructional approach emphasizes student-driven inquiry, allowing learners to design and conduct experiments on topics of personal interest. This process fosters increased engagement, and diverse perspectives, and encourages scientific curiosity. Throughout the unit, students will explore essential components of experimental design, including hypothesis formation, variable identification, data collection, and analysis. The culminating project requires students to present their experimental process and findings using a visual medium, such as a PowerPoint presentation or poster board. This unit serves as a meaningful instructional tool while providing valuable insights into curriculum development from a pre-service teacher's perspective.

Kevorkian, Hanneh; Luke, Carter; Todaro, Sophie; "The Final Bow: A Musical Film On Transitioning To Professional Theatre" (Tiffany Bostic-Brown)
This FUSE grant-funded research project, in the form of a film, explores the emotional and practical transition from musical theatre training to a professional career. The Final Bow is a ten-to-twenty-minute musical that follows Grace, a recent graduate navigating self-doubt, ambition, and the uncertainties of the performance industry. The project incorporates traditional and contemporary musical theatre songwriting techniques, collaboration with a living composer, and AI-generated music to develop a dynamic score that balances realism with heightened theatrical emotion. Our findings reveal that AI can enhance, but not replace, human creativity, with AI-generated melodies serving as a foundation that composers refine as well as the power of combining multiple art forms to enhance a story through the advantages that both mediums provide. This project demonstrates how interdisciplinary collaboration in scriptwriting, composition, and filmmaking deepens storytelling. Ultimately, The Final Bow highlights the realities of artistic careers, emphasizing resilience, adaptability, and passion as key to success.

Kidd, Cole "Enhancing Airline Passenger Satisfaction Through Predictive Analytics: A Data-driven Approach to Improving Customer Experience" (Lily Zhuhadar)
This research develops a predictive model using Gradient Boosted Trees to assess airline passenger satisfaction based on a dataset of over 100,000 survey responses. The model identifies key factors influencing passenger satisfaction, such as inflight entertainment and class, and demonstrates an impressive accuracy of 95.7%. Airlines can use this model to pinpoint and enhance elements of the flying

experience that most affect customer satisfaction, leading to improved retention, service quality, and profitability. The findings offer valuable insights for airlines, helping them understand customer preferences and optimize their services accordingly.

Kidd, Evan "An Atmospheric Review of July 6, 2016 Major Flash Flooding Over the Western Kentucky Region" (Joshua Durkee)
On July 6, 2016, a high precipitation event impacted the Paducah, KY, National Weather Service jurisdiction. Which resulted in significant flash flooding unprecedented precipitation, flooded roadways, evacuation notices, and widespread economic damage. The storm was associated with a localized dynamics that persisted through the precipitation period, despite subdued large-scale forcing. A top-down analysis reveals, at upper levels, the system displayed limited dynamics, with minimal upper-atmosphere interactions and a zonal jet stream positioned well north of the region. Temperature and thickness were near neutral, indicating faltering large-scale forcing. Interestingly, rotational forces were present and likely contributed to localized vertical motion. However, as the rotations progressed to Kentucky, it weakened substantially, further diminishing large-scale influence and horizontal translation. This study shall employ fundamental meteorological techniques as a framework to explore the role of this event's variables. Additionally, local variables related to precipitation and local energy dynamics will be used to understand localized weather forcing. The findings suggest that while large-scale factors were present, they were insufficient to sustain the storm's intensity. Instead, more localized processes likely played a dominant role in the event. This paper highlights the complex interplay between meteorological forces on July 6-7, 2016.

Kotagiri, Varshith; Kellog, Brian; "Developing a Novel Phenanthroimidazole-based Fluorescent Sensors for Detecting Analytes in an Aqueous Medium" (Lei Li)
Fluorescent sensors are organic fluorophores that detect specific analytes with quantitative fluorescence intensity changes. They have offered impressive benefits compared with instrumental techniques, such as low cost, high selectivity, and rapid responses. One issue that limits the fluorescent sensors for further application is their poor solubility in the aqueous medium, where most targeted analytes, including metal ions, inorganic anions, and neutral biomolecules, are readily soluble. When fluorescent sensors are utilized to detect these analytes, a heterogeneous phase is formed. In most cases, an extra water-miscible organic solvent is needed as an additive to facilitate the sensing process, which complicates the measurement operations and produces more organic waste. We aim to resolve this issue by skillful molecular design to introduce a hydrophilic side chain to the fluorescent sensor, increasing its water solubility and facilitating its sensing process to analytes, like various protons, fluoride ions, and copper ions, in an aqueous medium. Simultaneously, its sensitivity and selectivity will be retained. This work will simplify the sensing operations and reduce the amount of organic waste produced during the measurement. This strategy will additionally be of broad interest to the chemistry community, as it introduces the idea of modifying the molecular structure to apply an initial hydrophobic compound under hydrophilic conditions in a feasible way.

Krishnani, Sanam; Jabar, Lara; "Are You Looking Where I'm Looking? A study of Co-attention and Emotion" (Gordon Baylis)

Co-attention is a psychological phenomenon in which people tend to attend to the same things as other people and may play a crucial part in development of language and other social skills. The current study was to determine whether the emotional state of the two co-attending individuals affected the degree of co-attention. Participants performed a simple cueing task, modelled on Posner (1980), but with pictures of an individual looking to the left or right directing attention instead of an arrow. In addition, the model face could be expressing happiness, sadness, or be neutral. Participants in the study completed the Modified Differential Emotions Scale (Fredrikson et al. 2009) in order to determine their overall emotional state. As a result, the participants could be in the same or a different emotional state to that expressed by the model. The key question is whether synchronization of model and viewer led to an enhanced degree of co-attention compared to when these emotional states were not in accord. Initial results suggest that there is indeed an effect of emotional synchrony on the degree of co-attention.

Krishnani, Sanam; Gangumolu, Himani; King, Rodney; "Isolation and Analysis Of Bacteriophages Princessmocha and Gangumolu" (Rodney King)
Bacteriophages (phages) are a subgroup of viruses that infect bacterial cells. They play important roles in microbial ecology and hold significant promise as an alternative to antibiotics to treat antibiotic resistant infections. The goal of this project was to isolate and analyze bacteriophages capable of infecting Mycobacterium smegmatis from soil samples collected in Bowling Green, Kentucky. The soil samples were enriched for mycobacteriophages by culturing in the presence of M. smegmatis, a common soil microorganism. Spot testing confirmed the presence of phages and homogenous populations of bacteriophages PrincessMocha and Gangumolu were produced through multiple rounds of plaque purification. Highly concentrated stocks of each phage were generated, and the viral particles were observed using electron microscopy. Genomic DNA from each phage was isolated and analyzed by restriction enzyme digestion and gel electrophoresis. Despite having similar particle morphologies (siphoviruses), this analysis demonstrated differences in the genome composition. We conclude that PrincessMocha and Gangumolu are distinct from each other even though they were isolated on the same host and from similar geographic locations. This research has expanded our understanding of phages and their diversity. Future DNA sequence analysis of these phages will provide insights into evolutionary relationships.

Lampert, Mia "Burch & Bark" (Sheila Flener)
For this exciting design of a pet grooming facility AI was used to generate creative ideas. ChatGPT explored how Tory Burch's aesthetic could influence the design, resulting in a concept featuring vibrant colors, lively wall fixtures, and a blend of modern and traditional elements. This business aims to incorporate a level of aesthetic appeal that is often lacking in traditional grooming establishments. Tasked with transforming a blank commercial space, this project was developed into a comprehensive interior design, including space planning, furniture selection, lighting, and fixtures. Burch & Bark will highlight Tory Burch's love for style, vibrant colors, and bold patterns. This grooming center will deliver the luxury services that clients desire, fostering a stress-free atmosphere for pets and their owners during appointments and more.

Lane, Lauren; Lin, Ching-Yi; "Music Education For All: Connecting Cultures And Conservation" (Andrew

Braddock)

With the FUSE grant that was rewarded to me, I was able to volunteer with an organization called the Daraja Music Initiative (DMI). This organization plans a trip to go to Tanzania every summer and teach violin and clarinet in a town called Moshi. This creative activity was conducted in the span of three weeks and every day from Monday-Friday, we taught general music classes, violin classes, clarinet classes, and conservation lessons. The reason for going to Tanzania is to not only teach music, but to spread conservation efforts of saving the Mpingo tree from extinction. This tree is nicknamed the "music tree" because the wood is used to create clarinets. By volunteering with this organization, I participated in planting ceremonies of not just Mpingo trees, but also fruit trees. In return, I learned different songs and activities that students would share in their own language and culture. After the three weeks, I was able to implement the things I've learned in the classroom during my elementary placement of student teaching. Once DMI concluded the trip, they shared statistics of the efforts that everyone contributed to such as how many trees we planted and how many students were taught music.

Lanham, Kimberly "Cave City Stay & Play: A Family Fun Hotel" (Shahnaz Aly)

For my capstone I designed a family-oriented, resort-style hotel in Cave City, KY. Areas that created this resort-style hotel are indoor mini golf, arcade/game room and indoor swimming pool. There is also a gym for the hotel guests and a restaurant anyone can enjoy. I chose Cave City because it is close to WKU, Dinosaur World, and Mammoth Cave, so families are already traveling through. There are hotels around the area, but this one will provide a more family friendly atmosphere that parents or grandparents look for. I designed this building because I have always loved traveling with my family and staying in cool hotels. My goal was to create a building that has a modern feel but isn't out of place for Cave City; which is also sustainable and functional. Another goal was to bring families and friends together in a fun experience they can also stay at. This building can allow more people to extend travel in Cave City to explore the natural features such as the caves around the area, as many people just drive through or stay a single night.

Ley, Elena "Impact of a Final Project in an Introductory Physics Course" (Scott Bonham)

We have replaced a high-stakes final exam with a final project in an introductory physics course where students integrate multiple physics concepts to describe a real-life situation of their choice. The goal of this project is to help pre-health and life science students connect physics to their professional and personal interests. We are investigating the impact of the final project on student mastery of physics concepts, integration of ideas, application to real-world contexts, and affective aspects such as physics self-efficacy. Former students in the course are being surveyed to gather student perceptions of the project's benefits and challenges. Final projects are being systematically analyzed to identify patterns in conceptual integration and real-world applications. The results of this work will allow us to enhance student engagement and improve aspects of the final project.

Lich, Ava "Caves, Calculus, and Climate Change" (Chris Groves)

Climate change poses a significant global challenge, with increasing levels of atmospheric carbon dioxide as a primary driver of rising temperatures and environmental disruptions. Karst systems, such as those in South-Central Kentucky, play a crucial role in sequestering atmospheric CO_2 through the dissolution of

limestone, a process that forms unique landscapes while mitigating climate impacts. This study investigates the discharge dynamics of Cascade River in Great Onyx Cave to enhance understanding of the relationship between hydrology and carbon sequestration in karst environments. A barrel weir equipped with pressure transducers was employed to collect and measure water flow, and Torricelli's law was used to calculate discharge under varying conditions. Python-based computational modeling enabled efficient processing of large datasets, revealing a strong correlation between rainfall patterns and discharge rates. The findings highlight the sensitivity of flow dynamics to environmental inputs and demonstrate the potential of karst landscapes as natural carbon sinks. This research establishes a framework for future studies to refine discharge measurements, integrate real-time environmental monitoring, and quantify the contribution of limestone dissolution to atmospheric carbon sequestration.

Lin, Flora "Patrice Lumumba: Champion of Human Rights and Self-determination" (Patricia Minter)
Patrice Lumumba was a pivotal figure in the struggle for self-determination, human rights, and Pan-African unity, not only in the Democratic Republic of Congo but across Africa. As the first democratically elected Prime Minister, his leadership was marked by a vision for an independent and unified Congo, free from colonial exploitation. This presentation examines Lumumba's legacy within the broader historical context of Belgian colonial rule, Cold War geopolitics, and the lasting impact of Western interference. It also explores his advocacy for human rights, his role in the Pan-American movement, and the circumstances leading to his assassination.

Loveless, Colin; Reed, Steven; "Loss of Human CST Leads to Increased Genome Instability" (Jason Stewart)
Mammalian CST (CTC1-STN1-TEN1) is a highly conserved, heterotrimeric protein complex that plays essential roles in telomere maintenance and DNA replication. CST dysfunction, from mutation or altered expression, is associated with cancer and genetic disease. Previous research has shown a significant increase in common phenotypic markers of genome instability, namely micronuclei and anaphase bridges, in CST depleted cells. Such findings suggest CST plays an integral role in maintaining genome stability. CST was also shown to play a role in DNA damage response pathways (DDR), which recognize and recruit DNA repair factors to damaged DNA. The goal of this study was to (1) determine whether a complete gene knockout (KO) of CTC1 or STN1 increased micronuclei and anaphase bridges and (2) investigate the role of ATR, a kinase that activates the DDR, in protecting genome stability in CTC1 or STN1 KO cells. We measured anaphase bridges and micronuclei following KO of CTC1 or STN1 in the presence or absence of an ATR inhibitor. We determined that KO of either subunit increased both anaphase bridges and micronuclei. We are currently looking to see how ATR inhibition further affects genome instability. These findings will help determine how CST promotes genome stability and disease progression.

Lowman, Charlie; Hughes, Maysn; Aham, Victor; Pahari, Samir; Gani, Royhan; Gani, Nahid; "Geology in Flight: Unveiling WKU's Campus Karren Through Drone Technology" (Royhan Gani)
The foundation of WKU's campus rests on a geologically diverse and complex karst system. Our study is focused on several outcrops scattered throughout campus, showcasing mesoscale karst features called "karren". Karren provides important insight into the geological processes in shaping the area. By using

drone technology and physical geologic exploration we aim to enhance our understanding about the geology of our Hill. The primary objective of this study is to utilize drone-based imagery for mapping and analyzing mesoscale karst features within limestone outcrops at WKU's campus. A preliminary scouting survey identified ~12 outcrop sites across campus. We are collecting drone photos and videos of these sites for analysis and mapping, supplemented by detailed geologic ground investigation. Initial analysis reveals a network of highly jointed limestone beds distributed across multiple areas of campus. The exposed clints display rills, flutes, channels, and rillenkarren. The jointing (grikes) appears to be significantly weathered not only by hydraulic dissolution, but also by other weathering processes including frost wedging. Our findings will provide a foundation for future research on the geology of WKU's campus, particularly by highlighting ongoing geomorphological processes on the Hill.

Lunday, John; Gani, Nahid; Anderson, Sydney; Hughes, Maysn; Lowman, Charlie; Woodard, Dayvon; "Limestone Microscopy: A Case Study in the Optical Validation of Field Investigations in The Olmstead Quadrangle, Todd and Logan Counties, Kentucky" (Nahid Gani)
The Olmstead Quadrangle represents an area of southwestern Kentucky, located in parts of Todd and Logan Counties, that consists of dense forestry and agriculture. A previous study, conducted by George E. Ulrich in 1966, resulted in the creation of a geologic map for the region at a scale of 1:24,000. This previous study, although extensive, leaves three stratigraphic units undifferentiated, those being the Paint Creek Limestone, Bethel Sandstone, and Renault Limestone. In this study, we utilized remote sensing and machine learning technologies, in conjunction with field investigations and laboratory analyses, to differentiate these stratigraphic units to update the geologic map to a scale of 1:10,000. Results from remote sensing and machine learning were validated via laboratory analyses using the petrographic and scanning electron microscopes. In total, 24 samples out of 54 were chosen for thin section analysis. The mineralogical content of the collected samples was studied to discern the differences between muddy/microcrystalline limestone (Paint Creek) and oolitic limestone (Renault). Fossils and other notable features were recorded in this regard. After confirming the identity of the collected samples, an updated geologic map was finalized.

Maddux, Charles; Peak, Frankie; Hardesty, Roby; Hardesty, Roby; Peak, Frankie; "A Study on the Diversity and Distribution of Birds in Cloudbridge Nature Reserve" (Martin Stone)
Cloud forests are an uncommon, highly biodiverse subset of tropical forests. Dozens of unique bird species flock to these forests due to their unique climate, flora, and animals. With climate change threatening these fragile ecosystems, surveys on ecological health are becoming more important. Bird diversity levels can be an indicator of a forest's environmental health. Our study focuses on the bird diversity of Cloudbridge Nature Reserve — one of the 4 major cloud forests in Costa Rica. Using a point count survey, we measured the number of unique individuals and species in three areas with different levels of human development. In this poster, we present our data findings and the result of our project.

Marcel, Loveth; Williams, Kevin; "Reactions of Guanine Nucleotides with Platinum(ii) Complex Containing a Ligand That Can Switch Between Bidentate And Tridentate Binding Mode" (Kevin Williams)
The World Health Organization has projected that by 2030, twenty-six million people could be affected by cancer. As a result, the ongoing synthesis and characterization of various derivatives are crucial. In this

study, a platinum(II) complex derivative with a tridentate binding mode was synthesized. On interaction with 5'GMP, NMR studies conducted over 24 hours, 72 hours, 6 days, and 11 days showed that the four peaks on the far left gradually diminished in size compared to those on the right. By comparing the NMR data after 24 and 72 hours, it is evident that the peaks in the ~8.4-8.6 ppm range are likely mono products, as they appeared first and were furthest downfield. The peaks that grew in the ~8.1-8.3 ppm range are likely bis products, where two GMPs are coordinated, suggesting a bidentate binding mode. By day 11, the mono products were replaced by bis products. A notable observation about this derivative is that it exhibits a tridentate binding mode at low pH but transitions to a bidentate mode at high pH. In conclusion, our synthesized compound demonstrates the ability to switch between bidentate and tridentate modes upon interaction with the biological target 5'GMP.

Marcum, Ryan "A Large Scale and Local Variable Analysis of the 3-5 March 2015 Winter Storm Across Kentucky" (Joshua Durkee)
On 3 March-5 March 2015, Kentucky was impacted by a significant storm system/mid-latitude cyclone. The system came with one wave of heavy rain very late on the 3rd and into the 4th, and another where rain changed to sleet then to snow for much of the state on the 4th and continued into the early part of the 5th. This was a very abnormal winter storm as it came late within the winter season, especially for this region. Flooding and winter weather impacts were widespread with over two inches of rain and up to, and possibly over, two feet of snow for parts of the state. Drastic river flooding occurred for many locations. The large scale pattern and local scale factors were supportive of such a system with synoptic variables coming together to provide the lifting needed for formation and propagation and with impacts that were enhanced by local factors. This system will be thoroughly analyzed from a large scale and local standpoint to determine how and why it impacted the state of Kentucky in the manner it did. Variables leading up to and during the event will be analyzed to determine the forcing that led to the significant event and impacts.

Marcum, Ryan "Kentucky's Coldest Year: A Case Study of the Causes and Impacts of Kentucky's coldest year (1917)" (Jerald Brotzge)
In 1917, Kentucky experienced its coldest recorded year on record based on yearly average temperature. This work examines the meteorological factors leading to this coldest year by analyzing long- and short-term teleconnections alongside synoptic circulations using historical weather records. Climate statistics are evaluated on a month-by-month basis, revealing that the entire year did not remain consistently below normal. The impacts of the cold temperatures, at times, throughout the year were seen to be significant, which these weighed towards the winter months. The societal impacts of these extreme temperatures are explored through historical newspaper archives, highlighting disruptions in public health, public services, transportation, agriculture, and commerce. Reports detail widespread impacts including, but not limited to, frozen pipes, frozen livestock, cold deaths, coal transportation issues. This approach examines quantitative and qualitative data to access the meteorological and societal impacts associated with the coldest year in Kentucky's history. This study offers valuable insight into how communities across Kentucky managed this cold period in the past and how the impacts can be forecasted and mitigated within the future.

Martinez, Leo; Gachagua, Chris; "Assessing Fluorescent Dye Stability to Inform Groundwater Remediation" (Lee Anne Bledsoe)

More than 30% of Kentucky residents rely on groundwater for drinking water. According to the U.S. Geological Survey, one in five groundwater samples from U.S. drinking water aquifers contains contaminants exceeding human health concerns. A major source of contamination is petroleum products, such as gasoline, leaking from underground storage tanks. One of the most effective remediation methods uses strong oxidizing agents like persulfates to break down petroleum hydrocarbons. However, understanding groundwater flow is crucial for remediation success, and fluorescent dye tracing is the best tool for mapping underground hydrology. Unfortunately, most fluorescent dyes are susceptible to oxidation, creating challenges in persulfate-treated areas. In 2024, CHL conducted bench-top experiments to assess whether dye tracing remains viable in a petroleum-contaminated aquifer post-persulfate remediation. Initial results showed dye detection was possible in charcoal receptors and water samples, depending on persulfate levels. Field tests produced mixed results, highlighting the need for further refinement. To address this, ongoing research will test dye-persulfate interactions across different concentrations to determine at what conditions dye tracing remains effective. This study aims to establish guidelines for integrating dye tracing into remediation strategies, ensuring accurate groundwater assessment without compromising treatment effectiveness.

McBride, Sage; Khouryieh, John; "A Review on the Safety of Meat and Poultry Products Sold at Farmers' Markets" (John Khouryieh)

Farmers' markets have seen a significant rise in popularity, offering consumers a unique opportunity to purchase local food products directly from vendors. This growing trend has led to an increased presence of meat and poultry at farmers' markets across the country, highlighting the need for robust food safety measures. However, current research does not specifically address the safety of meat and poultry at these markets. This study aims to assess the effectiveness of existing food safety measures for meat and poultry products sold at farmers' markets by analyzing studies on vendor practices, consumer perceptions, and outbreaks. Consumer survey data indicates a general lack of concern among consumers regarding food safety at farmers' markets, while studies of vendor practices highlight deficiencies in essential food handling techniques, such as handwashing. Furthermore, research on pathogenic bacteria, including E. coli and Salmonella, found in meat and poultry products sold at farmers' markets underscores the risks of outbreaks and foodborne illnesses. By reviewing existing food safety research and analyzing outbreaks linked to meat and poultry, this study identifies proper vendor practices, necessary improvements, and areas for future research.

Mcclanahan, Sarah "Examination of the Large-scale and Local-scale Features That Contributed to the Spring Hill, Tn Tornado Event" (Joshua Durkee)

In May 8, 2024, in Spring Hill, Tennessee, a tornado rated an EF-3 moved through Maury County, TN, around 5:30 PM. It touched down along the Duck River and moved northeast before lifting in Marshall County, TN. As the tornado reached its maximum strength, a tornado emergency was issued by the National Weather Service in Nashville. The tornado was a product of complex atmospheric dynamics driven by upper- and mid-level troughs, warm air advection, and vertical wind shear. This study examines the significant large and local-scale weather pattern factors that contributed to the development and

intensification of the event using data from the RAPid Refresh model and meteorological theories. We identify key drivers of vertical motion, instability, and storm development by analyzing geopotential heights, relative vorticity, temperature advection, and differential vorticity advection across pressure levels. The findings highlight surface and upper atmospheric processes in severe weather generation, enhancing the supracellular storm's severity.

McPherson, Carly; Faulkenberg, Lily; Heckler, Jaime; Ratcliff, Camille; Hisler, Isaiah; Ledwidge, Patrick; "ERP Correlates of Cognitive Control During an Unanticipated Sidestep Maneuver: Preliminary Findings from an EEG Mobile Brain-Body Imaging (MOBI) Study" (Patrick Ledwidge)
This study examined how anticipating the direction of a forthcoming sidestep affects event-related potential (ERP) components of conflict monitoring to stimuli that dictate movement direction. We seek to establish the cognitive processes that guide unplanned movements. The yypothesis of this study was that N200 ERP amplitudes will be more negative when stimulus direction is unanticipated than anticipated. N200 amplitudes to unanticipated flankers will be negatively correlated with accuracy on these trials. Mobile EEG was recorded while participants (n = 14) jogged down a 12-foot runway and performed a sidestep change of direction.

Meador, Cole; Katz, Hilary; "Utilizing Spatial Transciptomics to Identify Molecular Mechanisms Underlying Spinal Cord Regeneration in the Larval Sea Lamprey" (Hilary Katz)
In mammals, spinal cord injuries generally result in permanent neurological deficits. In contrast, larval sea lampreys (Petromyzon marinus) demonstrate remarkable regenerative capacity after a spinal cord injury. To elucidate the molecular underpinnings of this recovery, we used spatial transcriptomics to identify trends in gene expression before and after injury in the lamprey spinal cord. Our analysis compared transcriptional profiles in rostral and caudal tissues relative to the transection site at 1- and 3-weeks post-injury against uninjured controls. Significant genes were ranked by log2 fold change for functional enrichment analysis using gprofiler2, an accompanying R package to a popular toolset for analyzing overrepresentation of genes relating to specific known pathways called g:Profiler. Using standard gene ontology (GO) annotations as a functional information source, differences across three nested levels of biological processes were found in all groups. Our analysis highlights key biological functions active during the regeneration process that could become potential targets for future therapeutics aimed at treating spinal cord injuries in humans.

Medina Disponett, Alana; To, Sheila; "Age-related Differences In The Perception Of Negative Emotions Including Pain" (Andrew Mienaltowski)
Age-related deficits in negative facial emotion recognition are generally weaker in tasks using dynamic emotion expressions relative to those using static expressions. This study extended prior aging research on emotion perception by asking adults ranging 20-79 years of age to observe dynamic negative emotion expressions from numerous emotion categories, including pain, in the context of an emotion identification task. Stimuli were randomly presented in blocks. Participants considered every stimulus relative to a single emotion category in each block. Signal detection measures of sensitivity and response bias were examined for each block. Overall, chronological age was negatively associated with participant sensitivity to sadness. Age did not predict signal sensitivity for other negative emotions. Additionally,

bias in perceiving pain in non-pain stimuli increased with age. This bias was not associated with participant self-reported physical or mental health, nor with the participants' tendencies to interact with people experiencing pain. These findings replicate prior research where age differences in emotion perception are minimal for dynamic expressions, highlighting that, as we age, we may display a pain empathy bias such that we perceive that others are in pain when they are expressing other negative emotions.

Milam, Lily; Woodward, Matthew; "Preferences and Utilization of Stress Management Techniques Among Young Adult Heavy Drinkers Enrolled in a Digital Health Intervention" (Matthew Woodward)
Previous studies have shown a high prevalence of anxiety, stress, and depression among college students. While adaptive stress regulation techniques can help mitigate these concerns, their impact is limited as many individuals are unable or unwilling to seek formal treatment services. The purpose of the present study was to identify preferences and utilization of stress management techniques offered within an ongoing randomized clinical trial of a digital health intervention. Participants include approximately 55 college students with a lifetime history of interpersonal trauma exposure who engaged in heavy drinking. Participants were provided psychoeducation on six affect management strategies and asked to set goals to practice the preferred strategies over the course of six months. Analysis revealed physical exercise was the most chosen strategy (43%), while cognitive restructuring was the least (10%). On average, participants adhered to goals 70% of the time and attempted at least two strategies. Results highlight the importance of tailored interventions that align with individual lifestyles. Given the link between substance use and mental health, delivering these tools via digital interventions offers significant potential to reduce substance-related problems and improve mental health.

Miles, Quade; Polk, Jason; Desloge, Adam; "Urban Karst Flood Hazard Mitigation at Fairview Plaza, Bowling Green, Kentucky, USA" (Jason Polk)
The City of Bowling Green, KY is established on karst topography, a landscape notable for caves and sinkholes providing direct drainage into underground aquifers. Fairview Plaza, a highly urbanized area, is prone to flooding because stormwater is directed from the surrounding commercial and area into a drainage complex of injection wells and sinkholes. The purpose of this study is to model flooding in Fairview Plaza using water level and rainfall data. Data were collected at a one-minute resolution before and during the February 2025 flood to establish a flooding threshold for prediction of future flooding during storms to help prevent damage and risk to people. Results of this study provide a better understanding of urban karst flood dynamics, which can be utilized for future stormwater management practices and to implement real-time monitoring for improved safety measures using triggered warning lights and signage during storm events, along with public data display and alerts. The methods used may improve safety and prevent damage to other similar locations in urbanized karst areas using technology combined with hydrologic modeling to mitigate future hazards and promote awareness.

Minteer, Victoria; Ferguson, Cheyla "Buti Yoga: Movement, Mindfulness, and Mental Health" (Jill Sauerheber)
The word "buti," an Indian Marathi word, means "the cure to something hidden beneath the surface."

Buti Yoga is a fusion of primal movement, dynamic asana, and cardio sprints. These movements bring people back home to themselves through spiraling movements, drumming, and shaking. Music leads the class to facilitate shaking that helps to release trauma stored in the body. The integration of mindfulness, somatic movement, and a sense of community within Buti Yoga aligns with contemporary therapeutic approaches, such as somatic experiencing and trauma-informed care. This presentation explores how Buti Yoga can complement traditional mental health interventions in the therapeutic space. For this independent research project, we collected anecdotal reports of Buti Yoga on mental health, and we found the most common responses included how it is "playful" and "freeing". Through this process, we discovered Buti provides something completely different than other workouts. As we are preparing for post-graduate employment, we found Buti Yoga can fill in the gaps within the mental health field, bringing an integrative and holistic approach to reconnect people with their bodies.

Mishchuk, Yulia "Can V1 Targeted Transcranial Focused Ultrasound Induce a Temporary Visual Blindspot?" (Gordon Baylis)
Transcranial focused ultrasound (tFUS) is an emerging technique for non-invasive brain stimulation which may be effective in modulating neural activity. While this technology has extraordinary potential for clinical application, there is no current method of titrating, or adjusting the amount of stimulation in order to personalize treatment for each patient. Our study aimed to develop a technique for measuring a threshold for tFUS by targeting the primary visual cortex (V1) and observing any temporary visual disruptions reported by participants. Participants carried out computerized tasks that tested different definitions of "seeing", while a researcher stimulated their left V1 with a tFUS device. The results showed that tFUS stimulation does not have a large effect on the vision of subjects, indicating that the ultrasound intensity we used may be close to the threshold for effects on the human visual system. This mirrors recent research by other teams who have suggested that increased intensity of tFUS may be needed. Once the tFUS device is modified for increased intensity (which will entail FDA approval), we will continue research to find an effective method for determining individual stimulation thresholds for eventual clinical administration.

Mixon, Arrmoni "Sustainable Fun For All: Clarksville's Ultimate Entertainment Hub" (Shahnaz Aly)
This presentation discusses a designed a multi-functional entertainment center for the city of Clarksville, which includes dining, a go-cart track, laser tag, bowling and more. Given the proximity to a military base and its rapid increase of families and residents, the project aimed to offer another convenient option alongside the existing entertainment in the area. The goal of the new facility was to provide more space, affordable pricing, and a variety of entertainment options all under one roof, catering to the community, regardless of age, and eliminating the need to travel to nearby cities like Nashville. The design was envisioned to follow contemporary design principles, with a focus on functionality, sleekness, and sustainability. Influenced by family entertainment centers like Dave & Busters, Big Time Entertainment, and Andretti's, the building aimed to create an inviting atmosphere with a futuristic feel, inside and out, to ensure an enjoyable experience for everyone.

Miya, Mahamad; Philips, Keith "A Phylogeographic Study of the Kentucky Endemic Cave Beetle Neaphaenops Tellkampfii Erichson (1844)" (Keith Philips)

Studies on the phylogeography of cave beetles in the United States remain limited despite their significant ecological role in cave habitats. My research addresses this issue by focusing on the Kentucky endemic cave beetle, Neaphaenops tellkampfii, a species found in central Kentucky. The study aims to elucidate the evolutionary history of this species while testing the validity of four proposed subspecies based on morphological differences. For this study, up to four individuals per cave were collected from 64 caves, including some newly discovered populations. DNA was extracted, and 1200 bases of the CO1 gene were amplified and sequenced. Phylogenetic trees were built using Bayesian, Maximum Likelihood, and Parsimony analyses. The result showed only two valid sub-species, with the Barren River the barrier separating the southern and northern populations. The result potentially has broad application to the speciation of many other cave organisms in this important karst region. Further, gene flow among populations of Neaphaenops indicates previously unrecognized intercave links. Cave studies such as this one are useful to subterranean biologists in the identification of unique cave systems that are important for biodiversity conservation efforts.

Naas, Ben; Butcher, Joel; Rice, Trent "Intra-rater Reliability of Activforce2 HHD in Assessing Hip Strength Musculature" (Melissa Tolbert)
ActivForce2 is a new, inexpensive hand-held dynamometer that can be remotely read using a mobile device. It has shown to have high interrater (0.85-0.97) and intra-rater (0.95-0.99) reliability for upper extremity motion (Karagiannopoulos et al.). However, the reliability of lower extremity strength has not been established. The purpose of this project is to examine the reliability of the ActivForce2 handheld dynamometer for assessment of strength of hip flexion and abduction. Approximately 20 healthy individuals, at least 18 years of age with no prior lower extremity injuries or surgeries, were included in this cross-sectional, single group study. Following a standard warm-up protocol, subjects underwent testing for hip abduction and hip flexion strength by three different raters (a student, expert clinician, and an externally fixated apparatus as a control). The average strength across two trials for each rater and each limb's hip flexion and hip abduction movement was used to assess reliability via intra-class correlation coefficients. Reliability results helped determine if this device is a viable option to use in clinics

Naik, Prthu; Potts, Logan "Tracking a Rolling Can Filled with Fluid Oscillating Along a Ramp" (Ivan Novikov)
In this project, we studied the rolling oscillations of a cylindrical container filled with viscous fluid rolling on an isochrone (tautochrone) ramp. The goal of the project was to determine how the period of oscillations depends on the viscosity of the liquid and to develop a data acquisition system (DAQ) to obtain video data. Coordinates of the rolling cylinder were determined from video obtained with multiple cameras readily available on the market. The cylinder coordinates were extracted from video data using a developed tracking algorithm. Although the DAQ proved to be effective, we are working on improving its accuracy by using a Raspberry PI 5 (RPI5) system with stereo cameras. In this presentation, we will discuss a developed experimental setup, present experimental data obtained with various liquids, and discuss the developed software used to determine cylinder coordinates.

Neagle, Presley; Marquardt, Joseph "Cell Shape is Mediated by a Joint Effort Between a Septin-

associated Kinase and Endocytic Protein." (Joseph Marquardt)

Cell shape is often a concerted effort between cell growth and cell division timing. Defects in regulating cellular morphology are linked to various diseases including cancer, infertility, and neurodegenerative disorders. In the budding yeast Saccharomyces cerevisiae, this coordinated regulation is exemplified by the kinase Elm1, which has been shown to regulate the shape of the growing bud by linking cell cycle progression to bud growth. In cells that lack the Elm1 gene the bud exhibits a dramatic elongated shape. This study investigates a possible downstream effector of Elm1: Ede1, an endocytosis scaffold that we have recently linked to Elm1 through proteomics data. Using both classical yeast genetics and fluorescence microscopy, this study examined cell shape regulation by Elm1 and Ede1. Results show that deletion of both genes causes a more dramatic elongation phenotype as well as a cytokinesis defect. Interestingly, Elm1 regulates Ede1-GFP localization at the site of cell division just prior to cytokinesis. Elm1-GFP localization is also increased in cells lacking Ede1, indicating a coordinated effort between endocytosis and the morphogenesis checkpoint. Since Elm1 and Ede1 have human homologs (LKB1 and EPS15, respectively), these results could translate to human systems to better understand the complexities of cellular morphology-related diseases.

Neitzel, Caleb "Clarity of the Source of Information in Attorney Advertisements and Effects on Risk Beliefs about Phamaceuticals" (Jacob Byl)

Attorneys often use television advertisements to recruit potential clients for class-action lawsuits, including suits against the medical and pharmaceutical industries. These advertisements cause concern among medical professionals that patients could be misled by exaggerative or misleading information in the advertisements, causing patients to ignore advice from their medical providers. To better understand how these advertisements affect viewers' risk beliefs about medications, we conducted a survey of 1,292 participants who were shown mock pharmaceutical and attorney advertisements and then asked about risk beliefs and perceptions of the advertisements. We found 24% of the participants believed that the source of the attorney advertisement was unclear. Respondents who believed that the source was unclear viewed the advertisements as less credible and experienced a smaller change in their perception of how risky the drug was compared to viewers who believed that the source was clear. Viewers who believed that the source was unclear were also less likely to believe that the advertisements are currently well-regulated. These results inform state and federal efforts to regulate these types of advertisements.

Noronha, Alrose; Cissell, Trenten "Investigating Crash Contributing Factors at Public Highway-railroad Grade Crossings in Kentucky" (Kirolos Haleem)

This study evaluates crash contributory factors at Kentucky's public highway-railroad grade crossings (HRGCs). This study analyzed 1,117 crashes at public HRGCs in Kentucky from 2014 to 2023 using data from the Kentucky Transportation Cabinet (KYTC). The contributing factors examined included crash-related factors (e.g., collision type and at-fault vehicle type), driver behaviors (e.g., aggressive driving), geometric features (e.g., presence of curves, grades, channelization, and track signalization), and environmental conditions (e.g., weather and crash timing). Statistical methods, including Chi-square test and odds ratio (OR), were applied. Additionally, police crash narratives were manually investigated to identify the potential causes for HRGC-related crashes. The Chi-square test of independence showed

that the manner of collision, at-fault vehicle type, speeding, presence of channelization nearby HRGCs, number of lanes, and time of crash significantly impacted the severity of crashes at HRGCs. Furthermore, the OR results indicated that the odds of severe crashes at HRGCs involving head-on collisions, motorcycles, and higher speed limits (≥45 mph) were 10.37, 15.03, and 2.355, respectively. The in-depth investigation of crash narratives indicated that driver behavior (lane changing and making left-turns) significantly contributed to HRGC crashes. The study suggested installing channelizing islands, reflective road markings, and chevron signs with retroreflective strips before sharp horizontal curves leading to HRGCs to help reduce severe HRGC-related crashes.

Ofoka, Emmanuella "Ceg10 Legionella Pneumophila Effector Protein Modulate Host Lipid Metabolism" (Simran Banga)
Legionella pneumophila is a gram-negative bacterium responsible for severe respiratory illnesses known as Legionnaire disease and a flu-like sickness known as Pontiac fever. Upon inhalation, the bacterium evades lysosomal degradation within alveolar macrophages, establishing Legionella-containing vacuoles (LCVs) for replication. The type IV secretion system enables Legionella to inject numerous effector proteins into the host cell, facilitating its survival and replication. However, L. pneumophila has about 300 effector proteins, and a lot of them are yet to be characterized and Ceg10 is one of them. In this study, we utilized the structural and functional characteristics of the Ceg10 protein to understand its role in the host during Legionella infection. We used the amino acid sequence retrieved from UniproKB to predict structure and function using I-TASSER, COFACTOR, ProBIS, and CAOCH to predict different protein conformations of PPARs involved in transcription factor activity. SWISS-MODEL and PHyRE2 both predicted functionalities characteristic of hydrolases and transferases. LocTree3 shows 86% confidence in Ceg10 nuclear localization. The transcriptomic analysis of Ceg10 expressed in HEK 293T cells in comparison to the control cells shows that Ceg10 significantly affects the lipid metabolism pathways.

Oney, Mason; Kambesis, Patricia "A History of Dye Tracing in the Hidden River Cave Groundwater Subbasin, Kentucky: Visualizations into Karst Hydrogeology and Contamination Risks" (Patricia Kambesis)
Dye tracing played a crucial role in understanding the hydrogeology of the Hidden River Cave groundwater subbasin in south-central Kentucky, a key part of the overall Gorin Mill groundwater basin. Hidden River Cave, contained within a sub-basin of the Gorin Mill Basin, is located in Horse Cave, Kentucky. Hidden River Cave serves as a major conduit for groundwater flow, with a rapid response to surface water inputs to outputs on the Green River. Recent dye-tracing studies confirmed that runoff from urban areas enters the cave system within 40 minutes to 1.5 hours. Extensive dye-tracing studies, particularly between 1975 and 1987, exposed significant contamination from raw sewage and industrial waste that traveled through the cave system and flowed into the Green River. Tracer studies conducted between 2019-2024 revealed the connection between city wastewater infrastructure and the cave system, industrial activity and microplastics contamination, and crayfish die off from manufacturing pollution. This project aimed to compile 50 years of dye trace results into a GIS to produce a dynamic visualization of contaminant source and transport within the Hidden River karst groundwater basin. The visualization has refined current groundwater models and informed environmental management in this highly vulnerable karst landscape.

Pahari, Samir; Gani, Nahid D. "Leveraging Deep Learning and Remote Sensing-based Geomorphology for Flood Susceptibility Mapping in the Appalachian Mountain Regions of Kentucky." (Nahid D. Gani)
Flooding is among the most devastating natural disasters, frequently disrupting lives and livelihoods. In Eastern Kentucky, located within the Appalachian Mountains, flooding risk is heightened by steep terrain and narrow valleys. In recent decades, increased settlement in low-lying riverine areas has increased flood risks due to inadequate disaster management and sustainable planning. This study evaluates flood susceptibility in the North Fork Kentucky sub-basin by combining deep learning (U-net architecture) with geomorphic data from remote sensing and LiDAR-based DEMs. Sentinel-2-based LULC and NDVI, soil, and rainfall data from PRISM were analyzed to generate a detailed flood susceptibility map. Using ArcGIS Pro, 11 raster layers were created, encompassing slope, aspect, elevation, river proximity, topographic wetness index, stream power index, curvature, LULC, soil type, rainfall, and NDVI. Flooded and non-flooded areas were identified using flood inventory mapping through Google Earth Engine and historical flood records. The U-net deep learning model performed pixel-wise segmentation to distinguish flooded from non-flooded areas, demonstrating its effectiveness in automated image analysis. The results highlight the model's superiority in mapping flood susceptibility and identifying vulnerable areas. This study aims to mitigate the problem of data scarcity in flood studies and support improved disaster preparedness planning in flood-prone areas of Eastern Kentucky.

Parrish, Hallie; Walton, Ethan; Bates, Parker; Mancini, Anthony "Assessing Heart Rate and Perceived Exertion in Virtual Reality Gaming for Aerobic Fitness" (David Bell)
Introduction: Virtual reality (VR) gaming has emerged as a potential tool for aerobic exercise, but its effectiveness in achieving target heart rates remains uncertain. This study investigates whether healthy individuals engaging in VR gaming using the upper extremities can achieve a desired target heart rate while reporting no more than moderate exertion on the rate of perceived exertion (RPE) scale. A convenience sample of approximately 40 healthy adults aged 18-30 with no prior experience of regular VR gaming or regular aerobic exercise will participate in a single-group design study. Participants will engage in a 15-minute session of Beat Saber using the Meta Quest 3 VR headset. Heart rate will be continuously monitored using an Apple Watch by utilizing the heart rate intensity zones, and perceived exertion will be assessed using the Borg RPE Scale. Data will occur in a controlled laboratory environment. Paired t-tests will compare heart rate (HR), time, and RPE on a scale of 6-20.

Patnaik, Amogh; Hahn, Lance "Computational Modeling of Free Association with Word2Vec and Frequency Analysis" (Lance Hahn)
Free association (FA) is the mental process by which one word (cue) may spontaneously suggest another (target/response). FA can reveal the cognitive processes underlying word creation. We developed an artificial intelligence (AI) model that replicates human FA data from the Nelson et al. (1998) FA norms. Using Python and a pre-trained Word2Vec model, cue and response words were transformed into high-dimensional vector embeddings. Cosine similarity analysis revealed that responses are not necessarily semantically similar to their cues. As a result, word vector differences were used to capture global relationships. Dimensionality reduction identified spatial patterns, leading to a novel prediction algorithm for zero-shot FA responses. To model repeated responses from a single simulated participant, an exponential moving average and word stem lemmatization were integrated. Model context was

further augmented by incorporating word frequency information from the Google n-grams dataset. A Monte Carlo simulation evaluated model performance and corroborated the model's ability to replicate human-like FA while revealing meaningful differences. This work presents a promising approach to computationally modeling FA, with potential applications in natural language processing, cognitive psychology, and AI.

Patterson, Kellen; Nee, Matthew "Synthesis of Polymer Beads with Incorporated Photocatalyst for Water Remediation" (Matthew Nee)
Oil pollution in aquatic environments is an issue that has become more relevant in recent years especially with many ecosystems now cornered by climate change, habitat loss, and other human activity. Harnessing photocatalysis by using polymer beads as a substrate is crucial in solving this decades old problem. The photocatalytic beads are designed to float over a body of water and use the light of the sun to catalyze the degradation of organic pollutants. Beads comprised of polystyrene and PMMA were synthesized with a goal of high surface-area-to-volume ratio to maximize photocatalyst incorporation. Energy dispersive X-ray spectroscopy confirmed titanium dioxide had been successfully incorporated into the beads' surface structure and UV-visible spectroscopy experiments were done to assess the polystyrene beads' effectiveness in degrading organic material. Data showed that methylene blue degraded faster in the presence of the photocatalytic beads than it did alone. Adding photocatalyst at the time of sonication-induced emulsion with at least 24 minutes of total sonication proved a crucial step in obtaining desirable bead product. Quantifying the surface-area-to-volume ratio of photocatalytic polystyrene beads will provide further insight into the relationship between sonication and surface morphology. Moving forward, the methods used for PMMA and polystyrene beads will be applied to biodegradable polymers which are more logical for real-world applications.

Patterson, Lex; Hans, Kate; Holley, Robert "Leaf Litter Invertebrate Diversity in Cloudbridge Costa Rica" (Keith Philips)
Cloudbridge Nature Reserve in Costa Rica, a cloud forest located in the Talamanca Mountains, is known for its incredible biodiversity of poorly known invertebrate species. Additionally, it has many types of forest habitats. This study was conducted to determine how the invertebrate biodiversity in leaf litter differs between forest types, and how much endemism exists. We studied four forest types: Primary Oak Forest, Primary Mixed Forest, Secondary Forest, and Riparian Forest. We hypothesized that the Oak Forest would have the least amount of invertebrate biodiversity while the Primary Mixed Forest would have the most. Weevils and rove beetles were used to compare habitat diversity and test our hypotheses. Contrary to our hypotheses, the Primary Mixed Forest had the most diversity and the Secondary Forest had less diversity than the Oak Forest. A previous study of weevil and rove beetle diversity suggests that 60% of the species in these groups are endemic to the Talamanca Mountains. In summary, our study highlights the significance of cloud forest habitats for invertebrates and shows how little data has been collected on the invertebrates in the Talamanca region. We sampled and exampled four sites in the Cloudbridge reserve for invertebrate diversity.

Payette, Thomas "Examining Local-scale Circulation Features that Contributed to the May 30th, 2024 EF3 Tornado in Midland, TX" (Joshua Durkee)

On May 30, 2024, a Midland, Texas, supercell produced an EF3 tornado that remained on the ground for 25 minutes and stretched over 6 miles. Throughout its time on the ground, the tornado caused damage to trees, oil mining equipment, and storage facilities. This study investigates the storm's dynamics at a large- and local-scale using various theories and meteorological processes. These equations diagnose upward vertical motion and pressure tendencies based on distinct meteorological variables. Each equation is analyzed individually by mapping their associated variables to understand their contributions to storm development and behavior. The analysis revealed that large-scale influences played a minimal role throughout the storm's lifecycle, which leads small-scale variables to play a larger role in development.

Pena, Crisitan; "Wya? (Where You At?)" (Shaina Feldman)
WYA? is a story about kids who grew up poor with little guidance, and in a harmful environment. The intent was to reminisce the innocence of friendship, the want to do more with one's life, and how it felt right before breaking out of the box. On set it was my goal to ensure that those participating felt less pressure and more freedom, to take the time to make a movie. As patience, collaboration, and curiosity is the most important part of any collaborative space. I found the best results come from heart, fun, and fulfillment. I feel as if those days we spent creating came to tell a story maybe some can't relate to, but can identify with nonetheless one way or another. As we tell a story encouraging our viewers to take a chance, and grow up.

Phelps, Luke "Comparing the Performance of the Fink, Fan Fink, and Compound Fink Truss Bridge Designs" (Kirolos Haleem)
This study represents an honors augmentation project for EM 222 (Statics) class. The study aims to evaluate the differences in the average tension force and average compression forces in three truss bridge designs, the Fink, Fan Fink, and Compound Fink trusses. Two case studies were conducted on each of the three trusses. In Case Study 1, the load was distributed equally across the upper joints, with 50% loads on both edges. In Case Study 2, the load was distributed equally across the bottom joints, with 50% load on both edges. The trusses were designed and analyzed using the MDSolids software. After each of the three truss dimensions were designed, point loads at the joints were simulated. The software could calculate the tension force, compression force, and zero force for each truss member in each of the two case studies. The mean tension force and compression force were then calculated for each truss for both case studies. Overall, The Compound Fink truss was able to bear the greatest loads when compared to the Fan Fink and Fink truss designs. In terms of cost, the Fink truss is the most cost-effective, since it is not as complex and does not require as many members (metal beams) to be used for construction.

Phillips, Nathaniel "Creating Community in Sports and Activity" (Shahnaz Aly)
For the research conference, I designed a sports facility. The city of Kingston Springs, Tennessee has a shortage of sports facilities and play/practice spaces. The fitness center fills a void in Southern Cheatham county's sports system. Kingston Springs is a rural town just 20 minutes outside of Nashville. This location pulls from surrounding cities including Pegram, Fairview, and Ashland City. The facility also attracts people from the Nashville area for practice and play area for recreational and travel teams from

multiple sports. These sports include soccer, lacrosse, basketball, volleyball, and football. The goal of the sports facility is to provide various types playing and practice surfaces, a weight room, tv lounge, restaurant and bar, and several meeting rooms. The new sports facility provides a space for athletes and viewers. There are multiple areas for viewers to go depending on their needs. If someone wants to grab a bite to eat, take another kid to play, study or do some work, or work out while their kid has practice then they will have the space to do that. The goal of the building is to create a place where all who come to the building can have something to do if they choose.

Philpot, Jonathan; Noronha, Alrose; Bailey, Rowan; Potts, Logan "Using Aquatic Macroinvertebrates as Bioindicators to Determine the Effect of Location on Water Quality in the Costa Rican Cloud Forest" (Samuel Earls)
Costa Rica's biodiversity is plainly visible everywhere, including its waterways. As the initial gathering point in a watershed, the health of a stream's organisms is representative of the health of the ecosystem. When analyzed, aquatic macroinvertebrate populations can show the water quality of a stream and any other stressors that may be affecting the area. Many methods exist to repair deforested land, each with a different effect on the land and the organisms that live there. This study examines the biodiversity of two different streams in the Costa Rican cloud forest, one in a natural regrowth area of forest and another in a planted area. We gathered aquatic macroinvertebrates from each stream, then categorized them by family and used the abundance and richness of the population to calculate the signal score for water quality. As was hypothesized, the natural regrowth stream indicated a higher water quality than the stream in the plantation. This shows that when a forest is allowed to regenerate on its own, the ecosystem becomes more resilient and more biodiverse in a shorter period of time.

Pippin, Hallie "The Secret Garden" (Sheila Flener)
The Secret Garden's purpose is to bring the beauty of nature into the heart of New York City by infusing floral designs with elements inspired by the city's historic architecture. The shop's exterior will showcase brownstone and wrought iron. The interior will display vintage ceiling panels, earth tones, natural lighting, distressed woods, and custom designed floral displays. Ways The Secret Garden will stand out compared to competitors is through hosting weekly workshops, a build your own bouquet area, and a variety of flowers to choose from.

Pitchford, Chase; Macy, Jay; Taylor, Ritchie; Macy, Gretchen; Sanyang, Edrisa "Historical County Level Maps of Natural Disasters and Extreme Weather Events for a Statewide Public Health Jurisdictional Risk Assessment" (Jacqueline Basham)
This study provides an analysis of extreme weather and natural disaster information for public health preparedness. The analysis is part of a statewide jurisdictional risk assessment designed to advance Kentucky's capabilities to prepare for and respond to public health threats. Specifically, this analysis provides the most significant weather and natural disaster threats on a county level; additionally, this study should inform policy and legislation related to public health in Kentucky. Historical Occurrences of extreme weather events and other natural disasters have affected Kentucky communities. While data on these hazards exists, more needs to be done to present the data in an easily understandable manner to those within affected communities. This observational study created maps using data sourced from the

National Oceanic and Atmospheric Administration (NOAA) showing the historical occurrences of Drought, Earthquakes, Extreme Temperature Events, Wildfires, Floods, Hailstorms, Landslides, Severe Winter Storms, Thunderstorms/Lightning, and Tornado/Windstorms that have caused either damage to property or bodily harm to one or more citizens of Kentucky. This data is presented at the county level from 2000-2024. The goal of this project is to highlight dangers associated with natural disasters so that local public health officials may bolster their preparedness, prevention, and mitigation plans.

Polly, Kaitlin; Savage, Savannah; Cline, Averi; Drinnon, Randi; Uchytil, Shaye; Hunter, Matthew; Lamont, Brice "Impact of Goal Type on Anxiety, Attention, and Performance: A Comparison of Intrinsic Versus Performance Goals" (Steven Wininger)
Goal Setting Theories note how different types of goals impact anxiety, attention, and performance. The purpose of this study was to examine how two types of goals impact levels of performance anxiety, selective attention, and performance across different tasks. Goal abandonment and switching were examined qualitatively. Seventy-four undergraduates completed a plank task and a basketball shooting task under intrinsic and performance goal conditions. For the basketball task cognitive anxiety levels were higher in the performance compared to the intrinsic goal trial. HRV was examined as a measure of somatic anxiety, but no significant differences were found. Positive bodily sensations attentional focus was significantly higher in the intrinsic vs performance trial for the plank task. Attentional focus for the basketball task was higher for negative task relevant thoughts during the performance trial. Performance-wise, participants held the plank longer in the performance goal trial vs intrinsic. Participants made more basketball shots in the performance goal trial vs intrinsic. Overall, goal type had a significant impact on anxiety, selective attention, and performance for basketball shooting. Significant differences for goal types with the plank task were more limited. Proposed explanations for the results, including the lack of significant findings, and applications will be discussed.

Potts, Lincoln "Development of the Gamma Array to Measure Angular Correlation of Gamma Rays" (Ivan Novikov)
Understanding the quantum numbers of nuclear state including the state total angular momentum is important to understanding the nuclear structure. The ratio of multipoles in a nuclear transition can be determined by observing the angular correlation of the gamma rays emitted in cascade during the de-excitation of a polarized nucleus. To detect cascading gamma rays, we propose to develop a spherical array of gamma detection. The design of the Array requires the optimization of variables such as the detector position, size, geometry, cost, and ease of construction. Various geometrical frame configurations were modeled and a design containing 150 possible detector positions was selected. The angles between all the possible detector positions were determined to make sure an adequate accuracy of coefficients of angular correlation measurement. The Array performance was tested using GEANT4 Monte Carlo simulation platform. Here we present the results of the Array performance and progress on construction of the Array including mechanical design of an optimal frame configuration and construction of BaF_2 gamma detectors.

Powers, Jackson; Fan, Xingang "Performance Analysis of Wrf-hydro Parameterization Schemes in Eastern Kentucky" (Xingang Fan)

Aiming to better understand the physical parameterization schemes on model simulations of flooding in variable topography, this study simulates the July 26-30, 2022 extreme precipitation event in mountainous Eastern Kentucky using the Weather Research and Forecasting (WRF) atmospheric model and the WRF-Hydro hydrological model. WRF was ran in standalone mode and in coupled model with WRF-Hydro with varying combinations of parameterization schemes to determine the ideal model configuration for this region. The model results are verified against Stage IV radar and gauge combined precipitation estimation data using RMSE, BIAS, and fBIAS (frequency bias), accompanied by visual verification methods. With variable topography, it is vital to have accurate representations of precipitation, runoff, and streamflow for flooding prediction and management.

Prabhakar, Tanya "Student Workers' Experiences of New Employee Socialization" (Jennifer Mize Smith) As costs of tuition and living rise, more and more post-secondary students have been forced to work while studying - often with detrimental academic effects. However, students who work on-campus tend to have significantly better academic outcomes than those who work off-campus. Prior research regarding on campus student workers was primarily focused on increasing retention and preventing turn over. Additionally, research often focused on workers within one specific role. The objective of this study was to explore the experience of university student workers during the new employee socialization process. Data were collected through semi-structured interviews and analyzed via open coding. Multiple findings emerged - student workers placed high importance on convenience when applying for and remaining in a job, there was integration of the student and worker roles, students sought out and anticipated receiving additional responsibility and employed a variety of strategies to learn and adjust to workplace expectations. Findings suggest tactics universities could potentially implement to increase interest in student worker positions and make the socialization process more successful for student workers.

Purvis, Robert; Williams, Kevin "On the DNA Binding Properties of Cisplatin and its Analogs" (Kevin Williams)
Cis-diaminodichloroplatinum(II) (cisplatin) is a chemotherapeutic drug which works by binding to purine residues in the DNA of cancerous cells, causing physical distortion of the DNA. Through nucleophilic attack, commonly by the N7 position on guanine, the chloride leaving ligands are replaced by the DNA residues to form a bifunctional complex. Typically, this is seen between two adjacent residues. This crosslink is the source of the DNA distortion. Proteins recognize these distorted regions and bind to them, blocking cellular repair factors and resulting in apoptosis. Previous work in our lab has focused on how manipulating the ligands attached to the platinum center impacts binding kinetics with residues of guanine. We found that bulkier non-leaving groups slow reaction progression due to steric hinderance. In terms of drug design however, there are other variables to optimize other than kinetics, DNA distortion being our current focus. The angle which DNA is bent by cisplatin and analogs is measurable and variable, though sound reasoning for this variability is unclear in the literature. Upcoming work by our lab will utilize AFM and protein binding assays to determine the DNA bend angle induced by non-traditional cisplatin analogs and how this may impact protein binding.

Putnam, Sydney "V-type ATPase's Role in Drosophila Melanogaster Air Sac Primordium Development"

(Ajay Srivastava)

Most of the 600,000 annual deaths due to cancer are the result of tumor metastasis, a process in which cancerous cells separate from the primary tumor and travel through the body. Members of the Drosophila (fruit fly) genus contain Air Sac Primordia (ASP), an organ that mimics the development of tumor metastasis. V-type ATPase, a membrane-embedded proton pump, plays a role in this process. Downregulation of V-type ATPase has been shown to affect tumor metastasis and ASP development (Powers and Srivastava, 2018). The aim of this study is to further investigate V-type ATPase's effect on ASP development and ASP cell junctions. Using the GAL4/UAS system, RNAi can be triggered to disrupt the expression of V-type ATPase. In this study, a Drosophila melanogaster stock carrying green fluorescent proteins (GFP) in the ASP was crossed with a stock carrying RNAi. The offspring resulting from this cross had downregulated V-type ATPase in the ASP, observable under a microscope due to GFP expression. These larvae were dissected and stained with antibodies for three proteins involved in cellular junctions and cell-cell adhesion and observed under a fluorescence microscope. They were analyzed and compared to wild type ASP in order to further investigate the effects of V-type ATPase downregulation on ASP development and cell-cell contacts.

Quinn, Mallory "Black/White Residential Segregation and Rates of Black Homicide Victimization" (James Kanan)

A review of recent research conducted by Moody's, Citigroup, and the Federal Reserve suggests that more racially-integrated (less segregated) census tracts and counties significantly benefit residents in those areas through higher GDPs, higher home prices, shorter commute times to work, better credit availability, more business activity, and lower crime rates. The general sense seems to be that racially segregated neighborhoods facilitate harm to residents who live there. In our research, we emphasize the latter issue (crime), with a particular focus on the relationship between measures of residential segregation and racially-disaggregated homicide victimization rates, per the Centers for Disease Control. A notable pattern in homicide victimization data is the overrepresentation of blacks. Beginning in the late 1980s, researchers highlighted the bleak picture of life (and death by homicide) for black Americans living in highly segregated cities. For our study, we explore updated empirical associations between recent measures of residential segregation (using Census data) on disaggregated homicide victimization rates by race and ethnicity (black, white, and Hispanic). The results provide a picture of the dramatic costs, in terms of lives lost, of the continued spatial and structural inequality of residential segregation.

Radford, Jalyn "A Case-Study Investigation of the Large-scale and Local Atmospheric Forcing Responsible for the January 4-5th, 2014 Winter Storm and Arctic Air Outbreak across the Ohio River Valley." (Joshua Durkee)

The January 4-5th, 2014, snowstorm and arctic outbreak, also known as Winter Storm Ion, was a pivotal meteorological event in the lives of many across the Midwest and Ohio Valley. In the following research analysis, the large and local atmospheric conditions that produced the event will be explored. Using National Weather Service (NWS) literature, The Weather Channel (TWC) summaries, the Integrated Data Viewer (IDV) software, and North American Model (NAM) atmospheric data, a specific combination of atmospheric variables will be analyzed to determine an explanation for the heavy snowfall and frigid air. From midnight January 4th, 2014, to midnight January 6th, 2014, the jet stream translated across the

eastern United States, as a surface low formed in the mid-Mississippi valley, bringing warm, moist air from the Gulf of Mexico. A powerful, positively tilted trough started to mature as tropical moisture interacted with arctic air and elevated rotation aloft, bringing heavy snowfall to a large swath of the Ohio River Valley. After the passage of the cold front, polar air spilled into the United States bringing temperatures to near -20°F. Ultimately, widespread snowfall reports of 1 foot were observed due to localized regions of elevated instability and wind-driven frontal boundaries.

Ramirez, Guadalupe "Engaging the Community Through Museum Design" (Shahnaz Aly)
Through the assistance of WKU Architecture Science, research on modern museums, exhibits, and interactive spaces led to the creation of four museums across the Bluegrass region. Over two semesters, projects developed from schematic design to final construction documents. Research covered space utilization, building codes (ADA and fire safety), and community engagement through museum interactions. Each museum aimed to serve the local community by preserving and showcasing its culture and artistic expression. A key objective was to engage youth through interactive museum design that fosters learning without boredom. Across the region, designs emphasized hands-on and visual learning to inspire curiosity. By project completion, these museums enhanced community engagement and education through interactive spaces that encouraged participation. The research and design process culminated in museums serving as cultural and artistic hubs. Prioritizing community involvement, they bridge gaps in cultural expression and knowledge, enriching the educational landscape of the Bluegrass region.

Ratnayake, Rangana; Srivastava, Ajay "Gene Expression Profiling of Cathepsin L Regulated Genes in Drosophila Melanogaster Wing Development" (Ajay Srivastava)
Cathepsin-L, a cysteine protease, plays a crucial role in development and tumorigenesis, yet how it brings about its effects remain unclear. One possible way could be by effecting global gene expression changes as a result of its activity. To elucidate the gene networks and molecular pathways influenced by Cathepsin-L, we have employed RNA sequencing (RNA-seq) as a transcriptomic approach. Our strategy involves both upregulation and downregulation of Cathepsin-L in Drosophila third instar larval wing imaginal discs, followed by RNA isolation and sequencing. Through genetic crosses, we induced targeted overexpression and knockdown of Cathepsin-L in third instar larvae. Wing imaginal discs were dissected, and RNA was extracted using TRIzol and the RNeasy Mini Kit. RNA sequencing will be conducted to identify differentially expressed genes and molecular pathways regulated by Cathepsin-L. By uncovering these interactions, we aim to clarify how Cathepsin-L contributes to epithelial tissue remodeling, tumor progression, and metastasis. The findings from this study will enhance our understanding of protease functions in development and disease. RNA sequencing is currently in progress, and results will be presented upon completion of the sequencing. The generated data will provide insights into the transcriptional changes associated with Cathepsin-L modulation, offering a deeper understanding of its role in development and tumorigenesis.

Renner, Nathan "A Large-to-Regional Scale Case Study Investigation of the May 26th-27th, 2024 Severe

Weather Across the Mid-South" (Joshua Durkee)
On May 26th – 27th, 2024 a significant severe weather event took place across the midsouth, resulting in widespread damaging winds, large hail, and several tornadoes. A investigative case study was completed using large-scale and small-scale methodology, allowing for a comprehensive understanding of the factors that lead up to the event. A broad upper-level trough paired with a deepening ridge, typical of a late spring atmosphere was the main driver on a large-scale consideration, which provided broad areas of enhanced flow and lift across the midsouth for a lot of the day leading to the event. In result, a dynamic low-pressure system at the surface developed which helped drive the advections throughout the day, also contributing to a moderate-strong low-level jet. Applying Quasi-Geostrophic Theory using high resolution Rapid-Refresh analysis data revealed that large scale lift from warm air moving in and enhanced spin had a considerable role in driving the event on a large scale, with the advection of warm air being the key contributor. Small-scale features throughout the day also contributed to locally enhanced areas of lift with the various modes of convection that were observed.

Risteski, Ljubomir; Kambesis, Dr. Patricia "Preliminary Investigation on Stream Flow Variations in the Black River Complex, Mammoth Cave" (Patricia Kambesis)
Scallops are asymmetrical, scoop-like indentations with a steep slope on the upstream side and a gentler slope on the downstream side, bound by crests also angled in the downstream direction. These features can in addition be utilized to calculate flow velocity and discharge. Scallops were measured throughout the Black Canyon passage and surrounding area named the Black River Complex in the Roppel Section of Mammoth Cave System. Here, scallops vary in size but show multiple flow-regime velocities and are in proximity of a boundary between two drainage basin boundaries: Pike Spring to the northwest and Turnhole Spring to the southwest. Measurements were taken of primary (paleo) and secondary (modern flood-stage) scallops and input into the program ScallopEx with the following parameters: length, assumed temperature, and average passage width. Our analysis yielded four different velocity calculations representing high flow and base flow from measurements taken throughout the area. Scallop velocity data coupled with discharge estimates of the passages in relation to one another suggest that a preliminary conclusion of this study is that this area is evidence of drainage to the north, towards Pike Spring, and is indicative of a shift from southward drainage towards Turnhole Bend Spring.

Roach, Donovan "Analysis of the Christmas Blizzard across the Central Great Plains During December 23-27, 2009" (Joshua Durkee)
On December 23rd, 2009, the atmosphere was primed for a perfect storm that would dump historic amounts of snow on the central Great Plains. This brutal storm prompted the second-ever blizzard warning issued by the National Weather Service in Tulsa, highlighting the extreme intensity of the event. This paper will be focusing on the winter weather aspect of this storm and what the large-scale setup looked like before and during the event. To accomplish this analysis, Python was used to extract data from the National Operational Model Archive and Distribution System website for these 5 days and put that data into Integrated Data Viewer to make different maps to visualize the event using the top-down method. Data was also extracted from the Norman, Oklahoma National Weather Service and the

Hastings, Nebraska National Weather Service data archives.

Rose, Helen; Brotzge, Jerald "Evolving Impacts of Tropical Systems on Kentucky's Climate: A Historical and Statistical Analysis of Precipitation Trends" (Jerald Brotzge)
By mid-September 2024, two-thirds (67%) of Kentucky was enduring moderate to extreme drought conditions. However, Hurricane Helene had made landfall in Florida on 26 September, and by the evening of 27 September, had moved into Kentucky, providing 3-7 inches of rainfall over the next several days. This hurricane rain alleviated drought conditions statewide, thereby improving hay yields and saving farmers millions of dollars in damages. Historically, Kentucky's climate is uniquely impacted by tropical systems that bring either drought-ending rains or floods and severe weather. Nevertheless, these influences are often overlooked because Kentucky is located relatively far inland. Using tropical storm data and precipitation data from 1895 to the present, basic statistical analyses were performed to identify the degree tropical systems impact Kentucky's monthly precipitation as well as to quantify the hazards they bring. This study will review the temporal and spatial impacts. The results demonstrate an evolution of tropical storm impact over time. For example, the current analysis revealed seasonal fluctuation as expected, but differences in tropical precipitation per climate division. Future iterations of this study will evaluate additional factors such as soil moisture, tornado presence, and river levels to expand the explanatory and predictive models using different variables.

Rutledge, Katelin "Brandscaping and Sustainability: The Use of Heritage Sites as Venues in the Paris 2024 Olympics" (Margaret Gripshover)
Throughout the history of the modern Olympic games, common practice has been to construct massive, state-of-the-art venues. While these new facilities are impressive, their construction is coupled with unsustainably high resource use and carbon emissions. These venues also lack a visual connection to the heritage of the host city. This urban geography research, titled "Brandscaping and Sustainability: The Use of Heritage Sites as Venues in the Paris 2024 Olympics," will be presented as an oral presentation and focuses on the question of how Paris 2024 was a notably innovative exception to this rule. Rather than constructing new venues, Paris adaptively reused heritage sites, such as Versailles and the Grand Palais, to more sustainably craft a geoinformative visual brandscape for the 2024 Olympic Games. Existing literature surrounding the history of Olympic brandscaping—notably the Sydney, Salt Lake City, and London Games—is used as the basis of comparison for just how innovative the Paris Games' approach was. The key finding of the research is that not only did the adaptive reuse serve to achieve Paris's sustainability goals, it also crafted a historic brandscape that achieved the overarching theme of "Games in the city" and set the precedent for future Olympics.

Sanborn, Emily "United Fitness" (Shahnaz Aly)
This fitness center in Elizabethtown, KY, merges contemporary industrial style with sustainable design, utilizing exposed natural materials and energy-efficient systems. Catering to basketball, tennis, and a training center, it offers diverse fitness options to meet the community's needs. The center aims to unite the community, providing a family-friendly and welcoming environment for individuals of all ages to pursue health and wellness. With the upcoming Ford Motors plant bringing around 22,000 new residents to the area, this facility addresses the growing demand for fitness centers. It features a large weight

room, basketball and tennis courts, group fitness studios, luxury locker rooms, a walking track, childcare services, and a health foods café. The fitness center serves as a hub for promoting a healthy lifestyle, offering spaces for nutritious food and social interaction. Its sustainability initiatives include rainwater collection systems, solar panels, site optimization, and energy-generating gym equipment, reducing its carbon footprint. By combining thoughtful architecture and environmentally friendly practices, this project demonstrates how design can foster community connections and create an inclusive environment.

Sander, Christian "Employee Future Prediction" (Lily Zhuhadar)
In this project, I used RapidMiner to analyze different factors regarding employee retention with the express goal of determining which factors have the largest effect on employee retention

Scannell, Piper "Mathematics Autobiographies by Pre-service Elementary Teachers: Past Experiences and Future Hopes" (Janet Tassell)
The mathematics education experiences of an individual's past can significantly shape their perceptions of future educational practices. This study analyzed mathematics autobiographical reflections from 325 Pre-service Elementary Teachers (PSETs). Through qualitative analysis, we identified themes from these narrative math autobiographies. When analyzing the results, we combined the sub-themes into three overarching themes: Theme 1: Emotional Experience with Math; Theme 2: Academic Experience with Math; and Theme 3: Future Aspirations for Teaching Mathematics. The subthemes mapping to Themes 1 and 2 were: Positive Experience with Math, Negative Experience with Math, Math is Challenging, Math is Easy, Perseverance, Math is Everchanging, and Neutral Feeling for Math. For Theme 3, we identified the following subthemes: Improve Math Experiences, Change Math Perspective, and Nervous about Teaching. Overall, this qualitative study provides insights into the PSETs' experiences with mathematics, contributing valuable information to the body of research on university-level PSET preparation programs to improve elementary mathematics instruction. The findings underscore the importance of addressing both the cognitive and affective dimensions of mathematics education in teacher preparation programs, highlighting the need for supportive, engaging, and reflective teaching practices that can positively influence future educators' attitudes toward mathematics.

Schlabach, Candice "Synthesis, Characterization, and Catalytic Study of Phthalocyanine-manganese (iii) Complexes" (Rui Zhang)
In the search for effective synthetic oxidation catalysts, much attention has been placed on biomimetic models of the ubiquitous cytochrome P450 enzymes found in nature, including metalloporphyrins, metallocorroles, and metallophthalocyanine complexes (MPc's). Among these, MPc's have garnered interest for their excellent optical and redox properties, as well as their relatively straightforward synthesis. However, their mechanistic activity and reactivity remain less explored. In this study, we report a direct synthesis of a tetra-tert-butylphthalocyanine manganese (III) chloride, i.e. MnIII(tBu4Pc)Cl, along with spectroscopic characterization using NMR, UV-vis, and ESI MS. In addition, the potential of MnIII(tBu4Pc)Cl as an oxidation catalyst for various organic substrates was studied. Finally, the kinetics of chemical and photochemical generation of a manganese (IV) oxo-intermediate were studied and the mechanisms of this generation probed using Hammet analyses

Schrock, Cassidy; Crump, Shamar; Southard, Luke; Justice, Dylan "Analysis of Distracted Driving Crashes Among At-fault Commercial Motor Vehicles in Kentucky Using Multiple Techniques" (Kirolos Haleem)
This study investigates the contributory factors associated with severe distraction-related commercial motor vehicle (CMV) crashes (with CMV as the at-fault vehicle type) in Kentucky between 2019-2022. The study investigated crash, roadway, and rarely-explored real-time weather variables in CMV studies (including solar radiation, relative humidity, air temperature, wind speed, precipitation, and visibility) that were collected from the High-Resolution Rapid Refresh "HRRR" database within 1-hour of the crash. Multiple statistical approaches were used, including the association rules mining (ARM) technique (to uncover associations/interdependencies between the variables and distraction-related CMV crash severity), odds ratio (OR), and Chi-square test of independence. The OR results revealed that distraction-related CMV crashes involving head-on collision type, aggressive driving, speeding, curved roads, foggy weather, relative humidity ($\leq$ 65%), and solar radiation ($\geq$ 200 Watts/m2) had the highest severity odds. The ARM technique showed 21 interesting rules, of which, air temperature (> 70°F), no precipitation or rainfall, visibility (> 5 miles), presence of vertical gradient, and interaction between "presence of vertical gradient & relative humidity $\leq$ 65%" were significantly associated with increased serious injury likelihood. Based on the study findings, installation of dynamic message signs (DMS) for specific weather-related states during the day (e.g., when relative humidity $\leq$ 65% in advance of vertical gradients) and installation of rumble strips are suggested to reduce the severity of distraction-related CMV crashes.

Scott, Dastin "Strategies and Outcomes of an Hourglass Quadruel" (Dominic Lanphier)
A truel is a three-person duel. To study a truel, one must first determine where each player should aim to maximize their chance of survival. Truels have been well-studied. Here we study a four-person variant of a truel, which we call an hourglass quadruel. In this game, there are four players divided into two teams of two people each. Each player plays against the other two players on the opposing team. We study where the players should aim, the overall strategy, and the possible outcomes.

Seavers, Michael; Li, Qi "Analyzing ALU and IO Instruction Distribution in Deep Learning on a Single CPU-GPU System" (Qi Li)
Maximizing efficiency and accuracy is one of the primary goals in deep learning models; however, alternating one typically impacts the other negatively. The present study aims to characterize the relationship between ALU-bound (GPU) and I/O-bound (CPU) operations during the training of convolutional neural networks on a CPU-GPU system. We experimented with varying batch sizes, load workers, persistent workers, prefetch factors, and pin memory settings on two different computers. The first computer has 32GB of CPU memory and 6GB of GPU memory, while the second has 64GB of CPU memory and 8GB of GPU memory. We employed profiling tools to measure distribution between IO and ALU instructions, identifying bottlenecks and inefficiencies in data loading versus computation. Our results demonstrate that a balanced utilization of CPU I/O and GPU ALU operations enhances model efficiency without compromising accuracy. The results also show that increasing data loader workers enhances GPU utilization, while excessively large batch sizes significantly extend training time. Building upon the insights gained from single GPU systems, we plan to address the unique challenges of ALU and I/O instruction optimization in multi-GPU distributed training scenarios.

Shaikh, Rehan "Resilient Architecture: Developing Infrastructure to Mitigate Flooding" (Shahnaz Aly)
This study offers a fresh perspective on flood mitigation infrastructure in architecture. Official studies predict that sea levels will continue to rise, leading to increased susceptibility of coastal residential areas to flooding and flood damage. Older construction areas with weaker buildings are particularly at risk, with coastal residential areas in New Orleans, Louisiana, being a prime example. These areas have faced significant flooding challenges due to their old construction and limited flood mitigation and defense infrastructure. In this paper, existing flood infrastructure is analyzed, and a 3-D modeling approach is used to present a product in the form of steel tiles that can be applied externally to buildings to protect them from flood and water damage. This product is cost-effective compared to existing home modifications, addressing a significant concern for the low-income areas of New Orleans. It is versatile and can be installed in various types of buildings. This study underscores the importance of exploring flood mitigation architecture by introducing a novel idea while building upon existing flood architecture. It suggests further research to keep pace with rising sea levels.

Sheehan, Amelia; Gast, Christina; King, Rodney "Exploring Diversity: A Comparison of Bacteriophages Huggins and Hersh" (Rodney King)
Bacteriophages, discovered by Felix d'Herelle and Frederick Twort, are viruses that infect bacteria. These viruses play a key role in microbial ecology and have great potential as an alternative to antibiotics to fight antibiotic-resistant pathogens. This study describes the isolation and characterization of two bacteriophages, Huggins and Hersh, that infect Mycobacterium smegmatis. Soil samples from the campus of Western Kentucky University were collected and enriched for mycobacteriophages. Spot testing confirmed the presence of phages, and homogeneous populations with uniform plaque morphologies were established through multiple rounds of plaque purification. Electron microscopy showed that both phages have a Siphoviridae morphology. However, restriction digests of purified genomic DNA revealed differences in enzyme recognition. Our results show that phages Huggins and Hersh differ in genetic composition despite being recovered from soil samples that were in close proximity to each other. In addition, both phages display differences in plaque morphology and temperature sensitivity. This study has expanded our understanding of bacteriophage distribution and diversity. Future studies would include DNA sequence analysis of Huggins and Hersh's genomes. This would allow evolutionary relationships to be explored and may reveal novel genes whose products may have therapeutic potential.

Shelton, John "Bluegrass Distillery" (Shahnaz Aly)
For my distillery, I mixed modern design with the rustic look that evokes memories of old bourbon barns in Kentucky. I wanted the look to incorporate Kentucky's famous history of bourbon and transform it into something new and modern. Blending contemporary design elements with rustic materials, such as wood and metal, to create a warm and inviting atmosphere that reflects Kentucky's heritage. I used large exterior windows so tourists could see inside the brewery easily, while letting in natural light. I paired this with wood to give it the rustic barn feel. This vibe follows into the interior, with the walls lined with wood and bourbon barrels, along with large glass panels. The goal was to make a place that

would allow people to come see the distilling process but also come for dinner or an event. I placed this building on a farm that has a creek running the perimeter of it, adding to the aesthetic that I was going for.

Smith, Jonah; Yates, Wade; Goebel, Alyssa; Evans, Caleb "The Sound of Love" (Shaina Feldman)
The Sound of Love is WKU Film's first musical film with an original soundtrack, score, and story. The story is as follows; a young, hopeful romantic writes a final love letter to the woman he loved, reminiscing about his time with her. As he retells their tales through song and dance, he's reminded of their first meeting, the proposal, and eventually her illness and death. In this reliving, he wrestles with the sadness that comes with losing her but also finds joy that they were once able to share, and closure in moving on without forgetting her. The Sound of Love is a 10-minute narrative short film submitted under the Arts and Humanities category.

Soliman, Nesma "English Phrasal Verb Difficulties Encountered by International Students Attending American Regional Universities" (Trini Stickle)
International students attending courses within an accredited university in the United States who come from non-English speaking countries face both linguistic and comprehension difficulties that hinder their academic progress and create communication barriers, often hindering their classroom success and social interactions. These difficulties are often exacerbated by linguistic features that are opaque in their linguistic-semantic interface. One such English language feature is the phrasal verb—a two-part construction of a verb and particle the combination of which creates its own meaning (e.g., throw up equals vomit). While international students must achieve a language proficiency score on standardized tests, these scores, however high, do not ensure that the students' ability to comprehend such common constructions. They do not prevent significant language challenges once they arrive on an English-speaking campus in the US. Students are required to understand classroom interaction and other communications no matter how good their test scores (TOEFL/IELTS/GRE) (Kuo, 2001). So, a better understanding of the factors that cause these difficulties and challenges not only will help students with their academic journey in the United States, but also educators and institutions which will be able to create a more inclusive and support learning environment, fostering the success and well-being of international students in higher education.

Spiva, Natalie "Proficiency and Positivity: Investigating Learner Affect Toward L2 Instructional Methods, Learner Goals, and L2 Success" (Trini Stickle)
Second language (L2) learning outcomes vary widely due to factors both internal and external to the learner, including learning and usage contexts and learner goals and motivations. Learners may feel more proficient in and positive towards an L2 if they have intrinsic motivation and positive experience with the L2. Many students in the United States are first exposed to an L2 later in life as an academic requirement, which often impedes L2 learning success and can limit the learner's relationship with the L2 and related cultures. Because of the highly interconnected global society, investigating the experiences of today's language learners is crucial for implementing effective and appropriate L2 pedagogy. The present study surveyed 174 university students about their L2 learning and usage; L2 motivations and goals; emotional experiences with the L2; and self-perceived L2 fluency. Statistical

analyses, including correlational regression and ANOVA tests, were performed to determine relationships between these factors and to investigate effects related to one's L2 learning and usage contexts. Implications for L2 pedagogy and considerations of bilingualism in social, political, and personal contexts are discussed.

Spychalski, Ryan "Social Media and Mental Health Insights for Public Policy and Public Health" (Lily Zhuhadar)
In the early 2000s, the rapid growth of social media transformed how people connect and communicate. Platforms like Friendster and LinkedIn laid the groundwork, with Facebook (2004), YouTube (2005), and Twitter (2006) revolutionizing online interaction. As social media became central to younger users' lives, its impact on behavior, relationships, and mental health emerged as a critical area of study. The link between social media and mental health is undeniable. Researchers are leveraging platform features like chat functions, interactive tools, and AI-driven insights to identify vulnerabilities and early warning signs of mental illness. Despite advancements, a robust predictive model addressing diversity, usage trends, and behavioral impacts is vital to refine these efforts. Barriers like stigma, cultural challenges, and limited care accessibility hinder progress, as mental health issues become increasingly severe across age groups. This research employs machine learning models—Naïve Bayes, Logistic Regression, Deep Learning, Decision Tree, and Random Forest—via RapidMiner© to investigate social media's influence on mental health. Following a 7-step business analytics process, it identifies patterns linking social media usage to mental health outcomes, offering data-driven recommendations for enhancing mental health policies and services.

Stewart, John "Effects of Regulations on Digital Asset Prices: Evidence From the Counter-strike Game Series" (Stephen Locke)
Counter-Strike: Global Offensive and Counter-Strike 2 are first-person-shooter video games in which players can own cosmetics for their weapons, known as "skins." These skins can be traded, bought, or sold through various means. This study seeks to examine the effects of a regulation implemented by developers of the game which banned the sale and trade of a common tax-free medium of exchange (case keys) for these skins and seeks to classify them as either a utility-based collectible or purely a digital commodity like cryptocurrencies. Using a novel and expansive panel data set gathered from the Steam Market and econometric models, I find that the regulation disproportionately increased the prices of rarer skins. Additionally, results suggest that hedonic models have significant predictive power, challenging prior research. These findings may provide insight into other digital assets or collectible markets, including challenging the law of one price in collectible markets.

Stewart, Melanie "Inquiry Oriented Dynamical Systems and Modeling for Pre-service Secondary Mathematics Teachers: Literature Review and Preliminary Data" (Nicholas Fortune)
The relevance and usefulness of upper division mathematics courses for prospective secondary school mathematics teachers has long been of concern (Begle, 1972; Klein, 1932; 2016; Wasserman et al., 2019). A number of studies document that teachers find their advanced mathematics courses have little relevance to their future professional life (e.g., Cofer, 2015; Wasserman, 2017, Zazkis & Leikin, 2010). One approach to addressing this issue, and the one taken in our larger overall project, is to redesign

upper division math content courses to make intentionally strong connections to high school mathematics content and teaching. The purpose of this poster is two-fold. First, I reviewed literature on pre-service teachers' education, learning, and experiences within upper division mathematics classes. For example, Goodchild and colleagues (2021) took a community of practice perspective to document the adoption by these prospective teachers of a critical stance toward learning and teaching mathematics. The larger project is collecting data at three universities over a three-year period from 2025 to 2027. In Spring 2025, we asked pre-service mathematics teachers to explain function and rate of change in their own words. This poster also shares preliminary findings on their meanings of function and rate of change.

Story, Sydney; Vandiver, Mason; Bowman, Ryan "3D Motion Analysis of Single Leg Squat with Association To Hip Abductor Strength and Ankle Dorsiflexion in a Population with Ankle Injuries" (Melissa Tolbert)
3D Motion Analysis of Single Leg Squat with Association to Hip Abductor Strength and Ankle Introduction: Ankle sprains are among the most prevalent injuries in the United States and can lead to long-term impairments at the ankle, knee, and hip, all of which play a critical role in gait mechanics. This study aims to investigate the relationship between hip abduction strength, ankle dorsiflexion range of motion (ROM), and knee flexion ROM during a single leg squat (SLS) in individuals with a recent ankle injury. Methods: Approximately 69 adults, ages 18 – 40 years, with ankle injury within the last six months, will be recruited in this prospective, cross-sectional exploratory methodological research study. Inclusion criteria include single leg stance ability of 20 seconds and symmetrical bilateral squat performance. Subjects will be assessed for the dependent variables of ankle dorsiflexion ROM, hip abductor strength, and SLS depth. Results: With the data, the dependent variables of hip abduction strength, ankle DF ROM, and SLS depth will be examined using Pearson Product Moment correlation coefficients. Discussion: We aim to provide evidence that demonstrates the relationship and importance of hip strength in maintaining ankle structure and stability in populations with ankle injuries.

Street, Carli; Whipple, Hadley; Allamyradov, Yaran; Er, Alper; Ateyeh, Mahmood; Gurbandurdyyev, Begench "Synthesis Of Silver Nanoparticles Via Laser Ablation in a Liquid Medium for Use in Photodynamic Therapy of Bacteria" (Ali Er)
Over-prescription of antibiotics has increased rates of resistant bacteria, making alternative treatments essential. This project investigates enhancements to photodynamic therapy (PDT), which uses a photosensitizer. Upon exposure to light, photosensitizers react with oxygen to produce reactive oxygen species (ROS) that kill bacterial cells. However, the low yield of ROS and the diminished effectiveness of methylene blue (MB) in human plasma constrain traditional PDT. To overcome these challenges, we synthesized silver nanoparticles (AgNPs) using both picosecond and nanosecond laser ablation methods, and then combined them with MB. The resulting AgNPs were characterized using UV-VIS spectroscopy and transmission electron microscopy (TEM). We subsequently evaluated the combined treatment on E. coli by measuring bacterial survival through colony-forming unit (CFU) counts. Preliminary findings indicate that integrating AgNPs with MB enhances ROS production and improves the photoinactivation of bacteria, offering promising prospects for advanced PDT protocols in the clinical management of antibiotic-resistant infections.

Sullivan, Shawn "Examining the Impact of Political Affiliation and Related Images on False Memories" (Amber Giacona)

The 2024 election, similar to the 2020 election, promised stress, political divide, and rampant misinformation. Given the intensity of this polarization, the likelihood of false memories occurring among the electorate may be significantly heightened. This election year presented a unique opportunity to conduct further research. Political affiliation and the use of photos have been evaluated in the acquisition of false memories; however, the current study aimed to investigate both variables simultaneously. Participants were presented with a range of news headlines, some of which were fictional and some true, along with some accompanied by related images and some without. They were then asked to assess their recollection of each event. The results of this study aim to contribute further to the field of memory research, thereby deepening our understanding of misinformation and its implications for the political environment.

Summers, Riley; North, Leslie "Costa Rica Ecotourism Policy Analysis To Measure Biodiversity Sustainment" (Leslie North)

Biodiversity degradation due to tourism is increasing as countries become dependent on the economic benefits of the tourism industry. While tourism is an important economic factor for many countries, it can cause irreversible damage to the environment. Ecotourism policies appear more frequently in tourism-reliant countries as people aim to be sustainable with their travels. The objective of this ongoing research is to identify which ecotourism policies are most effective for sustaining biodiversity by analyzing the current policies in the country of Costa Rica.

Talmon, Zachary "Synthesis and Catalytic Studies of Metalloporphyrin Complexes" (Rui Zhang)

Catalytic oxidation is an invaluable process in biological systems and has great potential for application in the development of clean energy, as well as industrial purposes. Synthetic metalloporphyrin complexes have been shown to serve as catalysts for catalytic oxygenation of various substrates and have been studied with the hopes of understanding cytochrome P450 to a greater degree. In particular, the synthesis of Fe(TDFPP)Cl and FeIII[TMP]Cl was completed and characterized by UV-Vis spectroscopy, and H1-NMR, then subsequently followed by their usage as oxidation catalysts. The substrates styrene, thioanisole, and cyclooctene were used, along with PhI(OAc)2 as the oxygen source or terminal oxygen donor. Additionally, a small amount of water was used, and the reaction carried out in an organic solvent. Under these conditions, the substrates were oxidized to substantial amounts, particularly the epoxide and sulfoxide products. This suggests that synthetic porphyrin compounds can be used as heme-like oxygen transfer catalysts in further use.

Tate, Andrew "Hendersonville Music Center: Where History Inspires the Present" (Shahnaz Aly)

The following project studies the requirements for a music center that contains an instrument museum, auditorium and practice rooms to host members of Hendersonville Tennessee affected by a love for music and a desire to learn. The musical instrument museum is an agent for preserving historic knowledge. As the museum's intent is to marry the past to the present, so should the form of the structure in a style such as rationalism. The materials are simple and designed to age in a manner where

the patina adds to the material beauty of the structure, such as local limestone and unfinished wood. The facade incorporates Vitruvian aspects of beauty in a modern context that focus on form over ornamentation, as well as some instrument based design motifs. This marriage between historic styles and modern finishes fits the needs of a museum of music. Overall this project studies community need for a space such as this, and explores the form necessary for a structure such as this.

Taylor, Rachel "Flat Hats, Stephen Mather, and Gs Scales: Inducement Strategies in National Park Service Training Documents" (Jennifer Mize Smith)
The purpose of this study is to review the materials that the National Park Service provides during employee training, analyze what methods of organizational identification inducement are used, and make relevant recommendations to improve the onboarding process concerning identity development. This is primarily a rhetorical message analysis where park-level and agency-level materials are analyzed and compared. Ultimately, there were significant differences in the two sets of materials, though advocacy of benefits, espousal of shared values, and unifying symbols were the three most commonly used tactics by training personnel. The analysis identified an additional common ground technique not found in existing literature: recognition of organizational heroes. Finally, this paper recommends specific actions for the National Park Service such as increasing the use of the assumed "we" to improve the training materials.

Taylor, Samantha "Analyzing the large-to-regional scale influences that produced tornadic thunderstorms in the Southern Great Plains on May 25th, 2024" (Joshua Durkee)
On May 25th, 2024, a severe weather outbreak occurred across Western Oklahoma and Northern Texas, spawning 11 tornadoes that injured 25 people and killed 2 others. Of the tornadoes, two were rated EF-3, and both violent tornadoes spawned by the system were on the ground simultaneously, despite being separated by a distance of nearly 250 miles. Archived model data from the National Centers for Environmental Information's Archive Information Request System (NCEI AIRS) applied to Integrated Data Viewer was used to complete a comprehensive analysis of the event to determine if large-scale or local-scale meteorological interactions were the dominant force behind the initialization and intensification of the storms that occurred in the Southern Plains. Further investigation found that a majority of the variables which determined the formation, movement, strength, and tornado-genesis properties of each supercell storm were mesoscale in nature; however, diverging upper-atmosphere winds, moderate differences in wind speed, changes in pressure, and significant warm air advection all contributed to making the synoptic environment capable of sustaining and supporting severe weather on the night of the 25th.

Thelen, Daniel; Bledsoe, Lee; Groves, Chris "Quantitative Analysis of Geochemistry and Flow Dynamics in The Great Onyx Groundwater Basin, Mammoth Cave National Park, Kentucky" (Lee Bledsoe)
Due to their complexity and extensive coverage, much energy has been put into developing the knowledge of karst landscapes and the vulnerable aquifer systems they contain. This research project utilized fluorescent dye tracing, water chemistry monitoring, and flow measurements to better understand the Great Onyx Groundwater Basin, a continuation of a long-term hydrogeological study started in 2017 by Crawford Hydrology Laboratory. Specifically, high-resolution data sondes were used

to collect pH, specific conductivity, temperature, and water level at Great Onyx Spring and Cascade Falls within Great Onyx Cave. Two separate dye traces were conducted using Fluorescein to determine the time of travel between Great Onyx Cave and Great Onyx Spring. The first injection was unexpectedly followed by a storm event, and the second was conducted during fall base flow conditions. Analysis of quantitative data revealed average flow velocity, allowed comparison of breakthrough curves during different antecedent conditions, and the evaluation of temporal differences between geochemical parameters at Cascade Falls and Great Onyx Spring. The data collected within this study adds to the overall knowledge of karst landscapes, provides resource managers within Mammoth Cave National Park with crucial information and paves the way for many studies to come.

Thomas, Sophia; King, Rodney; "Discovery and Analysis of Mycobacteriophage Kochu" (Rodney King)
Mycobacteriophages are viruses that infect members of the bacterial genus Mycobacterium. Bacteriophages are found worldwide, with an estimated population exceeding 10^{31} particles. However, relatively few have been characterized genetically. The goal of the SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) program is to isolate, purify, amplify, analyze, and sequence phages that specifically infect Mycobacterium smegmatis. For the project described here, a soil sample was collected near Lost River Cave in Bowling Green, Kentucky, and enriched for mycobacteriophages by culturing in the presence of M. smegmatis cells. After the presence of phage was confirmed using a spot test, serial dilutions were used to yield a single population of phage, named Kochu. Electron microscopy of a concentrated stock revealed a siphoviridae morphology. Genomic DNA was purified and analyzed by restriction enzyme digestion and gel electrophoresis. Digestion with the enzymes HaeIII and AhdI indicated the genome has a high GC content. Further characterization through lysogeny experiments demonstrated that Kochu can establish a stable relationship with its host. This research expands our understanding of bacteriophage behavior and diversity. Future analysis of the DNA sequence will allow evolutionary relationships to be studied and may reveal novel gene products with therapeutic potential.

Thompson, Sarah; Miller, Kelly "Totspot Ar" (Jeffrey Galloway)
The TotSpot AR Game project aims to develop an interactive augmented reality (AR) game for toddlers to enhance their cognitive skills through object identification. By overlaying visuals on the real world via a projection onto a car window, the game encourages players to touch the window to identify passing objects outside by highlighting them with colorful projected borders. Its simple user interface of audio and visual cues cater to a young audience to provide an engaging learning experience during car trips. The physical hardware to run the TotSpot will be installed within a 3D-printed container designed to mount to the back of a car seat, allowing for guardians to set up the TotSpot in their car easily. The game itself is developed using Unity. Its object detection features are implemented using a plugin that integrates the Open Computer Vision Library with the game engine. The audio was created using Audacity. By integrating AR via object highlighting into the identification game, TotSpot provides a layer of immersion to the experience. This project strives to convert the often monotonous environment of a car to something fun and interactive for children, connecting them to the outside world while also being educational.

Thorn, Emma "Genetic Interactions Between Ste20 and Elm1 Kinases Require Kinase Activity for Cell Morphogenesis" (Joseph Marquardt)

Cell shape and growth during division in Saccharomyces cerevisiae, budding yeast, is controlled by kinases, which are a type of enzyme that catalyze reactions by adding phosphates to change protein function. These changes in function can affect how the cell makes new daughter cells, or buds. The kinase Elm1 regulates cellular morphogenesis, causing elongated shape if deleted, and other effectors throughout this pathway which may be responsible for Elm1's growth regulation are unknown. This study focuses on one of the possible effectors: Ste20 kinase, a mitogen-activated protein (MAP) kinase, that regulates cell growth and polarity. This study explores the differences in cell shape and growth regulation through total deletion or kinase activity ablation of Ste20 and Elm1 using traditional yeast genetics, image analysis via fluorescence microscopy, and growth assays examined over three days. Initial findings show that loss of both Elm1 and Ste20 results in slow-growing phenotypes, indicating negative genetic interaction, thus establishing a connection between cell cycle and growth between Elm1 and Ste20. We have further identified that it is likely the kinase activity of each that is the important factor. Both kinases have human homologs, allowing these results to relate to human disorders which display uncontrolled cell growth/division.

Tinsley, Samantha "What If? A Contemporary Take on the Speculative Design Project, Attenborough Design Group" (Leah Spalding)

This presentation explores Speculative Design in reference to the book Speculative Everything: Design, Fiction, and Social Dreaming by Anthony Dunne and Fiona Raby. Specifically, the presentation showcases three Speculative Design works based on a project described in the book. Speculative Design is a design discipline in which possible futures are explored through hypothetical scenarios and works of art. A project by James Chambers, called "Attenborough Design Group" asks the question, "What if David Attenborough had become an industrial designer rather than a wildlife filmmaker, who, still fond of nature, established the Attenborough Design Group to explore how animal behavior could be used to equip technology products with survival instincts…". This presentation will serve as an updated version of the "Attenborough Design Group" project, reimagining this concept with contemporary technology of today. This presentation explores and challenges current design methodologies to imagine a hypothetical situation in which our technology was designed with certain "instincts" like that of an animal. In Chambers' original project, for example, he created a floppy disk drive that is able to stand up if liquid is detected nearby. In this instance, Chambers' creation reacts to the environment around it, actively avoiding a situation that would cause it harm. This project seeks to modernize Chambers' idea with emerging technologies and design methods.

Toussaint, Andrew "Analysis of Computational Approaches to Cognitive Diagnosis" (Huanjing Wang)

Cognitive diagnosis is the task of determining a student's proficiency in fine grained areas of knowledge based on their responses to an assessment. Recent advances in machine learning technology have facilitated new techniques to perform cognitive diagnosis quickly and accurately on large data sets. Three existing cognitive diagnosis models, as well as a novel reduction model, were trained on student response data from four sources and evaluated to characterize the performance of the models in five different scenarios. Training scenarios included a baseline, a sampled scenario that included 60% fewer

training examples, and three under-sampling scenarios where class ratios were adjusted to be equivalent, favor correct responses, and favor incorrect responses respectively. Results from these experiments reaffirm the increased performance of neural network-based models at the cost of longer training time. Among the neural network models, those that used labeled knowledge concepts were dependent on the granularity and accuracy of the labeling for good performance. Additionally, sampling was shown to be an effective way to reduce training time with minimal losses in performance.

Vass, Haylee; Robinson, Casey "Level Of Knowledge among Doctor of Physical Therapy (DPT) Students Regarding the Function, Roles, and Objectives of the Apta House of Delegates" (Kurt Neelly) Introduction: The American Physical Therapy Association (APTA) House of Delegates (HOD) serves as the representative and policymaking body of the APTA, shaping policies that affect the physical therapy profession. To date, no published reports exist on DPT student knowledge of the HOD's roles and responsibilities. The purpose of this study is to gauge Doctor of Physical Therapy (DPT) students' knowledge on the function, roles, and objectives of the APTA HOD. Methods: This study will utilize a descriptive, prospective cross-sectional survey. Survey questions will evaluate DPT students' knowledge of the function, roles, and objectives of the APTA House of Delegates. To ensure content validity, external content experts will review the survey, and revisions will be made as needed. The finalized survey will be distributed via Qualtrics (Qualtrics, Provo, UT) to approximately 650 DPT students across all academic years in Kentucky. Questions will be evenly distributed across topics about the HOD's functions, roles, and objectives to assess students' comprehension of the APTA House of Delegates. Results: Descriptive statistics will be used to summarize responses specifically looking at distribution, variability, and averages. Discussion: This study aims to identify knowledge gaps and opportunities for increasing student engagement, potentially strengthening long-term APTA membership.

Vilt, Mabel "Exploring the Morphology of the Inner and Peripheral Ear of the Loricariid Catfish Pterygoplichthys pardalis" (Michael Smith) Within teleost fishes, there exist taxonomic groups, such as the Otophysi, who possess adaptations that increase their auditory sensitivity and bandwidth. Such taxa are dubbed 'hearing specialists." Loricariidae is one such family. What differentiates them is their possession of paired swim bladders in their head, as opposed to the common centralized swim bladder. We hypothesize that this morphology improves their hearing. We explore the validity of this claim by describing the morphology of the inner and peripheral ear of one loricariid catfish, Pterygoplichthys pardalis. Specimens (n = 6) were preserved in 4% paraformaldehyde and dissected for examination of the gross morphology (using light microscopy) and the hair cell regions (using epifluorescence microscopy). From the dissections, images of all end organs (saccules, lagenae, and utricles) and their connection to the swim bladder were obtained, along with scanning electron microscopy images of each end organ's otolith. From images of the maculae, hair cell densities were calculated and orientation maps produced. These findings will contribute to the investigation of catfish hearing and provide inputs for engineering models testing if paired swim bladders enhance hearing, as hypothesized.

Waldrop, Dylan; Whitler, Cy; Kreilein, Mason; Bruckner, Benjamin; Bell, David; Head, Penny "Creation and Development of a Modulation-based Simulation To Assist in Development of Clinical Reasoning

Skills and Confidence in First Year DPT Students with Specific Pathologies" (Anthony Mancini)
The goal of the project is to describe the creation of an evidence based, serious-based game for future use to assess its effectiveness in improving clinical reasoning skills and confidence in the orthopedic setting. The tool is a serious-based game that utilizes a mini simulation format for patients with a variety of orthopedic conditions. The simulations created for this project focus on shoulder labral pathology as well as knee ACL pathology, and encourage the learner to think through case, starting with intake information and reasoning their way through an objective assessment. For phase two, it is hypothesized that the implementation of serious-based learning modules will improve DPT students' clinical reasoning skills.

Walker, Luke; Marquardt, Joseph; "Investigating the Signal Intensity of Two Fluorescence Markers in Relation to Proteins in the Morphogenesis Checkpoint in Yeast" (Joseph Marquardt)
Cell functionality is maintained through the cell's ability to control its shape. Defects in this regulation can lead to diseases such as cancer in humans. In the budding yeast, Saccharomyces cerevisiae, scaffolding is provided at the division site by septins which help to coordinate the shaping of the developing bud. This scaffolding serves as the binding site for checkpoint proteins assembled at the bud neck in the order of Elm1, Hsl1, Hsl7, and Swe1. To better understand the mechanism behind the control of cell shape, tagging the proteins with fluorescent markers can be used to examine localizations in the cell. The intensities of two fluorescent proteins, GFP and mNeonGreen, were analyzed to determine if there was a significant difference in the amount of signal provided upon successful tagging and visualization by fluorescent microscopy After comparison of the intensities in strains with successfully tagged proteins Hsl1, Hsl7, Gin4, and Bni5, it was determined that the intensity of the signal from cells tagged with mNeonGreen was higher than that of cells tagged with GFP. This can provide additional insights to the detailed patterns of protein localization throughout the cell cycle and give us clues to mechanisms of cell shape control in humans.

Weatherholt, William "Sawtooth City Lodge" (Shahnaz Aly)
For my capstone project, I designed a resort lodge with the combination elements of both modern cabins and European hunting lodges. The two designs share common elements, but they differ in the overall exterior and interior makeup. Instead of keeping the exterior and interior of one and the other I combined the outdoor materials and color scheme of modern design with form and sizing of the older Euro-design. The general exterior features radial symmetry and encapsulations of the surrounding environment in materials and form.

Wells, Jenna; Zhuhadar, Lily "Predicting College Student Drop Out Rates Using Predictive Analytics" (Lily Zhuhadar)
This research develops a predictive model to forecast college student dropout rates using RapidMiner, aiming to identify at-risk students early for timely interventions. Using a Kaggle dataset with 4,424 student records and 36 academic, demographic, and socioeconomic features, machine learning techniques classify students as graduates, dropouts, or currently enrolled. The model reveals critical factors influencing dropout rates, such as tuition fees, scholarship status, and second-semester grades. The Logistic Regression model, chosen for its accuracy and performance, shows promising results with a

precision of 82.64% and recall of 79.55% for predicting dropouts. The study is particularly relevant for Kentucky senators as it addresses student retention, which impacts both individual futures and the state's economic growth. By identifying at-risk students early, the model enables Kentucky's higher education institutions to implement targeted interventions, reducing dropout rates and improving graduation rates. With nearly 40% of U.S. students dropping out before graduation, the study provides a valuable tool for improving retention in Kentucky, optimizing state resources, and supporting long-term economic development. This model can assist policymakers in developing more effective strategies for student success, reducing the financial burden on the state while promoting a more educated workforce for Kentucky's future.

West, Allison "Understanding Perceived Pediatric Healthcare Needs in the Rural Mennonite Communities Of South Central Kentucky: A Community-based Research Study" (Kim Link)
This project aims to assess the healthcare needs, opinions, and access to modern pediatric medicine within a Mennonite community in South-Central Kentucky. While Anabaptist communities often live more isolated lifestyles and may avoid modern healthcare, little research has focused on the perspectives of parents in this region. The study surveyed Mennonite parents to understand their experiences with both modern and homeopathic pediatric medicine, their access to care, and factors influencing their healthcare decisions. A standardized child health questionnaire and a culturally sensitive healthcare preferences questionnaire was distributed to 70 families, with a response rate of 42. The results will provide insights into the pediatric healthcare needs of Anabaptist communities and inform future healthcare strategies for these populations.

Whipple, Hadley; Street, Carli; ben Yosef, Justice; Allamyradov, Yaran "Synthesis of Gold Nanoparticles Via Laser Ablation In A Liquid Medium for Use in Photodynamic Therapy of Bacteria" (Ali Er)
Antibiotic-resistant bacteria poses significant challenges in modern medicine, exacerbated by the overuse and over prescription of antibiotics. This research focuses on enhancing photodynamic therapy (PDT) as an alternative treatment. PDT uses a photosensitive chemical, or photosensitizer, to produce reactive oxygen species (ROS) when exposed to light, targeting bacterial infections. However, the low ROS concentration in human blood limits its effectiveness. To overcome this, gold nanoparticles (AuNPs) have been investigated for their potential to enhance PDT efficiency. In this study, AuNPs were synthesized using laser ablation and then combined with the photosensitizer methylene blue (MB) to treat Escherichia coli infections. Antibacterial efficacy was evaluated by counting colony-forming units (CFUs) after exposing the bacteria to various concentrations of the PDT mixture. Results indicate that the combination of AuNPs and MB is more effective than using either agent alone. This research contributes to ongoing efforts to combat antibiotic resistance and improve PDT strategies, with broader implications across multiple scientific fields.

Wiggins, Parker "Why Is Sleep Difficult" (Lily Zhuhadar)
We've been taught at a young age that sleep is important for a variety of reasons. Sleep can help decrease risks of diseases and helps you heal from injuries, but it also can keep your mind sharp. For children, sleep is even more important as a lack of it can stunt physical growth and mental development. From strengthening the immune system to making sure people stay in high spirits, sleep has major

benefits that nothing else can satisfy as well, but sometimes it isn't so easy. As much as people tell themselves they need to go to bed earlier, sometimes we find ourselves lying down with our eyes closed for too long. Some people get restless, tossing and turning until they give up and grab their phone to scroll on their preferred social media platform. But why do some people suffer from losing sleep for hours while others can fall into a peaceful slumber in minutes? In this research, we look at 13 different variables in an attempt to find out why sleep evades some and what we can do to better our sleep.

Wilkins, Kaymin "Exploring Suicide Intervention among a Community Sample" (Sarah Bonis)
Suicide ideation attempts and completion remain a mental and public health concern. Particularly alarming are the high rates of suicidal ideation in young people and their unmet mental health needs (Chakawa, 2022). While mental health help exists, there is evidence to suggest a community approach to prevent suicide is best. This study explores suicide prevention or intervention among a community sample through a vignette survey. Recommendations for helpful behavior from laypeople will be provided at the end of the survey.

Willhite, Promise "Effects of Controlled Fires on Ruminant Nutrition in South Africa" (Michael Stokes)
Controlled fires are a land management technique in which fire is set to a portion of land, which replenishes nitrogen in soil, leading to more nutritious grasses for ruminants. Many of these ruminants draw in tourists for ecotourism, which is a major contributor to the South African economy. In October 2022, land managers set a controlled fire in Olifants West Nature Reserve (OWNR). In June 2023, I travelled to OWNR to sample grasses and soils along transects through the burned and control regions. The local crew collected samples again in April 2024. We sent the samples to a commercial lab for analysis of nutrient content. We used statistical analysis in R to compare the unburned and burned area data, as well as wet season and dry season data, allowing us to study the effects of the fire in relation to the season. This study showed that moisture, ash, and fiber contents are improved by controlled fires, while amounts of protein and fat are seasonal. Moisture was found to be affected by both the season and fire, because of increased rain during the wet season.

Wilson, Lauren; Bard, Duerell; Dykes, Oceanna; Schueler, Anne "From Classroom to Clinic: Evolving Attitudes Toward AI in the Counseling Profession" (Lester Archer)
Since coined in 1956 by John McCarthy, artificial intelligence (AI) has advanced significantly. However, its role in counseling and mental health has sparked debate among practitioners and researchers. Recent literature highlights varying attitudes towards AI in education and medicine, from optimism in clinical settings to skepticism about its ethical and legal concerns (Asiksoy, 2024; Castagno & Khalifa, 2020; Fulmer et al., 2023). While research on AI spans across business, medicine, and education, there has been little focus on mental health and counseling professions. This study examines attitudes towards AI among counseling graduate students and practicing counseling professionals. Using a cross-sectional survey design, we analyzed factors like age, gender, counseling track, and practice setting. Participants are a convenience sample of alumni and currently enrolled graduate students in the counseling program at a regional university. We hypothesize that there are significant differences in attitudes between graduate students and professional counselors on the factors of interest. This study will provide future insight into the application of AI in helping professions such as counseling and will

discuss ethical implications for future use of AI in therapeutic settings.

Woodard, Dayvon; Gani, Nahid; Lunday, John "Windows into the Past: Fossil Identification And Classification though Thin Section Microscopy" (Nahid Gani)

Fossils serve are time capsules of Earth's prehistoric past, offering crucial information about sedimentary processes, evolutionary history, and ancient ecosystems. This project focuses on identifying and classifying Paleozoic fossils using thin-section microscopy. By analyzing microstructures in thin sections under plane-polarized and cross-polarized light, this study aims to distinguish various fossil types, describe their depositional environments, and identify key paleoenvironmental signatures. Through the examination of well-preserved pre-collected fossil thin-section samples and microscopic analysis, the results produce a detailed catalog of identified fossils with corresponding descriptions and classifications, insights into paleoenvironmental conditions, a collection of microscopic images showcasing fossil microstructures, and the potential connection between fossil samples and present-day geological structures. Fossils such as Brachiopods from low-energy shelf environments, Crinoid fragments from deeper marine settings, and Rugose corals from shallow carbonate platforms provide key insights into past ecological conditions, biodiversity, and evolutionary trends. Fenestrate Bryozoans and Blastoids, common in Mississippian-age limestone, indicate warm, shallow marine environments, while Horn corals and Gastropods suggest reef and lagoonal settings with diverse marine life. This project enhances the understanding of paleontology, sedimentology, and mineralogy by offering hands-on fossil identification experience and insights into past environments, while also contributing valuable data for future geological research.

Wooden, Austin; Collett, Cameron; Sugimoto, Nicholas; Pullen, Clark "Aquatic Macroinvertebrate Diversity as a Measure of Water Quality in Cloudbridge Nature Reserve" (Keith Philips)

For our study, we assessed the water quality of streams at different elevations within Cloudbridge nature reserve, a cloud forest ecosystem important to biodiversity, using aquatic macroinvertebrates. We collected macroinvertebrates from five streams from 1550m to 1830m in elevation. Each organism was identified to family level. We used the Biological Monitoring Working Party modified for Costa Rica or BMWP'-CR index and Simpson's diversity index for data analysis. The BMWP'-CR assigns each family a value between one and ten based on pollution tolerance, and each family present adds to the total score. Simpson's diversity index is used to calculate the biodiversity within an area. The results from the BMWP'-CR index indicate regular water quality with no significant change in water quality as elevation changes, and the Simpson's diversity index revealed a positive correlation between elevation and diversity. Similar levels of water quality indicated by the data show that Cloudbridge is protecting their streams well, even in lower elevations that see higher levels of human activity. Higher diversity at higher elevations indicates that conservation is more important in streams at higher elevations in cloud forest habitats.

Woolery, Edward "Heroes or Tyrants? Using the Leadership of Chiang Kai-shek to Reexamine the Legacy of Abraham Lincoln" (David Serafini)

Today, reappraisal of history has become paramount in society. Scholars seek to contextualize building names, statues, and the land we live on. However, historians time and time again fail to reappraise popular figures in American history and misrepresent them by placing them on a pedestal. This thesis

will analyze the existing body of scholarly work and primary historical sources to compare two such leaders from history: Chiang Kai-shek and Abraham Lincoln. Chiang is largely unfamiliar to American audiences, but his story gives a model to reappraise Lincoln through. Both men lead their nations through civil wars. Furthermore, both men used similar leadership tactics to guide their nations through war. And finally, both men have had their legacies misrepresented through history. The difference is that now, the Taiwanese public has revisited their views on Taiwan's founding father while Americans largely still accept Lincoln's glorified place in history. This thesis will compare the two men's leadership tactics and how they have affected their legacies, ultimately giving a lens in which Abraham Lincoln's legacy-and the legacy of others-can be reappraised.

Wright, Chloe "Green Acres Golf Club House" (Shanaz Aly)
I designed my golf course, Green Acres, taking inspiration from Bermudan architecture and Mediterranean style. I focused on natural textures and light colors to create a relaxed yet sophisticated feel. I used materials that added warmth and character, making the building feel like it belongs in a coastal setting. Soft, sandy tones helped reflect sunlight and kept the space feeling bright and airy. Low sloped roofs, curved detailed and cutouts also help to create the overall vibe. Water features, inspired by Mediterranean courtyards, added a peaceful touch and made the space feel more inviting. The overall shape of the building creates a natural, and effortlessly welcoming appeal as big windows wrap around the courtyard. Overall, I wanted the course to feel like a getaway while being located in a central area.

Yang, Ryan "Diabetes Prediction Modeling with Machine Learning Techniques" (Huanjing Wang)
Diabetes mellitus is a chronic condition that affects how the body regulates glucose by causing the pancreas to produce insufficient insulin, resulting in excess sugar buildup in the bloodstream. This study aims to develop and evaluate different machine learning models for diagnosing various progressions of diabetes (none, prediabetic, diabetic) and to highlight key features that may be important indicators of diabetes. Using Python and a preprocessed 2021 BRFSS dataset hosted on Kaggle, we developed and evaluated several models, notably AdaBoost and Artificial Neural Network (ANN), for diabetes prediction. Although AdaBoost had a higher average accuracy (83% vs. 73%), Artificial Neural Network demonstrated a superior Area Under the Curve (AUC) value (0.68 vs. 0.66). To accomplish high performance, methods such as an Adaptive Synthetic (ADASYN) oversample were used to form a more balanced representation of the imbalanced input dataset. Finally, the calculation of Shapley Additive Explanation (SHAP) values gives us the significance and contribution of different features (the most significant being high cholesterol), allowing effective feature selection. This study provides potential methods for early diagnosis of diabetes while also supplying insight on the distinct strengths of different models.

Zrelak, Nick "An Examination of Atmospheric Features that Contributed to the Historic Ohio River Flood of 2011" (Joshua Durkee)
Between April 22nd and May 2nd, 2011, the region commonly known as the lower Ohio River Valley experienced a heavy rain event that led to record breaking rainfall across many cities. This flooding event further caused the Ohio River to reach record levels that had not been reached since 1937. This

paper's purpose is to examine the atmospheric features that contributed to this event. The forcing for this event is broken down into large-scale and local scale mechanisms. Large-scale forcing for this event included several low-pressure systems, a stationary front and upper atmospheric jet dynamics. This is the idea for large-scale forcing both spatial and temporally. Quasi-Geostrophic Theory helps analyze these mechanisms by identifying dominant forcing terms influencing vertical motion. Local scale mechanisms such as the low-level jet aided in the development of several mesoscale convective systems. These systems led to a training pattern over the region leading to prolonged rainfall that exceeded the limitations of the levees along the Ohio River. Using the National Oceanic Atmospheric Administration's 2011 Rapid Refresh data, this was plugged into Integrated Data Viewer to show the analysis of this event.