

Adebayo, Olusegun, "Generalized Master Theorem in analysis of divide-and-conquer algorithms"
(Ferhan Atici)

The complexity of divide-and-conquer algorithms is typically analyzed using recurrence relations. A common type of recurrence describes a situation in which a problem is divided into a fixed number of smaller subproblems of equal size, and an additional cost is incurred in dividing the problem and combining the resulting solutions. In this setting, the time complexity depends on the number of subproblems, the reduction in input size at each step, and the cost associated with the divide-and-combine process. The Master Theorem is a tool used to determine the time complexity of such problems by comparing the growth of the divide-and-conquer cost with a growth rate determined by the recursive structure. This leads to three main cases, depending on whether the divide-and-combine cost grows more slowly than, at the same rate as, or faster than this growth rate. However, the Master Theorem has two main constraints. First, it requires that the problem be divided into subproblems of equal size. Second, it assumes that the divide-and-combine cost follows a polynomial growth pattern. In this work, we focus on a more general type of recurrence in which the problem is divided into two groups of subproblems of different sizes, together with an additional cost for dividing and combining. Similar to the Master Theorem, we determine the behavior of the solution based on the relationships among the number of subproblems, the reduction factor, and the cost function.

Adhikari, Sanskar, "Analysis of Extreme Hydroclimatic Events: Rainfall and Streamflow in the Salt River Basin, Kentucky" (Zachary Suriano)

Analysis of Extreme Hydroclimatic Events: Rainfall and Streamflow in the Salt River Basin, Kentucky (oral presentation) The combination of extreme hydrological events and flash floods poses significant threats to infrastructure and public safety throughout Kentucky due to its challenging terrain. While heavy rainfall is often viewed as the primary driver of flooding, the "memory" of the land, specifically how wet the soil is before a storm, plays a critical, yet often under-analyzed, role in determining whether a storm results in a manageable rise in river levels or a catastrophic flood. Using a 30-year climatological dataset (1995–2024), this research integrates meteorological data from PRISM, streamflow records from the USGS, and soil-moisture reanalysis from ERA5-Land to create observational climatology of extreme and compound events in the Salt River Basin, Kentucky, and understand how antecedent soil moisture conditions amplify streamflow variability during extreme precipitation events. The study identifies extreme events using the Peaks Over Threshold method. Following the observational analysis, to demonstrate the practical application of the compound-event framework for real-world flood forecasting, an event-scale flood study is conducted using the HEC-HMS hydrological model to simulate and evaluate the streamflow response to the April 7, 2025, flooding event at Shepherdsville.

Adhikari, Sujan, Gani, Dr Nahid, Blaylock, Owen, "Ai-driven Seismic Hazard and Risk Assessment Using High-resolution Lidar in Western Kentucky" (Nahid Gani)

Western Kentucky lies between the New Madrid and Wabash Valley seismic zones but remains poorly characterized for seismic hazard due to concealed intraplate faults, thick sedimentary cover, and subtle surface expression. This study develops an AI-enabled geospatial framework to improve seismic hazard assessment using high-resolution LiDAR digital elevation models. A multi-scale geomorphometric dataset (multi-azimuth hillshade composites, slope, curvature, roughness and topographic position

indices) is generated from the DEM. Automated fault detection is performed using a multi-channel U-Net semantic segmentation model. Model outputs are evaluated against existing geologic maps, drainage anomalies, and regional seismicity to assess both spatial accuracy and geologic plausibility. Detected fault structures are integrated with earthquake catalogs, site condition proxies, and exposure datasets (building footprints and infrastructure) to develop a preliminary seismic hazard and vulnerability framework. Results refine the spatial distribution and continuity of potential active faults and identify areas of elevated structural risk. This work demonstrates how AI-driven analysis of LiDAR topography can support hazard characterization and risk.

Adjekum, Joycelyn, "Synoptic Environments of Major Flood Events in the Ohio River Basin: A Case Study Analysis" (Xingang Fan)

Flooding in the Ohio River Basin (ORB) often occurs during prolonged periods of heavy rainfall driven by sustained moisture influx and large-scale atmospheric circulation. This study examines the synoptic environments associated with three major flood events in the ORB: March 1–8, 1997; April 22–May 3, 2011; and February 20–25, 2018. The objective is to better understand the atmospheric conditions that contribute to multi-day rainfall and flooding. ERA5 reanalysis data are used to analyze the evolution of large-scale circulation during each event. A case-based synoptic analysis is performed to investigate atmospheric rivers and their role in supplying moisture into the basin, including the contribution of low-level jets that enhance this transport. The analysis also evaluates quasi-stationary frontal boundaries and training precipitation systems that can anchor rainfall and sustain prolonged precipitation. By examining these flood cases, this study aims to improve understanding of the atmospheric environments commonly associated with severe flood-producing events in the Ohio River Basin.

Adkins, Elena, "It Is Plain that the Pulpit Must Have Something To Say": Human Rights In The Social Gospel Movement" (Patricia Minter)

At the turn of the 20th century, the United States was facing a crisis of social rights and American Protestant clergy were doing little about it. But as the Progressive Era dawned, so did a new theological framework that sought to champion the human dignity of the working class of America. The Social Gospel arose as a call from pulpits across the country for broad social reform with working people as their central concern. While the work of individuals like Walter Rauschenbusch and Rev. Washington Gladden were pivotal in introducing and defining the theology of the Social Gospel, group organization played a crucial role in the evolution and longevity of Social Gospel doctrine. The Federal Council of Churches (FCC) and the Young Women's Christian Association (YWCA) took public stands against child labor, the advancement of labor rights, and championed the human rights of the working class. Their work mobilized countless Protestants across the United States and even gave the FCC an audience with President Franklin Roosevelt. This paper explores the Social Gospel as a human rights movement and how its dedication to Progressive Era reforms shaped the future of Protestant theology.

Aguilar Guerra, Bradley, "The Next Generation: An Analysis of Cultural Risk and Protective Factors in Alcohol and Cannabis Use among Multigenerational Latinos" (Jenni Teeters)

Background: Latinos are a growing US demographic, projected to comprise a significant portion of the population within the coming decades. Despite this growth, research examining how cultural beliefs

shape substance use across Latino generational statuses remains limited. The present study addresses this gap by examining how familismo, religiosity, gender roles (machismo, caballerismo, marianismo), and bicultural identity influence alcohol and cannabis use and related outcomes. Method: Participants were Latino college students (N = 2,817) who completed the Project HOLAS survey, reporting on alcohol and cannabis use, related problems, and endorsement of cultural beliefs. Results: Bivariate correlations indicated machismo endorsement was significantly associated with greater cannabis use/related consequences in Latinos ($r = .188$). Among Latinas, familism was positively associated with cannabis use/problems ($B = 2.03$, $SE = 0.61$, $\beta = .22$, $p = .001$, 95% CI [0.83, 3.24]), whereas marianismo was negatively associated ($B = -3.02$, $SE = 0.98$, $\beta = -.21$, $p = .002$, 95% CI [-4.95, -1.10]). Discussion: These results show that specific cultural factors may serve as risk and protective factors in cannabis use among Latino college students. Further research into how and why cultural factors shape substance use among Latinos is needed.

Aham, Victor, Gani, Royhan, "Automated Salt Delineation in the Gulf of Mexico: A Deep Learning Approach to 3d Seismic Segmentation" (Royhan Gani)

Accurate salt body delineation is essential in seismic subsurface exploration, particularly for velocity model building, understanding salt tectonics, and ensuring safe drilling operations. Traditional methods rely on seismic attributes that highlight steep dips and chaotic signals, but these approaches are labor-intensive and often inefficient in geologically complex regions with abundant salt deposits, like in the Gulf of Mexico. Using deep learning approaches, we present an automated technique employing 3D convolutional residual neural networks (CNNs) with an encoder-decoder architecture to segment salt bodies directly from seismic volumes in the northern Gulf of Mexico. For efficient network training, we designed a data generator that randomly extracts sub-volumes from a large-scale 3D training dataset, followed by geologically informed data augmentation. We fed these sub-volumes in large numbers to the network, using salt/non-salt binary labels generated by thresholding the velocity model as ground truth. We evaluated the model on validation sets, and achieved over 0.65 dice score, successfully detecting complex salt features in chaotic regions. Additionally, testing on an adjacent field datasets revealed the model is capable to generalize across different seismic datasets, confirming its robustness and potential for broader application.

Akangbe, Ayomide, "Synthesis of diesters via the esterification of L-ascorbic acid with dicarboxylic acids" (Lawrence Hill)

The antioxidant properties of ascorbic acid have encouraged its use as a drug delivery system in pharmaceutical industries. Our research aims at synthesizing diesters of dicarboxylic acids by esterification of the primary hydroxyl group of L-ascorbic acid with carboxylic acids. These diesters would be used as monomers to form polymers of L-ascorbic acid. Our first steps are to recreate and purify monoesters synthesized from fatty acids and apply these methods to dicarboxylic acids using concentrated sulfuric acid as an acid catalyst. These esters were characterized using IR, NMR and LC-MS and the results from the characterization showed that the monoesters of fatty acids were synthesized with good yield. This result will be replicated using dicarboxylic acids where the esters and bis-diesters of ascorbic acid synthesized will have ene-diol on both ends of the ascorbic acid. These ene-diols will then be used as sites for polymerization.

Akers, Halley, "Gender Perceptions on Sexual Crime and Sentencing" (Amber Giacona)

Transgender people experience prejudice and discrimination due to stereotypes, especially by the media about their potential sexual deviance. Ringger (2020) even found that with nonviolent crimes, transgender defendants were more likely to be found guilty than their cisgender counterparts. Our goal with this research is to explore gender bias in sentencing sexual crimes, especially with regards to transgender individuals. Prior research has shown that transgender individuals are judged harsher and receive longer sentences, but this may not necessarily be related to overt feelings of transphobia (Ringger, 2020). For the study, participants completed a survey through Qualtrics where they read vignettes that depicted different sexual crimes that are all considered Class D Felonies, only varying the gender of the suspect. After reading the vignettes, the participants will be asked questions regarding the crime and its severity, transphobia and masculinity, and demographic questions. Based on previous research (Beeby et al., 2021; Ringger, 2020), we expected cis-gender females to receive lightest sentences and transgender individuals overall to receive the harshest sentences. If our research aligns with previous research, this can impact how transgender individuals are being judged in a court of law.

Alavi, Charlie, Taylor, Emma, Cygan, Chase, Burgett, Ricki, "Improving Paleofire Reconstructions Using Geospatial Analysis to Calibrate Charcoal Records from Jackson Lake, Wyoming" (Gilliane Rasbold)

Over the past century, Grand Teton National Park has experienced severe wildfires that release charcoal into the atmosphere, which deposits in lake sediments where it can be recovered and quantified. Sedimentary charcoal accumulation rates (CHAR) provide a reliable proxy for reconstructing past fire timing, frequency, and intensity, and for evaluating fire-climate linkages. This study analyzes charcoal deposition from twenty-two short sediment cores collected in Jackson Lake, WY (2019–2023). Cores are processed at 1 cm intervals using 1 cm³ subsamples, followed by wet-sieving and stereomicroscope counting to calculate CHAR (pieces cm⁻² yr⁻¹). Age-depth models based on ²¹⁰Pb and ¹³⁷Cs constrain the record over the past ~150 years. Key fire events, the Dave Adams Hill Fire (1987), Yellowstone Fires (1988), Wilcox Fire (2000), and Bear Paw Bay Fire (2009), were confirmed using geospatial analysis and Landsat 5 imagery and are expected to appear as distinct peaks in the sediment record, serving as calibration points for the CHAR data. Together, spatial fire mapping and CHAR reconstruction will enable a high-resolution calibration of the sedimentary record, establishing a foundation for extending fire history into the Holocene.

Albert, Kevin, "Hydration Status Prediction Using Auto Model: Classifying Daily Hydration Patterns From Lifestyle And Environmental Factors" (Lily Popova Zhuhadar)

Maintaining proper hydration is critical for health, physical performance, and cognitive function, yet many individuals underestimate how lifestyle and environmental conditions shape daily fluid needs. This project uses the Daily Water Intake & Hydration Patterns dataset (30,000 observations) to develop a predictive analytics solution that classifies an individual's hydration status as Good or Poor based on demographic, behavioral, and contextual factors such as age, body weight, daily water intake, physical activity level, and weather conditions. Using the seven-step Business Analytics Process, the analysis begins with problem framing around dehydration risk identification, followed by data understanding and preparation for automated model training. RapidMiner's Auto Model is employed to compare multiple classification approaches (e.g., Naïve Bayes, generalized linear models, logistic regression, Fast Large

Margin, deep learning, and decision trees) and select a best-performing model using confusion-matrix-based evaluation. Results indicate strong predictive performance across models, with the Fast Large Margin approach achieving the highest accuracy (approximately 98%) and stable precision for both hydration classes. Feature-weight analysis consistently highlights daily water intake and physical activity level as the most influential predictors. The final model can be deployed in wellness applications to support early dehydration risk alerts and personalized hydration recommendations for individuals and health-focused organizations.

Ali, Areej, Chen, Leah, "Risk and Protective Moderators of Social Media Use and Psychological Well-being" (Qin Zhao)

Social media has become a central part of daily life for young adults, raising important questions about its impact on psychological well-being. Prior research has linked high social media usage with negative outcomes such as lower self-esteem, reduced life satisfaction, and increased negative affect. However, individuals differ substantially in how social media influences their well-being, suggesting that certain psychological traits may act as risk or protective factors. The present study examines whether social comparison orientation (SCO), perceived control (PC), and emotional self-efficacy (ESE) moderate the relationship between social media usage and psychological well-being. Social comparison orientation refers to the tendency to compare oneself with others, which may intensify negative effects of social media exposure. In contrast, perceived control and emotional self-efficacy may buffer individuals against adverse psychological outcomes. College students will complete an online survey measuring social media usage, SCO, PC, ESE, and indicators of psychological well-being. Correlation and regression analyses will test whether these individual differences strengthen or weaken the association between social media use and well-being. Understanding these moderating factors may help explain why some individuals are more vulnerable to negative effects of social media while others remain resilient.

Ali, Sonia, "The effects of Wnt/ β -catenin upregulation on regeneration and recovery post-spinal cord injury (SCI) in larval sea lamprey (*Petromyzon marinus*)" (Hilary Katz)

The Wnt/ β -catenin signaling pathway drives cell proliferation and regeneration and is of particular interest in spinal cord repair. This pathway can be effectively studied in the larval sea lamprey (*Petromyzon marinus*). These animals exhibit significant functional recovery following complete spinal cord transection, regaining forward swimming within 3 weeks and near-complete abilities by 11 weeks post-injury (wpi). While recent studies using the Wnt inhibitor Wnt-C59 (PORCN) demonstrate reduced recovery after spinal cord injury, the therapeutic potential of Wnt upregulation remains unknown. This study addresses that gap by evaluating pharmacological activation of the Wnt/ β -catenin pathway using a Wnt agonist (Calbiochem). Recovery was assessed through bulk anterograde labeling, cell survival assays of reticulospinal (RS) neurons, and behavioral scoring throughout recovery. While it was expected that upregulation would promote axon growth and accelerate functional recovery, preliminary findings demonstrate three key outcomes: 1) increased axons below the injury site, 2) reduced survival of giant RS neurons, and 3) reduced swimming recovery in agonist-treated animals in comparison to controls. These findings indicate that, while Wnt/ β -catenin upregulation enhanced structural plasticity, it did not translate into improved functional recovery or neuronal survival. This work provides new insights into Wnt/ β -catenin upregulation that may inform future mammalian neural repair strategies.

Amezcuca, Jazlina, Akomeah, Lizann, "Physiological Effects of Discrimination/Family Stress on Mental Health" (Qingfang Song)

Unfair treatment is a well-documented stressor for ethnic minority youth and how they respond to unfair treatment experiences directly relates to physical and mental health problems. Based on the conceptualization of stress response as a multi-faceted construct involving physiological and cognitive processes, this study examines the intercorrelations between physiological response and narrative processing of past unfair treatment experiences among ethnic minority youth. A sample of 66 African and Latino adolescents (M = 12.79 years) recalled and described an unfair treatment experience in a lab visit. Adolescents' autonomic functioning (i.e., skin conductance and heart rate variability) was monitored continuously during the resting baseline, recalling the unfair treatment, and subsequent recovery period. Adolescents' narratives about unfair treatment experiences were coded for coherence. Thematic coherence, telling a story coherently with embellished details and a developed story structure, was associated with lower skin conductance at baseline ($r = -.25, p = .043$) and slower recovery in heart rate variability ($r = -.29, p = .024$). Contextual coherence, situating a story in specific time and space, was associated with faster recovery of skin conductance level ($r = .25, p = .046$). The findings suggest that narrative coherence may reflect a more adaptive cognitive response, potentially helping ethnic minority youth further engagement in coping with unfair treatment through mobilizing physiological resources.

Anatune, Chibuzor, "Functionalizing the Artificial Molecular Muscles with the Property of Self-healing" (Lei Li)

The development of artificial molecular muscles with the function of self-heal is important for future devices. Polymer-based artificial molecular muscles are inspired by real muscle's contraction and extension behaviors. They could shrink and expand in responding to external stimuli, including light, heat, and chemical redox conditions, etc. The artificial molecular muscles have great potentials to be used in areas like mini medical devices, robotics, and smart textiles. However, the sustainability of these materials has become an issue, affecting their lifetime and leading to more waste produced. This project focuses on developing artificial molecular muscles with the functionality of self-healing. Through rationally designing the material structure utilizing favorable intermolecular interactions, a new family of artificial molecular muscles will be prepared. Within the designed artificial molecular muscles, the viologen molecules were used as an engine because they can control the material's size change under redox conditions: the material will shrink under reduction condition and expand under oxidation condition. Switching between these two conditions drives a contraction–expansion cycle and converts chemical energy into mechanical force. The self-healing property, driven by the universal Van der Waals interactions, enables the material to recover from surface cracks and breakage, thereby extending its lifetime for long-term use.

Annamuradov, Berdimyrat, Khuzhakulov, Zikrulloh, Khenner, Mikhail, Terzic, Jasminka, Er, Ali Oguz, "The Crystallinity And Morphology Change In Pld Al/zr Multilayer Thin Films At Different Temperature" (Ali Oguz Er)

Al/Zr multilayer thin films were fabricated using pulsed laser deposition (PLD) with a 248 nm KrF excimer laser to study their structural and surface characteristics for potential use in extreme ultraviolet (EUV)

optical and protective coatings. Alternating layers of aluminum and zirconium were deposited on silicon substrates under high vacuum conditions, with nanometer-scale thickness control verified by spectroscopic ellipsometry. X-ray diffraction analysis showed improved crystallinity at 400 °C, highlighted by a dominant Zr(002) orientation. Surface examinations by SEM and AFM indicated a transition from smooth, two-dimensional (2D) growth to a rough, three-dimensional (3D) morphology at 500 °C, likely due to increased adatom mobility and interfacial strain. SEM images of Al films deposited at 400 °C revealed a uniform nanocrystalline surface with compact grains and minimal porosity, characteristic of stable 2D growth. Computational modeling based on free-energy minimization further confirmed the 2D–3D transition, predicting a critical film thickness of around 1–2 nm, which aligns with experimental findings. Overall, this study highlights the effectiveness of PLD in producing high-quality Al/Zr multilayers suitable for EUV mirror and advanced coating applications.

Annamuradov, Berdimyrat, Brula, Hosam, Brula, Hosamulhaq, Gurbandurdyev, Begench, Er, Ali Oguz, "Direct Laser Shockwave Imprinting of Shape Memory Alloys with Tunable Surface" (Ali Oguz Er) Shape memory alloys (SMAs) are a unique class of smart materials with widespread applications in biomedical and aerospace technologies. In this study, we demonstrate an efficient and low-cost laser shockwave-assisted direct imprinting method to fabricate thermally controllable surface patterns on Ni₅₀Ti₅₀ (at.%). Patterned micro-indentations were produced using a 1064 nm Nd:YAG laser operating at 10 Hz. The effects of laser energy, shape recovery behavior of NiTi, and shockwave dynamics were investigated experimentally and numerically. Focused laser pulses on the NiTi surface generated transient pressure pulses reaching several GPa. Optical microscopy revealed that the resulting surface patterns exhibited tunable geometries, with the imprint depth increasing as a function of laser power and irradiation time. Upon thermal activation, partial recovery of the patterned features was observed, with a maximum depth recovery ratio of ~30%. As the number of pulses—and consequently the well depth—increased, the recovery ratio decreased and plateaued near 15%. Finite-element simulations of pressure evolution in the SMA correlated well with experimental results, capturing the rapid rise, decay, and attenuation of stress waves within the material. Ongoing experiments employing picosecond laser-induced shockwave imprinting will also be discussed.

Arugha, Annie, Conte, Eric, Islam, Abul Kasem Mohammad Mydul, "Quantitative Analysis of Antimicrobial β -defensin Proteins in Bovine Milk Using Liquid Chromatography-mass Spectrometry" (Eric Conte)

Bovine mastitis, an inflammatory condition affecting the udder tissue of cows, poses a significant threat to the global dairy industry. Triggered by physical injury or bacterial infection, this condition leads to substantial economic losses for farmers. The causative organisms of bovine mastitis are diverse, including both gram-positive and gram-negative bacteria, many of which are highly contagious. The impact of mastitis is significant: it reduces milk production, compromises milk quality, and increases milk discard rates. Additionally, the disease incurs higher treatment and labor costs, often resulting in the premature culling of infected cows. Understanding the cow's innate immune response is crucial for addressing this persistent issue. β -defensins, a vital component of this defense system, serve as the first line of defense against mastitis. However, quantitative analysis of β -defensins in bovine milk is limited in the literature. This study aims to address this knowledge gap by developing a robust analytical method to

measure β -defensins in 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.

Ashaolu, Ayanfe, Srivastava, Ajay, "Characterization of an Antibody to Detect the Nuclear Pore Complex in *Drosophila melanogaster*" (Joseph Marquardt)

The nuclear pore complex (NPC) is a massive, evolutionarily conserved gatekeeper that regulates selective exchange of cargo between the nucleus and cytoplasm. It consists of approximately 30 nucleoporins (Nups). Molecules smaller than 30 kDa can traverse the NPC by passive diffusion, whereas larger cargoes require facilitated transport mediated by specialized nuclear transport receptors. The NPC also undergoes remodeling during cell growth and development. *Drosophila melanogaster* is a model of choice for NPC studies because of its short generation time, well-characterized genome, and the strong evolutionary conservation between many *Drosophila* genes and their human homologs. Although the structural architecture of the NPC is well documented across species, high-quality, validated tools to study these components in *Drosophila melanogaster* remain limited. This study addresses this gap by characterizing an antibody targeting an NPC component in *Drosophila*. Using a dual-validation strategy, Western blotting was used to confirm biochemical specificity and molecular weight, and immunofluorescence microscopy was used to define the subcellular localization of the target protein at the nuclear envelope.

Ashburn, Kenedi, Brown, Zoe, Brown, Zoe, "Novel Control Design and Lyapunov-Based Exponential Stability Analysis for a SCOLE-Inspired Beam-Mass-Beam Configuration with Interface Rotational Inertia" (Ozkan Ozer)

We study the stability of a hybrid PDE-ODE model motivated by flexible-structure dynamics and SCOLE (Spacecraft Control Laboratory Experiment) benchmark configurations. The system consists of two Euler-Bernoulli beams coupled through an interior point mass, where the interface dynamics fully incorporate rotational inertia. To the best of our knowledge, this mathematical model is considered here for the first time in a form that retains the relevant physics of the original SCOLE model, while extending it to a beam-mass-beam configuration with a dynamic interior joint. We propose a novel dynamic feedback control design acting through the interface and develop a constructive Lyapunov framework that yields explicit energy estimates and proves rapid (exponential) decay of the total energy of admissible vibrations. The results complement recently submitted works of Akil, Ismail, Ozer, and Fragnelli (2025) and Akil, Ashburn, Brown, Fragnelli, Ismail, and Ozer (2025), which emphasize resolvent-based analyses and related partial-damping configurations. This Lyapunov-based approach, developed in our submitted work Ashburn, Brown, Ozer (2026), is well-suited for numerical analysis and discrete stability investigations. We also discuss structure-preserving staggered finite difference schemes and show that they capture the continuous stability regime predicted by the Lyapunov method.

Awe, Rebecca, Nee, Matthew, "Molecular Dynamics Insights into SO_2 -Water Interactions during Aerosol Formation" (Matthew Nee)

Atmospheric aerosols are tiny particles suspended in the air that play a critical role in air quality, human health, and climate change. Many of these particles originate from sulfur dioxide (SO_2), a common

pollutant released through industrial activities. Although the environmental impacts of sulfur-based aerosols are well known, the molecular-level processes driving their formation remain difficult to observe experimentally. In this work, molecular dynamics simulations are used to investigate how SO₂ interacts with water and ions during the early stages of aerosol formation. By modeling the motion and interactions of sulfur-containing molecules, this study provides molecular-level insight into their behavior in aqueous environments relevant to the atmosphere. Attention is given to interactions between SO₂, water molecules, and ions, and how these interactions may promote molecular clustering and particle growth. Understanding these early processes supports the development of improved air quality and climate models.

Bailey, Rowan, "The Impact of Local Government Outreach on Perceptions of Performance and Policy Support" (Joel Turner)

Outreach is used by public institutions to keep their constituents informed, engaged, and confident in the administration. This paper investigates how citizen perceptions of local government outreach affect popular opinion of the government and support for creative policy ideas. The study was conducted using WKU Center for Local Governments and Rural Policy survey data from the small city of Owensboro, KY. Perceptions of outreach were compared to various metrics of governmental support using a Pearson correlation, and the relationship between outreach and approval of accessory dwelling units as policy support was tested in an ordered logit model. Widely varying opinions of Owensboro's outreach were significantly positively correlated with each measurement of approval. Among a range of demographic controls, outreach and civic attachment and optimism were the only variables that significantly impacted the likelihood of support for ADU's. These results demonstrate the importance of engaging in quality outreach for local governments, both to improve their reputation and to earn political capital that could be used to pursue policy goals.

Bakari, Ndaye, "Optimizing Data Consistency in Low-bandwidth Environments" (Huanjing Wang)

This project was conceived after observing that most small businesses in less developed countries, despite having access to mobile phones, often lack consistently reliable internet access. This compels many small businesses to maintain financial and transaction records using manual, paper-based methods, which inherently increases the risk of data loss. This project addresses this vulnerability by offering an Android app built on an offline-first architecture, thereby ensuring data consistency. The primary function of this app is to enable small businesses operating in low-bandwidth environments to collect and securely save their business data, receive immediate performance calculations, and have unrestricted access to their records. Regarding the concern that accidental deletion of the app by a user could result in data loss, this is mitigated because the app is designed to automatically synchronize data to the cloud upon detecting an internet connection.

Bakhos, Aleen, Mitchell, Sophia, Mitchell, Sophia, King, Rodney, "Comparative Analysis of Mycobacteriophages Estrellaoasis and Limatchia" (Rodney King)

Of the biological entities on earth, bacteriophages ("phages") far outnumber them all. Bacteriophages are not considered living; they are viruses that infect particular bacterial hosts. In the fall of 2025, we participated in the SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and

Evolutionary Science) program. Bacteriophages specific to *Mycobacterium smegmatis* (“mycobacteriophages”) were isolated, purified, amplified, and analyzed. The goal of this study was to explore bacteriophage diversity in Kentucky. To accomplish this, soil samples were obtained from two different regions of the state, Maysville, Kentucky, and Richmond, Kentucky. Bacteriophages EstrellaOasis, from Maysville, and Limatchia, from Richmond were successfully recovered. The genomic DNA from these phages was isolated, digested with restriction enzymes and analyzed by gel electrophoresis. The resulting pattern of fragments confirmed that the phages differed at the genetic level. However, electron microscopy revealed that EstrellaOasis and Limatchia both have siphoviridae morphology. A preliminary lysogeny experiment suggested that EstrellaOasis may form lysogens, but Limatchia may be limited to the lytic lifestyle only. Our results support the idea that the phage population in Kentucky is diverse.

Barbour, Tiara, "The Outcome of Library Staff Training on Human Trafficking" (Daniel Boamah)

Libraries are known as safe spaces and for serving every population. One of those populations is those who are vulnerable or oppressed. Human trafficking victims are a vulnerable population who are often overlooked, as the victims can blend in broad daylight. This poster board examines the impact of human trafficking (HT) training on library staff’s awareness, identification, response, and support of potential victims seeking refuge within the library. To be analyzed are any changes in staff mindset and knowledge prior to and following the training. An explanatory sequential design will be the qualitative method research design used to gather data. A pre- and post-test created on Qualtrics Survey Tool was developed to ask specific questions relating to the training. To assess the library staff’s comprehension and grasp of the information and attitudinal change — what HT is, how to spot potential victims, why a potentially trafficked person seeks refuge at the library, and how to approach and support the individual are areas covered in the training and asked in the survey. The hypothesis is that with the implementation of library-oriented training on HT, it will heighten staff alertness and recognition ability of indicators of trafficking. After the training, library staff will be equipped to respond and react appropriately and show improved knowledge of general HT information.

Barth, Haley, "Thresholds of Representation" (Yvonne Petkus)

This paper, "Thresholds of Representation", will discuss semiotics, specifically the tensions found between the recognizable and the impulse to dismantle legibility, as explored through my own studio research and that of Czech painter Daniel Pitín. In "The Door Through Time and Space", contemporary art curator Jane Neal articulates how Pitín constructs images that appear legible yet ultimately undo their own coherence. His compositions offer cues: a corridor, a beam of light, a fragment of structure. For a moment the signifier aligns with the signified. Yet that alignment wavers. Light falls sharply, space folds inward, and certainty recedes. The cue remains, but what it promises dissolves. I find a similar approach in my painting. I begin with something tangible, something seen, but as paint gathers and surfaces shift, the original referent loosens. The image no longer explains; it hovers. As forms repeat, colors press forward, and what once seemed fixed becomes provisional. Our practices share this quiet undoing. Representation is neither rejected nor fully trusted. It is approached as a threshold that is entered and unsettled. In that space between signifier and signified, between cue and collapse, the work begins, representation used not to assert authority but to test its limits.

Beckmann, Maya, Heintz, Kieran, Whitehead, Samuel, Yeager, Kevin, Dilworth, John, Thigpen, Ryan, Schweitzer, Sydney, McGlue, Michael, "A High-Resolution 800-Year Fire History of Jackson Lake, Grand Teton National Park" (Giliane Rasbold)

Wildfires are frequent natural events in the western United States, driven by dry climate, warming trends, and human activity. However, detailed fire records for the Grand Teton National Park region remain limited. This study reconstructs Late Holocene fire activity using sediment cores collected from Jackson Lake and analyzed at 1 cm resolution, allowing improved detection of individual fire events.

Macrocharcoal particles ($>106 \mu\text{m}$) were isolated through chemical dispersion and wet sieving, then quantified under stereomicroscope. Charcoal accumulation rates (CHAR; pieces $\text{cm}^{-2} \text{yr}^{-1}$) were calculated using sedimentation rates derived from an established age-depth model. Preliminary results from the last 800 years BP show an average CHAR of 2 particles $\text{cm}^{-2} \text{yr}^{-1}$ (SD = 1.4). The last 400 years are characterized by multiple distinct peaks exceeding 5 particles $\text{cm}^{-2} \text{yr}^{-1}$. The highest peak occurred at approximately 375 years BP, reaching 7.8 particles $\text{cm}^{-2} \text{yr}^{-1}$, with additional peaks at approximately 304, 283, 162, and 39 years BP. These results indicate increased fire frequency and intensity during the most recent centuries. Ongoing analyses aim to extend this high-resolution reconstruction back to the Early Holocene, providing a longer-term perspective on fire regime variability in the Jackson Lake region.

Bentley, Alexander, "Guanine-triggered Ring Opening in a Platinum(ii) Tridentate Complex" (Kevin Williams)

Certain platinum(II) complexes are recognized for suppressing cancer cell proliferation in a way that parallels the activity of cisplatin. Complexes bearing a triamine ligand are generally expected to bind only one guanine; however, studies examining the reactivity of chloro [2-(4-methyl-1,4-diazepan-1-yl)ethanamine] platinum(II) chloride, $[\text{Pt}(\text{L})\text{Cl}]^+$, with guanine derivatives including guanosine 5'-monophosphate (5'-GMP) and 9-ethylguanine (9-EtG) reveal additional behavior. Under acidic conditions, evidence supports coordination of two guanine molecules. Since $[\text{Pt}(\text{L})\text{Cl}]^+$ is present as a pair of enantiomers, its reaction with 5'-GMP produces diastereomeric species, whereas reactions with 9-EtG result in less complex NMR spectra that are easier to interpret. At pH 4, $[\text{Pt}(\text{L})\text{Cl}]\text{Cl}$ reacts with 5'-GMP to generate both $[\text{Pt}(\text{L})(5'\text{-GMP})]^+$ and $[\text{Pt}(\kappa^2\text{L})(5'\text{-GMP})_2]$, where the latter reflects bidentate coordination of the L ligand. Molecular mechanics modeling of $[\text{Pt}(\text{L})\text{Cl}]^+$ and its potential 9-EtG adducts indicates that the tertiary nitrogen atom positioned cis to the chloride ligand is the most probable site displaced during guanine coordination. Altogether, these results suggest that under suitable conditions, $[\text{Pt}(\text{L})\text{Cl}]\text{Cl}$ can associate with DNA in a bidentate manner similar to the binding mode observed for cisplatin.

Bertsch, McKenzie, Bertsch, McKenzie, Polk, Jason, "Environmental Distribution and Vector Transport of Microplastics and Heavy Metal Contamination in Karst Groundwater Systems" (Jason Polk)

Urban karst environments are highly vulnerable to emerging contaminants. This study investigates microplastics originating from Bowling Green, Kentucky, as primary vectors for transporting adsorbed heavy metals into regional groundwater systems. Microplastics are polymers that primarily undergo weathering and degradation, altering their surface and increasing their chances of adsorbing heavy metals. Sources of microplastics are dominated by urban stormwater runoff, including tire wear

fragments and synthetic fibers, potentially accumulating metals throughout the Lost River Groundwater Basin and Jennings Creek Groundwater Basin. Water and sediment samples will be collected at key selected sites to define concentrations and characteristics of the contaminants. Microplastic quantification will involve mixed methods of separation and filtration of the samples with microscopic analysis. Samples will also be analyzed for heavy metals with Inductively Coupled Plasma Mass Spectrometry laboratory methods, water quality parameters, and total suspended solids. Precipitation events will be sampled to analyze contamination of seasonal variability with atmospheric deposition. The findings will establish correlations between microplastic characteristics and heavy metal concentrations within karst aquifers. Understanding the sources, fate, and transport of microplastic characteristics with heavy metals is critical for assessing the water quality in urban karst environments.

Billingsley, Brendan, Baker, Camerik, "ClockedIn - A Refined Approach To Restaurant-based Scheduling" (Guangming Xing)

Restaurant scheduling is often managed through manual processes or generalized scheduling software that fails to address the operational complexity of food service environments. These systems frequently overlook factors such as employee skill hierarchy, shift role requirements, and dynamic staffing constraints. cLockedIn is a specialized scheduling application designed specifically for restaurant operations, providing managers with a structured and efficient method for generating staff schedules. The system introduces a role-based scheduling model that accounts for job code hierarchies, employee availability, and daily staffing requirements. Managers can define the number of employees needed for each position per shift while the system ensures qualified employees are assigned appropriately based on their skill level. Additional features include employee management, availability tracking, and schedule generation tools designed to reduce manual planning effort. By focusing on the unique scheduling constraints present in restaurant environments, cLockedIn aims to streamline managerial workflows and reduce scheduling errors. The platform provides a more tailored alternative to general workforce management tools, improving both operational efficiency and schedule clarity for restaurant staff.

Billingsley, Brendan, "Detecting Malware through Binary Representation of .exe Files Using 1d CNN" (Qi Li)

Malware detection is a critical component of modern cybersecurity, yet traditional signature-based approaches struggle to identify previously unseen or obfuscated threats. Recent advances in deep learning have introduced new methods for detecting malicious software through automated feature extraction and pattern recognition. This project explores the use of a one-dimensional convolutional neural network (1D CNN) to classify executable files as either benign or malicious based on their raw byte sequences. Instead of relying on handcrafted features or static signatures, the model analyzes normalized byte data extracted directly from executable files. These sequences are processed through multiple convolutional layers that learn hierarchical patterns indicative of malicious behavior. The model is trained and evaluated using separate training, validation, and testing datasets to ensure generalization and prevent overfitting. Experimental results demonstrate that deep learning models such as 1D CNNs can effectively identify malware by learning structural patterns within binary data. This approach highlights the potential of neural networks to enhance automated threat detection systems and provide a scalable alternative to traditional malware analysis techniques.

Biswakarma, Kamal, Brotzge, Jerald, "Evaluating Spatial and Temporal Patterns in Climate Across a Small Urban Area: A Case Study of Bowling Green, Kentucky" (Jerald Brotzge)

Urban Heat Islands (UHIs), where urban areas exhibit higher temperatures than their rural surroundings, are well documented in major metropolitan regions but less frequently studied in small and mid-sized cities. This study analyzes the spatial and temporal characteristics and controlling factors of local climate and associated UHI across Bowling Green, Kentucky. One full year of high-resolution (5-minute) measurements collected during 2025 from 38 weather stations deployed in and around Bowling Green are reviewed. The 38 monitoring sites were each classified using the Local Climate Zone (LCZ) land surface classification system and then evaluated based upon its UHI climatology. Initial results show Bowling Green to have a measurable UHI, strongest around midnight as built surfaces cool slowly under nocturnal longwave conditions, with drier air over more urbanized sites. Persistent hotspots appear to align with impervious cover and dense infrastructure with limited vegetation, with larger summer contrasts but a longer-lasting nocturnal signal in winter. This study will also assess the reliability of satellite climate products for monitoring UHI by conducting a comparison study with the in-situ observations. This study provides one of the first high-resolution assessments of UHI behavior in a rapidly developing small city, offering critical insights for heat-risk evaluation, urban planning, and climate-resilient infrastructure design.

Bizzell, Makayla, "Secondary Agricultural Mechanics Instructors Adaptations When Integrating Special Needs Students into the Laboratory Environment" (Thomas Kingery)

As efforts to integrate students with special needs into general education classrooms expand, secondary agricultural education programs must adapt to meet the needs of diverse learners. Much of the responsibility for successful accommodation of students with disabilities rests on teachers. This study explores how secondary agricultural mechanics instructors modify instructional strategies, laboratory environments, and curriculum materials to accommodate these students. A survey was developed and distributed to multiple regions within a state. Results indicate that educators most consistently use strategies that are easy to implement and enhance engagement for all students, such as hands-on activities and visual aids. Strategies requiring specialized training, external support, or additional resources, including assistive technology and emotional regulation techniques, were used least often. Teachers primarily relied on IEP guidelines, extended time, simplified assignments, and peer assistance to support students with special needs. Most agricultural mechanics teachers reported that their shop environments were designed for general safety, with safety and supervision prioritized above all else. In some cases, students with more severe physical disabilities were restricted from shop participation. Overall, findings suggest a reactive approach to accessibility and highlight the need for professional development focused on inclusive lab design, adaptive safety planning, and assistive tool integration.

Blair, Allison, Gani, Nahid, "Geobiology Perspectives: Using Fossils to Reveal Earth's Changing Environments" (Nahid Gani)

Fossils are a valuable resource that act as a record of time and help us understand past environments. By studying fossils, we learn about the history of life on Earth and gain insight into how environments may change in the future. We explore these geobiology perspectives by working with WKU's vast fossil

collection. Our research focuses on identifying, classifying, and documenting fossils that span many different geologic time periods and represent a wide range of ancient life. Many of these specimens had not been updated or recorded in more than 30 years. We examined and noted over 3,000 specimens using standard paleontology references, past manuscripts, and museum-style identification practices. This work helps make the collection easier to use for teaching and future study. We also began creating digital representations of selected index fossils using 3D scanning. These models provide accurate replicas that increase accessibility and support learning about fossil form, function, and environmental significance. We are continuing to organize the physical specimens, and the next step is developing an online library where these fossils can be explored. Through this project, WKU's fossil collection becomes a stronger resource for understanding Earth's changing environments through the lens of deep-time and geobiology.

Blakeman, Abigail, "Expressive Arts and Their Effects on Childhood Cultural Adaptation" (Tiffany Bostic-Brown)

Expressive Arts Therapy emphasizes an interdisciplinary approach to arts therapy in contrast to the other specialized approaches. These art forms include music, theater, painting, writing, and more. I became very passionate about expressive arts therapy and its use in the classroom after assisting in music therapy interventions with cross-cultural children in my local community. Because of this, I am presenting a poster presentation on expressive arts and their effect on childhood cultural adaptation. I hypothesized that expressive arts would be positively correlated to this process for children and adolescents. Through my FUSE grant, I was able to lead high school students through expressive arts experiences. Together, we listened to music and made a project inspired by an African art form known as adinkra. Before we began, I observed that they didn't speak to me. However, after we started working, they began asking me questions, telling me about themselves, and overall connecting with me. This showed a positive correlation between cultural adaptation and expressive arts. This is important to open the door to communication between multicultural classes and their teachers.

Blaylock, Owen, Gani, Nahid, Adhikari, Sujan, "Fault Reconnaissance, Liquefaction, and Seismic Risk in Western Kentucky: Seismic Hazard Mitigation" (Nahid Gani)

Western Kentucky is in a high-seismic-hazard region influenced by the New Madrid Seismic Zone and its extent into the Jackson Purchase. Much of the research done in Western Kentucky is outdated, making information on subsurface faults and reactivated Paleozoic structures difficult to find. Understanding these features is vital to the safety of those within the region as it is highly susceptible to liquefaction. Using data sources such as LiDAR digital elevation models to locate faults, historical earthquake data, and surficial sediment mapping, we can locate liquefaction prone areas. By using fault proximity, sediment mapping, and population density, we can understand what zones are most susceptible to hazards. The presence of Quaternary alluvium, high groundwater tables, and unconsolidated fluvial deposits could amplify shaking increasing risk of infrastructural damage and sand blows. Early findings highlight the need to update regional seismic microzonation maps, seismic infrastructure planning, and public preparation for seismic hazards. This research is vital to understanding seismic risks to make sure the public and infrastructure are prepared and built to deal with possible seismic events as well as to comprehend the underlying geological processes of Western

Kentucky.

Boateng, Ama, Lickenbrock, Diane, Borges, Hailey, "Paternal Intrusiveness: The Roles of Parent Efficacy, Temperament, and Support" (Diane Lickenbrock)

Parental intrusiveness, the degree to which parents impose their own agenda on their child, can hinder children's socio-emotional and behavioral outcomes (Eisenberg et al., 2015; Smaling et al., 2017). Predictors of other parenting behaviors (parental sensitivity), such as parent efficacy, infant temperament, and partner support have been largely unexamined with parental intrusiveness (Bailes et al., 2024; Grimes, 2012; Razurel et al., 2016). Past research examining paternal parenting behaviors is also limited (Volling & Cabrera, 2019). The present longitudinal study (n=62 dyads) examined the association between parental efficacy and paternal intrusiveness across early infancy, including infant temperament and perceived partner support as moderators. At 4-months, fathers completed questionnaires assessing infant temperament (Gartstein & Rothbart) and partner support (Cronenwett et al., 1988). At 8 months, paternal intrusiveness was rated during a face-to-face, father-infant play task (Braungart-Rieker et al., 2014; Tronick et al., 1978). Multiple regression model results indicated direct care support ($B=-.552, p<.001$) and infant negative temperamental reactivity ($B=.393, p=.012$) were moderators between parental efficacy and paternal intrusiveness. Paternal support findings were consistent with prior studies (Leahy-Warren et al., 2011), but infant temperament findings were inconsistent. Future studies should continue to examine infant and environmental factors that can affect fathers' parenting behaviors.

Branch, Lilian, Marquardt, Joseph, "Coordination of Two Yeast Kinases Localization Patterns to Control Cell Shape" (Joseph Marquardt)

Many cellular diseases, such as cancer, can be caused by unregulated growth and cell division. Due to the close cellular similarity between the budding yeast *Saccharomyces cerevisiae* and humans, we can use yeast as a model system to study cellular processes. Proper cell division and growth leads to stereotypical yeast cell shapes that can be easily examined. The yeast protein kinase Elm1 regulates cytokinesis and cellular morphogenesis, and when deleted, cells become elongated. Another kinase Ste20 is responsible for regulating cell growth. This study researches the coordinated effects of Elm1 and Ste20 on cell division and growth using classical yeast genetics and fluorescence microscopy. It primarily focuses on localization interdependencies of Elm1 and Ste20 when either are deleted. Ste20 normally localizes in growing buds. However, when Elm1 is missing, Ste20's localization becomes randomized, appearing in both the mother and bud. This suggests that Elm1 plays a role in Ste20 localization. Our data also suggest that Ste20 could potentially increase Elm1 intensity at the site of cell division. Gaining more knowledge in the functions and pathways of Elm1 and Ste20 can further our understanding of cellular division and growth in yeast cells, which can then be applied to human illnesses.

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. It is known as a causative agent of respiratory illnesses such as Legionnaires' disease and Pontiac fever. This study investigated the effectiveness of

Photodynamic Treatment (PDT) in inhibiting the growth of *L. pneumophila* in a water environment. Photodynamic Treatment is the method of using light-sensitive chemicals, also known as Photosensitizers, combined with light to induce bacterial cell destruction. In this study, the photosensitizer that was used was Methylene Blue. We tested the response of cultured *L. pneumophila* to PDT treatment by exposing the bacteria to methylene blue and red light. Both the wild-type and the type IV secretion system mutant strains showed similar sensitivity to the treatment. We subsequently performed a time-course analysis to determine the optimal time of PDT treatment exposure that can effectively limit the amount of growth of *L. pneumophila* in water. Our data shows a time dependent reduction in bacterial counts with about 99% reduction in bacterial survival within 3 minutes exposure. Currently, we are performing infection assays to determine if the bacteria that were treated with PDT will have reduced capability to infect human macrophages and amoeba cells in comparison to untreated by PDT.

Browder, Kenia, "Cornerstone Commons" (Shahnaz Aly)

Cornerstone Commons Kenia Browder This community center was designed to be a welcoming place for everyone in Bowling Green. The main goal was to create a safe and comfortable space where people of all ages can come together, join activities, and feel included. Whether someone wants to exercise, learn something new, or just spend time with friends and neighbors, the center offers something for everyone. The building is designed to be easy to navigate, with open spaces and clear pathways so everyone can move around freely. It includes classrooms, exercise areas, multipurpose rooms, and gathering spaces that encourage learning, teamwork, and social interaction. The lobby and common areas provide a place for people to meet, hang out, and build relationships. Safety and comfort are important parts of the design. Restrooms, locker rooms, and accessible paths make sure everyone can use the facility, no matter their age or ability. Overall, this community center is more than just a building, it's a place for the community to grow, connect, and feel supported. By providing a positive and friendly environment, it hopes to bring people together and serve Bowling Green as a safe, fun, and welcoming space for many years to come.

Brown, Sorrell, Katz, Hilary, "Neuromast Structure in a Larval Jawless Vertebrate, Sea Lamprey" (John Andersland)

Neuromasts are mechanosensory organs held on top or within the skin used to detect water movement, pressure changes, and vibrations within fish. Lampreys are jawless vertebrates that have neuromasts located around the rostral region of their body on the surface of their skin. My goal was to investigate the structure of these superficial neuromasts in larval sea lamprey (*Petromyzon marinus*). I located neuromasts by imaging samples with a scanning electron microscope. I imaged the neuromasts on different skin samples that were either freeze-dried or chemically fixed, ethanol dehydrated, and critical point dried. The neuromasts follow a similar structural pattern to bony fish, having stereocilia and kinocilia protected by the cupula. The cupula is embedded in ethanol-soluble mucus, keeping it intact.

Brown, Zoe, Ashburn, Kenedi, "Stability-preserving Finite Difference Approximation For Interconnected Wave Equations With Discontinuous Transmission Control" (Ahmet Ozkan Ozer)

We study a serially connected two-wave system with a clamped left end and a dynamic boundary with tip

inertia, arising, for example, from mass loading at the right end, where the control designs act only at the interior interface. One physical realization of this model is two vibrating cables connected at an interface, with a mass attached at the tip and damping devices acting at the connection point. Two transmission control designs are considered: a continuous (standard) design and a discontinuous design. The continuous design uses two feedback controllers, one higher-order based on angular velocity and one lower-order based on pointwise velocity. Despite the higher-order feedback, this design yields only conditional stability, and for certain physical parameters, the vibrations are not fully suppressed (Brown-Ozer, 2025, L-CSS). In contrast, the novel discontinuous design yields unconditional exponential stability and ensures rapid suppression of vibrations using only lower-order feedback mechanisms (Akil-Brown-Ozer, 2026, L-CSS). A stability-preserving numerical approximation is developed for both designs (Brown-Ozer, 2026, Wolfram Demonstrations). Standard finite difference approximations fail to preserve the stability of the original system because they introduce spurious high-frequency eigenvalues, known as the spillover effect. To overcome this difficulty, we use a modified finite difference approach that avoids spillover and provides more accurate approximations of the original system.

Brula, Hosamulhaq, Gurbandurdyev, Begench, Gross, Brayden, Annamuradov, Berdimyrat, "Laser-Produced Gold Nanoparticles for Enhanced Photodynamic Therapy Against Pathogenic Bacteria" (Ali Oguz Er)

Multidrug-resistant (MDR) bacterial infections represent a critical global health threat, responsible for approximately 1.2 million deaths annually. Photodynamic therapy (PDT) has emerged as a promising alternative antimicrobial strategy, utilizing photosensitizing agents to generate cytotoxic reactive oxygen species (ROS) upon light activation. This work investigates a novel PDT system comprising gold nanoparticles (Au NPs) conjugated with the methylene blue (MB) photosensitizer to enhance bactericidal efficacy against Gram-negative *Escherichia coli*. The AuNPs were synthesized using picosecond pulsed laser ablation in liquid (PLAL) at different laser frequencies and powers. The resulting AuNPs were characterized in terms of nanoparticle size, morphology, plasmonic absorbance profiles across the visible spectrum, and ROS generation efficiency to establish the relationship between nanoparticle physicochemical properties and photosensitization activity. Ongoing experiments on singlet oxygen generation with different sizes of AuNPs compared to MB will be presented. This plasmonic sensitization strategy represents a powerful approach to overcoming the limitations of limited, conventional photosensitizers, offering amplified ROS yield and targeted activity against MDR pathogens where traditional antibiotic therapies have failed.

Bush, James, Riggs, Ashyn, Steiner, Madison, "Student Observation of Exercise Prescription Practices by Clinical Instructors during Clinical Rotation" (Anthony Mancini)

Introduction: Clinical education provides physical therapy students opportunities to engage in real-world clinical experiences under supervised learning environments to develop professional competency in clinical decision-making regarding exercise prescription. This study aims to capture DPT students' observations of their clinical instructors on exercise prescription and dosing practices throughout their clinical rotation. Methods: This exploratory, cross-sectional survey will be used to review student physical therapists' observations of their clinical instructors' exercise prescription methods. An anonymous survey will be administered through Qualtrics to students who've completed at least one

clinical rotation. Out of 40,000 PT students across the US, we desire a sample size of at least 370. Once we've gathered responses, the data will be organized, analyzed, presented, and submitted for publication. The independent variables are clinical instructors with different settings, training, and experience. The dependent variable is students' perspectives of exercise prescription. Results: A correlation analysis will be conducted to assess if there is a relationship between exercise prescription and clinical setting, patient volume, and years of experience. Discussion: This study will gather students' observations on their clinical instructor's adherence to exercise parameters compared to guidelines developed by the ACSM.

Butler, Madison, "Drawn Boundaries: Dehumanization and Containment in the U.S." (Robin Valenzuela)
This oral paper explores central themes that appeared during a directed study. The research and discussions focused on the ethnographic and historical study of borders, their functions and meanings with current examples including the U.S.- Mexico Border, the territorial conflict between Israel and Palestine, and the detainment of immigrants within the United States. This paper begins with the history of borders across the world, outlining their original uses and how these uses have changed. I then provide a short history of immigration policy in the United States, focusing on its exclusion of "less desirable" immigrants. I focus on two prevalent themes from my research: the entrapment and containment of immigrants into specific, highly militarized or securitized areas and the dehumanization of these immigrants through these bordering practices. Understanding borders through an ethnographic and historical perspective contextualizes present-day issues and allows us to analyze the unethical treatment of immigrants in the United States including the unprecedented expansion of indefinite mass migration detention.

Byrd, Thorin, "From Plantations to Petrochemicals" (Patricia Kambesis)
The stretch of the Mississippi River between Baton Rouge and New Orleans is widely known as Cancer Alley due to the dense concentration of petrochemical facilities, long-standing concerns about toxic exposures, and persistent environmental health inequities. Building on recent findings of elevated hazardous air pollutants and disproportionate risk for nearby residents—often Black and low-income communities—this study links historical plantation-era land-use patterns to present-day industrial siting and exposure burdens. Using georeferenced 1800s plantation charts, the project reconstructs past property boundaries, transportation corridors, and settlement patterns, then overlays these with contemporary facility footprints, emissions indicators, and demographic measures. The resulting spatial narrative examines how a landscape organized around coerced labor and racialized extraction in the nineteenth century was reworked into a modern industrial corridor, while social vulnerability and environmental burdens remain unevenly distributed. By integrating archival cartography, GIS-based exposure proxies, and environmental justice metrics, the study clarifies historical continuities in land control, infrastructure investment, and risk placement, and provides an evidence base for community-engaged monitoring and policy responses.

Caffey, Tanner, "South B.G. Community Center" (Shahnaz Aly)
Southern Bowling Green is experiencing rapid residential growth, creating a need for spaces that foster connection and wellness. My senior project proposed a community center designed to serve as both a

functional facility and a social gathering place for the expanding community. Rather than simply accommodating programmed activities, the design emphasizes community interaction, inclusivity, and flexibility. The building was conceived as a welcoming space that encourages movement and engagement through intentional circulation, natural light, and open gathering areas. Spaces in the building include recreational areas, multipurpose rooms, and event areas. These spaces were designed to promote accessibility for users of all ages. Through thoughtful spatial planning and a community-centered design, this project explored how architecture can strengthen communities while supporting the needs of a fast-growing population.

Calico, Quincy, Silverthorn, Nico, Magnuson, Haley, Covey, Sav, "The Salamander: Children's Books through a Filmmaking Lens" (Shaina Feldman)

Throughout the making of "The Salamander," filmmaking techniques and production design became a method of exploring the qualities of children's books that have a transcendent impact beyond the boundaries of age. Children's books are a powerful tool for storytelling and guiding children through life into adulthood. Interpreted through this lens, film production serves a similar purpose to adults as children's books by creating a path for viewers to explore moral and cultural life lessons found in a character's journey. The world of "The Salamander," was an opportunity to ask how to bring a pop-up book illustration into a three-dimensional world. The use of craft materials, such as paper, cardboard, and fabric, allowed us to experiment with the size of set pieces, amplifying the natural world of animals through a magnifying glass and creating an illustrative effect. We searched for ways an actor might inhabit this world through their costuming, creating the impression of an animal through color, pattern, texture, and silhouette, while allowing the human connection film provides that goes beyond the page. Film production and design have allowed us to further a children's story format by bringing it to life and broadening the reach of its message to engage all ages.

Calloway III, Paul, Heckler, Jaime, Ratcliff, Camille, Ledwidge, Dr. Patrick, "Neural Correlates of Plantar Flexion Response Preparation: A Mobile EEG Study" (Patrick Ledwidge)

The purpose of this study is to determine the cognitive-motor brain processes used for quick, reactive lower-limb decision making. This may be used in future research to develop a method to prevent anterior cruciate ligament injuries, which occur more frequently after concussion, but have unknown etiology. Sixteen participants completed a standing flanker task while 16-electrode electroencephalography (EEG) was acquired. Participants made plantar flexion responses (heel releases) using two foot pedals. Responses were based on the middle arrow of a visual stimulus, which was pointed to the right or left, congruent or incongruent to flanker arrows, and cued/anticipated (e.g., >>>) or not cued/unanticipated (e.g., XXXXX). When direction was anticipated, response time was delayed when lifting the dominant heel vs. non-dominant. We are processing the EEG using EEGLAB/ERPLAB toolboxes, such as measuring the Lateralized Readiness Potential (LRP) embedded within the EEG, to identify the neural explanation of this response delay. The S-LRP reflects cognitive aspects of movement preparation (i.e., decision-making). The LRP-R reflects motor execution. We will measure the onset of these ERPs (ms). We expect to establish one or more neural biomarkers of cognitive-motor processing during reactive lower-limb responding, which we will leverage in future work to help prevent lower-limbed injuries.

Carden, Mykah, "Polygenetic Karstification in the Mammoth Cave Region" (Patricia Kambesis)

The Mammoth Cave Region is one of the world's most extensively studied karst landscapes, with over 1,000 km of mapped cave passages and potential for further discoveries. Traditionally, all caves in the region are classified as epigenic, formed by top-down dissolution of limestone by meteoric water enriched with soil CO₂. However, emerging evidence suggests that hypogene processes may also have contributed to cave development. Several caves, particularly in the southern part of the region, exhibit extensive gypsum deposits, complex maze morphologies, hydrocarbon seeps, and sulfur-reducing microbial communities. Additionally, sulfurous springs emerging from a monoclinical structure suggest interaction with subsurface hydrocarbon deposits, reinforcing the possibility of bottom-up dissolution driven by hypogene speleogenesis. This study aims to determine whether these hypogenic characteristics indicate incipient hypogene karstification, hypogene overprinting on pre-existing epigenic passages, or both. The findings challenge the prevailing paradigm that karst development follows a strictly homogeneous trajectory with distinct epigenic or hypogene end members. Instead, they suggest a more complex, polygenetic model of cave evolution. Understanding these processes has significant implications for karst hydrology, geochemical cycles, and subsurface resource management, broadening our perspective on the interplay between epigenic and hypogene speleogenesis in large karst systems.

Carver, Ava, Amorim, Cecelia, King, Rodney, "Bacteriophage Diversity and Ubiquity: Comparing and Contrasting Mycobacteriophages Budgie and Opalite" (Rodney King)

Bacteriophages are viruses capable of infecting specific bacterial hosts and they are the most diverse and abundant biological entities in the biosphere. Despite their abundance, there is limited information regarding the extent of genetic variation and relationships between bacteriophages. To address this, we partnered with the Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Sciences (SEA-PHAGES) program to examine bacteriophage diversity. We collected soil samples from Kentucky and enriched for mycobacteriophages using *Mycobacterium smegmatis* as the host. Phages Budgie and Opalite were purified, amplified, and characterized by plaque phenotype, restriction digest profiles, morphology and activity at different temperatures. Both were classified as siphoviridae and displayed turbid plaque phenotypes. Despite similar characteristics, variations in particle size, optimal growth temperature, and plaque phenotypes were noted, highlighting diversity even among phages isolated on the same bacterial host. Our study has contributed important new information to the Actinobacteriophage database. This data also serves as the basis for real-world applications like phage therapy, which provides an alternative approach to battle antibiotic resistance. DNA sequencing of Budgie has been completed, and its genome is currently being annotated. This work will allow detailed genetic analysis of its genome and the establishment of evolutionary relationships with other actinobacteriophages.

Chaduvula, Nishita, Dines, Grace, "Determining Most Applicable Variable for Moisture Climatology Situations" (Jerald Brotzge)

The goal of this research is to document a climatology of moisture variability across Kentucky. Atmospheric moisture variables are important in a variety of applications, including human health and agricultural monitoring. Both relative humidity and dewpoint are considered. Dewpoint is the temperature at which condensation occurs. Relative humidity is the percentage of water vapor in the air

relative to the maximum it can hold at a given temperature. Daily and five-minute interval data for both dewpoint and relative humidity were obtained from the Kentucky Mesonet over a 15-year period, 2010-2025. The Kentucky Mesonet, a division of the Kentucky Climate Center, collects data from a network of 86 weather stations across the state. These data was analyzed and visualized using Python. The analysis evaluated how the two variables varied by season, location, and climate divisions. Both variables were then compared to one another to determine which would be more suitable for different applications. Monthly and seasonal variability will be highlighted in the presentation.

Chang, Eaden, Sandifer, Kathryb, King, Rodney, "Exploring Diversity: Comparison of Novel Bacteriophages PogoBogo and Asterisk" (Rodney King)

Bacteriophages are viruses that infect bacteria, and they are being developed as an alternative therapeutic to fight antibiotic resistance pathogens. Our goal was to isolate, characterize, and compare bacteriophages from the environment to further explore the largest reservoir of untapped genetic information on the planet. In this study, two mycobacteriophages, PogoBogo and Asterisk, were isolated from distinct soil samples using the non-pathogenic host *Mycobacterium smegmatis*. The phages were purified through a series of plaque assays and examined using electron microscopy to determine morphologies. Genomic DNA was isolated from each phage and subjected to restriction enzyme digestion and gel electrophoresis. Our results show that Asterisk and PogoBogo are distinct bacteriophages despite being isolated using the same methods and host. Electron microscopy revealed that both phages exhibit Siphoviridae morphology but differences in plaque morphology, restriction digest patterns, and average capsid diameter/tail length indicate they are unique. Our results have expanded our understanding of bacteriophage diversity and evolution. Future plans include comparing the genomic DNA sequence of PogoBogo and Asterisk. This analysis will provide insight into evolutionary relationships and may identify individual genes with potential therapeutic applications.

Cechi Giraldi, Gabrielly, Trudelle, Clarie, Khouryieh, John, Silva, Luiz, "Effects of Aging Period and Phosphate Inclusion on Emulsified Sausage Physical Properties" (Luiz Silva)

The effects of aging on fresh meat quality have been extensively studied; however, its influence on meat products remains poorly understood. This study investigated the effect of aging period and phosphate addition on the technological quality of emulsified sausages produced from the Supraspinatus muscle. Muscles from four carcasses were subjected to three aging periods (2, 7, and 14 days) and emulsions were prepared with or without phosphate (0.5%) in a 3 × 2 factorial arrangement. Emulsion pH and instrumental color were unaffected by aging, phosphate, or their interaction ($P > 0.05$). A significant aging x phosphate interaction was detected for water activity ($P = 0.02$), where phosphate reduced water activity at 7 and 14 days but not at 2 days of aging. Interaction was also observed for water loss during cooking ($P = 0.01$); extended aging reduced water loss in phosphate-free emulsions but increased it in phosphate-containing formulations. Aging did not affect the texture profile ($P > 0.05$); however, phosphate inclusion increased firmness and cohesiveness ($P < 0.05$). These findings suggest that the technological effects of phosphate addition on emulsified sausage properties are dependent on the aging period of the raw material

Chen, Leah, "Bioinspired Co₂ Capture: Mimicking Carbonic Anhydrase with a Zn(ii) Histidine Metal Organic Framework" (Bangbo Yan)

Demand for energy to power industrial processes continues to increase in modern society, leading to increased carbon dioxide emissions into the atmosphere as a byproduct of burning fossil fuels and subsequent climate change phenomena. The enzyme carbonic anhydrase (CA) has an incredibly high catalytic efficiency in the conversion of carbon dioxide into bicarbonate, giving it potential as an environmentally friendly material for carbon dioxide capture. However, its sensitivity to pH and high temperatures prevents practical applications. This study features the synthesis and characterization of a novel metal-organic framework (MOF)-[Zn(HIS)] (HIS = histidine) to mimic the catalytic functions of CA. The crystal structure of the MOF was determined with single crystal x-ray diffraction, yielding two types of Zn(II) coordination geometries. One is tetrahedral 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. The stability of the MOF in basic solutions was tested using powder x-ray diffraction to compare the structural integrity of compound before and after soaking in solution. The biomimetic ability was analyzed through the rate of the paranitrophenylacetate model reaction with the MOF being used as the catalyst.

Clark, Gray, "Equal Tests, Different Results: Is There a Difference Between the Air Force's Standard and Alternative Protocol to Fitness Testing?" (Whitley Stone)

BACKGROUND: The United States Air Force Fitness Assessment is a measure of aerobic fitness, muscular strength, and muscular endurance. These measurements are calculated from a maximal effort 1.5-mile run, push-ups in a minute, and sit-ups in a minute. On January 1, 2022, the Air Force introduced alternative testing options as an opportunity to opt out of the standard tests. Previous research on the Navy's standard protocol (like the Air Force) and the alternative protocol concluded the alternative protocol yielded higher pass rates with lower perceived effort. The purpose of this study is to evaluate how the alternative components of the Air Force Fitness Assessment influence performance and scoring compared to the standard tests. **METHODS:** I plan to recruit 20 college-aged individuals to complete this quasi-experimental design. Participants will first complete either (a) the standard test battery or (b) alternative test battery (beep test, hand release pushups, and plank hold for time). On a separate day, they will return to complete the remaining test battery, ensuring all participants experience both conditions. The purpose of this investigation is to determine if pass rates differ between standard and alternative test batteries. **ANTICIPATED RESULTS:** It is expected that the alternative test battery will yield higher pass rates than the standard protocol due to lower physical demands.

Clark, Jenna, Shea, Ava, "Myths and Misconceptions? What People Really Think about the Insanity Defense" (Christopher Peters)

Not Guilty by Reason of Insanity (NGRI) is an excuse defense wherein the defendant claims that they cannot be held responsible for their actions due to a severe mental illness or defect at the time of a crime. Research has revealed a number of misconceptions and false assumptions about the insanity defense which have caused prejudice towards defendants who attempt to utilize the defense. The most notable myths are outlined by Perlin's research (1994, 1995, 2002) in which nine key myths are identified that shape the public misconceptions of the insanity defense. The goal of the study is to attempt to

replicate Perlin's myths in a spontaneous open-ended format.

Clark, Natalie, "Computational Evaluations of Functions" (Dominic Lanphier)

In modern calculators today, computational systems can rapidly evaluate complex algebraic and trigonometric functions. While we use these functions to help us solve everyday mathematical equations, we don't often stop to think about how these answers are being computed. These internal algorithms are typically proprietary and unknown, as calculator companies keep these optimized methods as trade secrets. This research project explores how classical mathematical approximation methods can be used to quickly analyze and replicate these evaluations. Specifically, I focused on quickly estimating algebraic functions such as e^x , $\ln(x)$, x^y , factorials, and Gamma functions, along with trigonometric functions including sine, cosine, tangent, and their inverses. Through using Taylor and Maclaurin expansions, Stirling's approximation, recurrence relations, and numerical integration techniques such as Simpson's Rule, I have constructed rapid and efficient approximation models and evaluated their computational complexity and accuracy. These results not only show that classic approximation methods can be performed to produce highly accurate estimates but also display how increased accuracy often requires greater computational efforts.

Clements, Lexi, "Maternal Stress and Sleep Quality Across Pregnancy and Postpartum" (Rachel Tinius)

Introduction: Maternal sleep and maternal stress play a critical role in maternal and neonatal health outcomes. The purpose of the study is to explore the maternal stress and maternal sleep levels throughout pregnancy and postpartum, and how they relate to each other. Methods: Stress and sleep scores were assessed via REDCap surveys at 5 different timepoints (early, mid, and late pregnancy, and 6 and 12 weeks postpartum) (n=69). The Perceived Stress Scale was used to measure stress, and the Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep quality. Results: Stress levels changed significantly over time (p14 is considered moderate stress. Sleep scores also changed significantly over time (p5, which indicates overall poor sleep quality for women throughout pregnancy and postpartum. Sleep scores and stress scores were significantly correlated ($R= 0.572$, $p=0.032$). Conclusion: Sleep quality is low and stress levels are high throughout pregnancy and postpartum. There is a direct correlation between quality of sleep and stress levels.

Clemons, Hunter, "Optimizing Learning in a Rural Community Through Steam-inspired Architecture" (Shahnaz Aly)

The Legacy STEAM Center was born from the desire to build a center for modern technological and extra-curricular activity to a rural area of Kentucky. It aimed to house the local community with a way to gain knowledge beyond the traditional and standardized educational systems in place throughout the country. One of the key factors in optimizing learning is known to be the environment in which it takes place. To achieve its purpose, the Legacy STEAM Center blended the industrial connotations of the STEAM acronym and natural elements to stimulate an engaging environment. This project served as a study to analyze how a learning center can go beyond the 4 walls of a classroom and serve patrons socially and educationally. The building featured social spaces, classrooms, computer labs, workshops, a library, and galleries to display the work of the patrons of the center. This space holds unique spaces for children, young adults, and even the elderly community. Patrons with varying interests all have a space to take

their hobbies and interests to the next level. Henceforth, the Legacy STEAM Center brought together all types of people to engage in science, technology, engineering, arts, and mathematics.

Coleman, Hannah, "Patterns of Association Between Parasites and Bats From Madagascar" (Carl Dick)
Patterns of association between parasites and bats from Madagascar (Poster) Parasitism is a common life strategy used by up to 50% of species. Bats host a diverse array of ectoparasites, including flies of the family Nycteribiidae. Bat flies possess many adaptations to life on their hosts. Madagascar is a global biodiversity hotspot with many endemic species. Our research uses 6 years of data from bat flies sampled from bats in Madagascar. More than 5,000 bats of 46 species were captured and examined for parasites yielding 4,523 bat flies from 900 hosts. We focused on the 4 most abundant bat species to explore patterns in parasite associations. Mean intensity of infestation ranged between 1.4 and 5.3 flies per host. We found relatively high host specificity in most fly species, with some interesting exceptions. We also found consistent pairings of parasite species on certain hosts, wherein co-occurring fly species exhibited differing morphology. Finally, we found no preference for host sex, and no consistent differences in fly sex ratios. Our results on host specificity and species pairings are consistent with studies of bat flies from other parts of the world and suggest mechanisms may exist to facilitate coexistence of parasite species.

Colovos, Christina, "Human Exceptionalism in the Bible and Richard Powers' The Overstory" (Wes Berry)
Human exceptionalism is foundational to Christianity and biblical thought, as found in theological concepts such as imago dei (image of God), which establishes humanity as uniquely dignified within creation. Hierarchical models such as the Tree of Knowledge system support this idea by placing humans above animals and nature. This paper examines the tension between imago dei and ecological thought in Richard Powers' 2018 novel *The Overstory*. Powers challenges biblical foundations of human exceptionalism by crafting an ecocentric narrative that grants nonhuman entities, particularly trees, animacy. Through an analysis of the novel's arboreal and animistic lens, this project demonstrates how Powers relocates authority from humans to the nonhuman. I argue that Powers simultaneously critiques and reframes human exceptionalism, offering a contemporary ecological vision that complicates traditional interpretations of humanity's place within creation.

Condella, Drew, "AI In The English Classroom: Toward a Language of Trust" (Gillian Knoll)
As an undergraduate in WKU's English department, I became aware of a concerning silence: students having hushed conversations about AI among themselves while their instructors stayed mostly silent on the subject beyond boilerplate syllabus policies. Both groups have confided feelings of being alone and unequipped to bridge the divide. A literature review found existing scholarship on student-teacher communication points toward collaborative, dialogic approaches as the most promising path toward critical student/teacher dialogues about AI, yet mutual trust (Felten, Forsyth & Sutherland) widely identified as foundational to meaningful classroom interaction, has gone largely unexamined in humanities contexts. Using a mixed methods approach (departmental survey and open interview formats), this small-scale, FUSE-funded study proposes "trust" as a lens through which we might better understand where and why conversations involving AI between English students and teachers aren't happening, and what conditions would allow these conversations to happen more openly. With a better

understanding of where barriers to trust-supported dialogues about AI exist between students and professors, recommendations can be made for WKU and similar institutions to ensure more effective, equitable AI policies, interventions, and communication techniques in rapidly shifting English education environments.

Cooley, Shelby, "Gender Identity in Dance" (Meghen McKinley)

"Gender Identity in Dance" is a short-form documentary that follows three gender non-conforming dancers in both academic and professional settings. Each dancer discusses their personal approach to gender expression within their artistic ventures and how social gender constructs have influenced their experiences within the world of dance. The purpose of this documentary is to provide representation for various gender non-conforming dancers, and to advocate for further acceptance for non-binary artists within the field. Discussing the hardships and successes that come alongside dedication to a traditionally Euro-centric, binary artform provides an outlet for further discussion upon queer identity. This mini-documentary showcases the passion and drive that queer creatives must utilize to endure within the world of dance.

Cortes-Sheroan, Keira, Tassell, Janet, Scannell, Piper, "Revisiting the 2016-2017 Math Mindfulness Seminar Series Participants: What has changed now that it is 2025?" (Janet Tassell)

This longitudinal study revisits eight of the original participants of a Math Mindfulness Seminar Series—conducted during the 2016-2017 academic year—examining its' lasting impact on pre-service elementary school teachers (PSETs) who have since transitioned to in-service teacher roles (ISETs). The original study revealed the interconnectedness of four variables (mindfulness, mathematics anxiety, self-efficacy, and mindset) within PSETs. Nearly a decade later, Math Mindfulness Interviews were conducted to determine how participants have since retained, applied, and considered the seminar content within their classroom practices as ISETs. Through thematic analysis of the interview transcriptions, three main themes were identified: Presence of Anxiety, Growth Mindset, and Teacher Growth. In exploring these themes and their associated subthemes, we have found that our research is guided by Social Cognitive Theory. The results of this study suggest that early implementation of professional development goes beyond initial intervention, contributing to a firm yet adaptable repertoire of classroom practices relative to mindfulness, anxiety awareness, and growth-oriented mathematics instruction. The findings reinforce outcomes observed by the original study and inform a revised conceptual framework: the Teacher Transition Hourglass. This research indicates that, given changing contexts and evolving factors, teacher learning is a cyclical process of reinforced practices.

Cowan, Audrey, Day, Martha, "Competition-associated Changes in Temporomandibular Joint Sensitivity in Western Performance Horses" (Dr. Debra Shoulders)

The assessment of temporomandibular joint (TMJ) sensitivity in show horses was conducted using the WKU TMJ Scale to evaluate the effects of show-related environmental stress on TMJ function. Sixteen horses were evaluated at multiple time points before, during, and after a competitive show to quantify changes associated with competition and recovery. Baseline TMJ scores were recorded prior to the show, with additional assessments performed throughout the competition period and during post-show recovery. This repeated-measures design allowed for direct comparison of TMJ scores across pre-show,

in-show, and post-show conditions. Results demonstrated significant variation in TMJ scores over the study period, indicating that the competitive show environment and associated stressors have a measurable impact on equine TMJ sensitivity. These findings support the use of standardized TMJ scoring as a practical tool for monitoring stress-related changes in performance horses and for informing future clinical and research applications.

Crisp, Lydia, Rich, Timothy, "South Korean Perceptions on Reunification with North Korea"

(Timothy Rich)

To what extent do economic considerations depress support for unification in South Korea? Survey data consistently shows a public supportive of unification, but research rarely captures to what extent the public considers the costs associated with this outcome, nor whether, when given the choice, whether they consider peaceful coexistence as an acceptable alternative, especially as South Koreans increasingly view North Koreans as not part of the same nation. Using an experiment embedded in a national survey, we find that not only does priming respondents to think of costs depress unification support, but surprisingly it also depresses support of peaceful coexistence. These patterns endure even when controlling for broader views of identity, contact, and beliefs about North Korea. The results suggest the extent in which views on the future of the Korean peninsula may remain malleable.

Cruz, George, "First Responder Wellness" (Dana Sullivan)

First responders operate in high-stress, performance-driven environments where repeated trauma exposure, organizational strain, and cultural stigma significantly affect mental health. This study examines the relationship between occupational stress, perceived organizational support, mental health stigma, and barriers to care among full-time first responders in the United States and seeks to identify patterns in burnout, secondary traumatic stress, compassion fatigue, and help-seeking hesitancy. Using a cross-sectional survey design administered through Qualtrics, first responders completed validated instruments measuring professional quality of life, perceived organizational support, and attitudes toward mental health treatment. More than 100 participants completed the survey. Of those, 95% worked full-time and almost half were ages 25-34. Forty-one percent of respondents indicated that their sleep schedule is impacted by their work shifts. The results showed that the majority of participants were satisfied with their jobs, had mental health services available through work, but 46% said they were not comfortable seeking help when needed. The results of this research will inform system-level interventions that move beyond individual resilience and toward organizational accountability. It will point to necessary but often avoided conversations surrounding stigma, leadership culture, access to care, and expectations that responders should simply "handle it." By centering lived experiences, this project advances dialogue on workforce sustainability, mental health access, and cultural change within emergency services.

Daniels, Denver, "Forever Forward Foundation" (Shahnaz Aly)

The Forever Forward Foundation is a transitional housing initiative designed to reintegrate unhoused individuals into stable, middle-class lifestyles through structured, time-bound support. The program focuses on individualized casework with goals of employment placement, sobriety milestones, and improved mental health. The facility integrates essential amenities—including dining, daycare, on-site

medical services, a fitness space, and flexible assembly rooms—to reduce barriers to daily stability and community participation. Residential units draw inspiration from Housing & Urban Development (HUD) low-income models, offering minimal rent for initial occupants and maintaining below-market rates as residents progress financially. Stays are standardized to three months, emphasizing rapid stabilization and forward momentum. Housing typologies include single-occupancy rooms, shared units, and family suites, with ADA-compliant options throughout. Each floor also contains one small fraternity dormitory to encourage peer support and socialization. The project positions itself as an active agent in social and financial mobility, using spatial dignity, accessible services, and structured programming to create a pathway from crisis to independence.

Darling, Abigail, Vogler, Kennedy, Duvall, Grayson, "Characterization of Ctc1 Overexpression in Stn1 Knockout Cells" (Jason Stewart)

Telomeres are repetitive DNA sequences at the ends of chromosomes that protect the ends from being detected as a double strand break. The CST (CTC1-STN1-TEN1) protein complex is a single-stranded DNA-binding protein essential for telomere replication and genome stability. It protects single-stranded telomeric DNA from degradation and regulates telomere extension. In this study, we used STN1 knockout (KO) cells, in which the STN1 gene is inactivated, to understand STN1 function. STN1 KO causes proliferation defects: G2-phase arrest, and telomere dysfunction. Previous work found that STN1 stabilizes CTC1 by protecting it from degradation and bridges the interactions between CTC1 and TEN1. Accordingly, we sought to determine whether the decreased CTC1 expression was responsible for the STN1 KO phenotypes. We hypothesized that stabilization of CTC1 by STN1 was not solely responsible for the observed phenotypes. To test our hypothesis, CTC1 was overexpressed in the STN1 KO cells. We found that overexpression of CTC1 did not rescue telomere dysfunction, cell proliferation, or the G2-phase arrested cells in the STN1 KO cells. Therefore, these phenotypes are not caused by STN1's ability to stabilize CTC1.

Deo, Amanda, Marquardt, Joseph, "Investigating the Role of Lte1 and Kin4 in Yeast Cell Division and Morphology" (Joseph Marquardt)

Cell shape is a highly conserved process mediated by many genes, which when disrupted can lead to cellular diseases such as cancer and neurodegenerative disorders. In the budding yeast *Saccharomyces cerevisiae*, exit from mitosis is promoted by the mitotic exit network (MEN) which is further regulated by the spindle position checkpoint (SPOC) signaling pathway. During anaphase Kin4 and Lte1 localize to the mother and bud cell cortexes, respectively. Kin4 is a kinase that inhibits MEN, preventing cell division until the mitotic spindle is properly aligned. This inhibition is mediated by Lte1 which suppresses Kin4 until the spindle has entered the growing bud; ensuring the proper transfer of genetic information. In this study, classical yeast genetics, growth assays, and fluorescent microscopy were conducted to observe the interaction of Lte1, Kin4, and the cell shape kinase Elm1 in the MEN of *S. cerevisiae*. Our data suggests a negative genetic interaction between Elm1 and Lte1 and that Lte1 coordinates with Elm1 to regulate the septin cytoskeleton at the site of cell division. Overall, this data will shed light on the highly conserved regulatory methods of eukaryotic mitosis and help elucidate the causes of cellular diseases.

Dickerson, Dalton, "Examining the Interpersonal Context of Betrayal-Related Trauma" (Matthew Woodward)

Betrayal trauma, perpetration of trauma by a close other, may lead to maladaptive interpersonal responses such as decreased trust and increased anxious or avoidant attachment. However, many questions remain surrounding the interpersonal consequences of betrayal trauma. This study examined the role trust and insecure attachment play in the relationship between betrayal trauma and PTSD. Simple mediation analysis indicated that trust mediated the relationship between betrayal trauma and PTSD. Specifically, high betrayal was negatively associated with trust ($R^2 = 0.04$, $F(2,343) = 7.81$, $p < .001$). Furthermore, trust was negatively associated with PTSD symptomology ($R^2 = 0.16$, $F(3,342) = 22.42$, $p < .001$). The indirect effect of betrayal on PTSD through trust was significant (Indirect = 1.25, 95% CI [0.20, 2.61]). Parallel mediation with anxious and avoidant attachment indicated that only avoidant attachment mediated the relationship between betrayal and PTSD. Specifically, betrayal was positively associated with avoidant attachment ($R^2 = 0.07$, $F(2,343) = 13.67$, $p < .001$) and avoidant attachment was positively associated with PTSD ($R^2 = 0.33$, $F(4,341) = 42.79$, $p < .001$). Findings indicate betrayal trauma is associated with an array of negative interpersonal responses, which in turn affect PTSD.

Dim, Cing, "Energy Delay Product Analysis of CPU-GPU Synchronization in Deep Learning Pipelines" (Qi Li)

Modern deep learning training relies heavily on GPUs for high-throughput computation. However, GPU performance can be significantly limited by the CPU side of the pipeline, particularly during data loading and preprocessing. When data preparation on the CPU cannot keep pace with GPU computation, the GPU may remain idle, leading to reduced throughput and unnecessary energy consumption. This study investigates how CPU-GPU synchronization affects the performance and energy efficiency of deep learning pipelines. In particular, we examine how the level of parallelism in CPU-based data loading influences GPU utilization and overall system efficiency. Inefficient coordination between CPU data preparation and GPU computation can introduce pipeline stalls, reduce throughput, and increase energy usage. To evaluate these effects, we conduct experiments using the ResNet-50 convolutional neural network trained on the Animals-10 dataset. The experiments evaluate four DataLoader worker configurations—2, 4, 8, and 16 workers—to study how varying degrees of data loading parallelism affect pipeline behavior. These configurations are tested across four different GPU environments on Google Colab to examine the influence of hardware variability on system performance. Performance is evaluated using execution time, GPU energy consumption, and the Energy Delay Product (EDP), which combines runtime and energy usage into a single efficiency metric. The goal of this study is to identify how DataLoader parallelism impacts GPU utilization and pipeline efficiency, and to determine worker configurations that improve throughput while reducing the energy cost of deep learning workloads.

Dover, Peyton, "Examining the Effectiveness of Multiple Independent Lineup Technique (MILT) in Adults" (Amber Giacona)

Eyewitness testimonies act as key pieces of evidence in over a quarter of criminal investigations (Innocence Project, 2025). This project seeks to determine whether the use of the multiple independent lineup technique (MILT) is more effective at reviving eyewitness memory than traditional lineups currently used in the justice system, as their narrow focus solely on facial recognition leaves substantial room for

error (Wixted & Wells, 2017). This is an understudied area of forensic psychology, and a main focus of previous research has been conducted on child eyewitnesses (Carr, 2025). In our study, each participant watched a fictitious crime video portraying a robbery with the presence of a weapon. Participants were asked to choose the suspect's shirt, pants, weapon, voice, and face within lineups. After each lineup was presented, the participants were asked how confident they were in their decision on a 0-100% scale. Results thus far show that our face lineup accuracy is 84.5% overall, indicating a high level of facial recognition. More participants are needed to have enough power to draw conclusions; still, our results shed light on the understudied topic and pose questions for future research.

Ducker, Jenna, "A Predictive Analysis of Bank Marketing Campaigns" (Lily Popova Zhuhadar)

This project uses the Bank Marketing Data Set to analyze the effectiveness of direct marketing campaigns conducted by a Portuguese banking institution. The primary goal is to predict whether a client will subscribe to a term deposit—captured by the target variable y (Yes/No)—and to identify the campaign, client, and macroeconomic factors most strongly associated with successful conversions. The dataset includes three categories of predictors: (1) client demographics and banking profile, (2) campaign contact attributes (e.g., communication type, timing, and frequency), and (3) social and economic context variables that describe market conditions during the campaign period. To address this problem, the outcome variable will be encoded as a binary class (1 = subscribed, 0 = not subscribed), and multiple supervised machine learning classification models will be developed and compared, including Logistic Regression, Random Forest, and Gradient Boosting. Model performance will be evaluated using confusion matrices, accuracy, precision, recall, ROC curves, and lift charts to assess both predictive quality and practical targeting value. The resulting model is expected to support more efficient campaign design by helping the bank prioritize high-probability clients, reduce wasted outreach, and improve return on marketing investment while strengthening customer acquisition and retention strategies.

Dudley, Samantha, Li, Lei, Sy, Simon, "Synthetic methodology studies on substituted indoles: Applications of C-H activation in bioactive molecules preparation" (Lei Li)

Substituted indoles are one of the most abundant heterocyclic compounds in nature, and it comes over 45,000 hits when searching for substituted indoles with biological activity from the Beilstein database. In countless biologically active natural products, pharmaceuticals, agrochemicals, and functional materials, substituted indoles have found widespread availability. Because of that, substituted indoles are termed "privileged motifs" in the field of medicinal chemistry. The importance of substituted indoles and their broad spectrum of applications justify their call as "The lord of the Rings" among aromatic compounds. Quite a few multistep classical methods have been employed for the synthesis and functionalization of indoles. To expand the synthesis of substituted indoles, two new synthetic methodologies were studied in this project. With C-H activation as the key step, the designed synthetic approaches have been evaluated in terms of starting materials and various catalyst ligands. With the reaction conditions screened, a few of them proved to be promising for producing the desired products, while the reaction yield still has enough room for further improvement. Future work will focus on expanding the scope of starting materials in a further step and assessing additional catalysts for the designed synthetic approaches.

Duggins, Chase, "The Bluegrass Commons Community Center" (Shahnaz Aly)

The Bluegrass Commons is a community center designed for Bowling Green, Kentucky, with the goal of bringing people together through learning, recreation, and shared public space. As Bowling Green continues to grow, there is an increasing need for places that support both social connection and community wellness. This project explores how architecture can respond to that need by creating a welcoming, flexible space for people of all ages. The design includes areas for indoor recreation, educational areas, community events, and informal gathering. Spaces are arranged to encourage movement and interaction, helping users feel connected to both the building and each other. Outdoor areas are also included to strengthen the relationship between the center and its surrounding environment, allowing activities to extend beyond the building itself. The Bluegrass Commons is designed to reflect the values and identity of Bowling Green by serving as a shared place where education, play, and community life come together. Through thoughtful planning and human-centered design, this project demonstrates how a community center can grow alongside the city it serves, supporting learning, health, and recreation as Bowling Green continues to develop.

Edwards, Brennan, Potts, Lincoln, Salada, Benjamin, Novikov, Ivan, "Development And Characterization of BaF2 Gamma Detector for BaFFLD Array" (Ivan Novikov)

Gamma-ray angular correlation measurements give critical nuclear structure information needed to interpret T-violation searches in resonance neutron reactions. Identifying individual cascade events in background radiation requires fast-timing scintillator detectors with sub-nanosecond time resolution. Barium fluoride scintillators are ideally suited for this application due to their fast-timing UV emission at 220 nm, enabling precise coincidence measurements. However, conventional photomultiplier tubes cannot detect this UV component directly—it must be wavelength-shifted to visible light using tetraphenyl butadiene (TPB) coatings. TPB coating quality and uniformity directly impact detector performance, making coating optimization critical for the BaFFLD array. We present TPB coating optimization studies for BaF2 detectors. Three techniques—spin coating, submersion, and pipette application—were evaluated on glass slides and characterized for uniformity and thickness using a SEM, with wavelength-shifting efficiency quantified via fluorescence spectroscopy under 220 nm excitation. Preliminary results show pipette application achieves sufficient thickness in single applications, while spin coating requires multiple applications but provides superior uniformity. In addition, we have begun applying TPB directly to photomultiplier tube glass. Ongoing work focuses on characterizing these PMT-glass coatings using a UV light source to assess wavelength-shifting performance across techniques. We discuss coating optimization and implications for assembling detector modules for the BaFFLD array.

Edwards, Ethan, "Loan Approval Classification" (Lily Popova Zhuhadar)

In the banking industry, mitigating financial risk during loan approval is essential to reducing defaults and protecting profitability. Using the Loan Approval Classification dataset from Kaggle, this project will predict whether a loan application is approved based on applicant and loan characteristics. Key predictor variables include income, education, loan amount, and related factors. The target variable, `loan_status`, is binary with values 0 = rejected and 1 = approved, making this a binary classification problem. To build and compare predictive performance, we will develop multiple classification models, including Logistic Regression, Random Forest, and Gradient Boosting. Models will be evaluated using

confusion matrices, accuracy, precision, recall, ROC curves, and lift charts, with a primary emphasis on minimizing false positives (approving loans that are likely to default). By identifying the most influential factors driving approval decisions, this analysis supports more responsible and consistent lending strategies. The expected outcome is improved credit risk assessment, fewer high-risk approvals, reduced default rates, and stronger long-term financial performance for lending institutions.

Ekrikpo, Inyeneabasi, Kircher, Madison, "Analysis of the Role of Shelterin in Telomere Protection in Cst-deleted Cells" (Jason Stewart)

Telomeres are repetitive DNA-protein sequences that function to protect the ends of linear chromosomes. The telomeres consist of a double-stranded region as well as a single-stranded region that is characterized by a repeat of nucleotides that form a guanine-rich 3'-overhang (G-overhang). In addition, telomeres associate with a variety of proteins including the heterotrimeric protein, CST, and the six-subunit protein called shelterin. These proteins assist in the protection of telomeres through the formation of t-loops and the inhibition of DNA repair processes, which prevents chromosome fusion and genome instability. Our previous results demonstrated that deletion of CST subunits, STN1 and CTC1, elicited an extension of the G-overhang, and DNA damage signaling through the binding of RPA to the overhang. However, we did not observe chromosome fusion in the cells. In this study, we sought to assess if shelterin is still associated with RPA-bound telomeres. To test this, we analyzed the co-localization of the shelterin subunits, TPP1, TRF2, or POT1 with RPA by fluorescence microscopy. Preliminary results indicate that only a fraction of RPA-bound telomeres have shelterin present following CST-deletion. These factors suggest that additional factors may localize to telomeres following RPA binding, to prevent unwanted DNA repair.

Elmer, Keelin, "Predict Conversion in Digital Marketing" (Lily Popova Zhuhadar)

Digital marketing is a primary channel through which organizations attract, engage, and convert potential customers, yet limited marketing budgets require firms to allocate resources efficiently. This project develops a predictive analytics model to estimate whether an individual customer will convert in response to a digital marketing campaign, enabling data-driven targeting and campaign optimization. The dataset includes customer demographic information, marketing-specific variables, engagement behaviors, and historical purchase indicators. The target variable is binary (1 = converted, 0 = not converted). Following data preparation (handling missing values, encoding categorical variables, scaling features, and addressing potential class imbalance) multiple supervised classification models are trained and compared, including Logistic Regression, Random Forest, and Gradient Boosting. Model performance is evaluated using accuracy, precision, recall, F1-score, ROC-AUC, and confusion matrices. Lift charts and decile-based gains analysis are also employed to assess marketing effectiveness by measuring the model's ability to identify high-probability converters relative to random targeting. The final deliverable includes an interpretable summary of key drivers of conversion and a recommended model that balances predictive performance with business usability. By improving conversion prediction, organizations can enhance targeting strategies, reduce wasted advertising spend, and increase return on marketing investment.

ENEM, IFECHUKWU, Maddox, Jeremy, "Computational Evaluation of a Proposed Menadione–ascorbic Acid Polymerization Mechanism" (Jeremy Maddox)

Computational evaluation of reaction mechanisms provides an effective strategy for assessing synthetic feasibility prior to experimental implementation. This study examines a proposed polymerization mechanism between menadione (vitamin K₃), a redox-active naphthoquinone, and ascorbic acid (vitamin C) to determine whether the transformation can thermodynamically support structural propagation. All reactants, intermediates, and products involved in the proposed pathway are being systematically constructed and optimized computationally. Geometry optimizations are performed to obtain stable structures, followed by vibrational frequency analyses to confirm true minima and obtain thermochemical corrections. Gibbs free energy (ΔG) differences between reactants and products for each mechanistic step are being determined to evaluate reaction favorability and identify potential energetic barriers within the pathway. Semi-empirical calculations are currently employed to efficiently map the full reaction sequence, while higher-level density functional theory (DFT) methods are planned to refine and validate the energetic profile. Establishing the thermodynamic landscape of the mechanism will clarify whether the proposed transformation is feasible and provide a computational foundation for guiding future experimental synthesis.

Faizi, Humaira, "Airline Delay Prediction Using Scheduling Data" (Lily Popova Zhuhadar)

Flight delays disrupt airline operations, increase costs, and negatively impact passenger satisfaction. Because airlines and airports often need decisions before a flight departs, there is strong practical value in predictive tools that rely only on information available at scheduling time. This project develops a classification-based predictive model to estimate whether a flight will be delayed (Class: 1 = delayed, 0 = on time) using the Airlines Delay Dataset (539,383 flights, 8 variables). The dataset includes only pre-departure predictors: Flight (ID), Time (scheduled departure in minutes), Length (scheduled duration), Airline, AirportFrom, AirportTo, DayOfWeek, and the binary outcome Class. The workflow will follow a standard analytics pipeline: data inspection and cleaning, encoding categorical variables, scaling numeric variables when needed, and splitting the data into training and test sets. Multiple classification models will be trained and compared, including Logistic Regression, Decision Trees, Random Forest, and Gradient Boosting. Performance will be evaluated using confusion matrices, precision, recall, F1-score, and ROC-AUC, with additional attention to operationally meaningful tradeoffs. Preliminary exploration suggests that later-day departures and flights scheduled on Fridays are associated with higher delay probability. The final model will provide a schedule-only delay risk score that can support proactive gate and passenger communication, and early rebooking decisions and the consistency of published flight schedules.

Fitzgerald, Lori, Mansour, Osama, "A Multi-Zone Analysis of Residential Radon Dynamics in a Single-Family Home in Kentucky" (Osama Mansour)

Radon accumulation in homes is a dynamic process driven by environmental factors and building characteristics. This study characterizes the radon profiles of four distinct zones within a single-family residence to better understand their interrelationships. Continuous hourly monitoring was conducted for 100 days in a detached Kentucky home, collecting simultaneous data from the indoor living area, crawlspace, unconditioned attic, and outdoor air. Using descriptive statistical analysis, including mean

concentrations and standard deviations, this research establishes the baseline radon behavior for each zone under closed-house conditions. The study compares the temporal trends and variability of radon levels in the peripheral zones (attic and crawlspace) against those in the primary living space. By examining these distributions, the research highlights the complex nature of radon transport, revealing that indoor concentrations are part of a connected whole-building system rather than an isolated phenomenon. These findings demonstrate the value of multi-zone monitoring for accurately assessing residential radon dynamics.

Forrest, Hanna, Milam, Lily, Teeters, Jenni, "Utilization of Stress Management Techniques in a Digital Health Intervention" (Matthew Woodward)

Previous literature has shown a heightened risk for anxiety, depression, and stress among young adults, particularly individuals with interpersonal trauma, which increases risk for substance use (Brown et al., 2009). Adaptive stress regulation techniques may help alleviate these outcomes. The purpose of the present study was to describe preferences and utilization of stress management strategies offered to participants within a digital health intervention. Participants included 55 young adult heavy drinkers from a midwestern university with a lifetime history of interpersonal trauma (M age= 19.6; 83% Female, 17% Male; 75% White). On a monthly basis over six months, participants texted with a peer coach where they were asked to select one preferred stress management technique presented and to set personalized goals regarding how frequently they wanted to practice it over the upcoming month. Analysis of these exchanges showed that the tool chosen most frequently was physical exercise (selected in 43% of all exchanges). In 70% of the exchanges, participants reported successfully meeting their personalized goals regarding practice of the tools. Results indicate that physical exercise is a popular and successful stress management tool, and that peer coaching may help facilitate their implementation.

Freeman, Dylan, Polly, Silvio, Schafer, Mark, "Effects of the Universal Wellness Six-week Bingocize® Intervention on Functional Performance and Fall Risk in Older Adults" (Silvio Polly)

Falls are a leading cause of injury and loss of independence among older adults. Exercise interventions are shown to reduce fall risk; however, adherence to traditional programs remains a barrier. Bingocize® is an intervention integrating structured exercise and health education into the game of bingo. Prior research has demonstrated functional improvements using a 10-week Bingocize® format. This study examined the effects of a 6-week Bingocize® Universal Wellness intervention on fall-related physical outcomes in older adults. Ten (n=10) (1 male, 9 female) met attendance criteria and completed post-testing. Outcomes included the Timed Up and Go (TUG), 30-second sit-to-stand, Four Square Step Test (FSST), hand-grip strength (HGS), and Trail Making Test (TMT). TUG performance improved significantly, $t(9) = 3.27, p = 0.01$. Moderate, non-significant effects were observed for the 30-second sit-to-stand, $t(8) = -2.04, p = 0.08$, FSST, $t(8) = 2.04, p = 0.08$, TMT Part A, $t(9) = 1.53, p = 0.17$, and TMT Part B, $t(9) = 1.62, p = 0.14$. Non-significant changes were observed for left HGS, $t(9) = 1.4, p = 0.2$ and right HGS, $t(9) = 0.31, p = 0.8$. These findings suggest that a shortened, game-based exercise program such as Bingocize® may provide an engaging approach to improving fall-related outcomes in older adults.

Fridell, Gregory, "Fake/Real Job Listings" (Lily Popova Zhuhadar)

Fraudulent job postings have become an increasing problem on online employment platforms such as LinkedIn, Indeed, and Glassdoor. These scams waste applicants' time, expose users to financial or identity risks, and erode trust in legitimate recruiters. Using a Kaggle dataset of job advertisements, this project will develop a binary classification model to distinguish fraudulent postings from legitimate ones. The dataset is structured and includes both categorical fields and text-based variables such as job title, job description, and requirements. The target variable is labeled fraudulent = 1 and legitimate = 0. The workflow will include text preprocessing (e.g., cleaning and feature extraction) and model training using multiple algorithms, including Logistic Regression, Random Forest, and Gradient Boosting. Model performance will be evaluated using confusion matrices, precision, recall, and ROC/AUC, with a primary emphasis on minimizing false negatives (fraudulent posts incorrectly predicted as legitimate). The resulting predictive model can support job platforms by helping identify and flag suspicious listings earlier, improving moderation efficiency and contributing to a safer, more trustworthy online hiring environment for both job seekers and recruiters.

Fugatt, Alexis, Guercio, Harmony, "Snowfall Phenology in the Central United States: A Climate Change Signal" (Zachary Suriano)

The variability of, and long-term changes in, snowfall have pronounced implications for the environment and various socioeconomic sectors. While extensive research has examined trends in snowfall totals as a result of global climate change, the often-ignored timing of snow, or snowfall phenology, during the cool season directly influences logistical and recreational decisions. By resolving the climatological nature of snowfall phenology and quantifying past trends and forcing mechanisms, this research provides insight into how a changing climate can impact transportation, water resource management, human health, and recreation. Using a dataset of 362 daily snowfall observation stations across the central United States, gradients in the timing of first and last snowfall dates and snowfall season length are identified based on elevation, latitude, and temperature forcings. Over time, the snowfall season has increased across the

northern Great Plains, driven primarily by an earlier start to the snowfall season by as much as five weeks from 1948 to 2021. Conversely, a shorter snowfall season is observed in the Ohio River Valley, where later first snowfalls and earlier last snowfalls reduce the season by more than six weeks. For snow removal and transportation logistics, noted changes in the timing of snowfall strain decision makers and will require adaptation beyond traditional approaches that do not account for long term trends.

Fuquay, Zachary, Suriano, Zachary, Hiler, Ryan, "Rain-on-snow Ablation in the Ohio River Valley: Synoptic Conditions" (Zachary Suriano)

The impacts of liquid precipitation on melting snowpack, known as rain-on-snow ablation (ROS), can be substantial. ROS can cause large volumes of water to enter the environment from the dual sources of runoff, leading to flooding, environmental impacts, and other events. Despite the frequency of ROS and their potential for negative outcomes, research into ROS and specifically into the forcing mechanisms that trigger the events in the eastern United States is lacking. This study evaluates the different synoptic-scale weather types that cause ROS in the Ohio River basin. A Temporal Synoptic Index classification procedure from January 1981-December 2024 was conducted. Results indicate that there are 5 synoptic types labeled by their most notable center of pressure. Evaluations into the inter- and intra-annual frequency have been conducted along with reanalysis of the specific weather conditions for each type and possible related teleconnections. This informs us of how these events change and vary with time. It was also found that teleconnections play very little role in the occurrence of ROS events. These results could aid in the development of better forecast methods of these events and therefore improved preparedness by communities and emergency management personnel.

Gachagua, Chris, "Assessing the Impact of Persulfate Oxidants on Fluorescent Dye Detection" (Lee Anne Bledsoe)

Persulfates are compounds capable of oxidizing a wide range of organic materials. They can be used in soil and groundwater remediation to break down organic contaminants. More than 50% of the U.S. population relies on groundwater for drinking water, which is also one of the most important sources of water for irrigation. Unfortunately, groundwater in karst and fractured bedrock areas is highly susceptible to pollution. To help solve groundwater problems, organic fluorescent dyes can be used to determine the direction of groundwater flow and velocity. The goal of this research is to understand how persulfate oxidizing agents interact with fluorescent dyes. Solutions of deionized water and persulfate were spiked with a range of dye concentrations and then analyzed using a spectrofluorophotometer. A minimum threshold of persulfate was determined for Rhodamine WT dye detection in water and the dye showed no degradation when collected on charcoal exposed to the persulfate solutions.

Gardner, Madison, "Building A Real-time Digital Twin for Smart Manufacturing Using Multi-modal Sensor Fusion" (Gregory Arbuckle)

Modern manufacturing is shifting from reactive maintenance to proactive, data-driven systems that can predict failures before they occur. A key technology enabling this shift is the digital twin, a real-time virtual model that mirrors the behavior of a physical machine. This project presents a multi-modal sensor fusion framework designed to synchronize a digital twin with a Fanuc industrial robotic arm used in smart manufacturing research. The system integrates three complementary data sources: external optical

tracking through computer vision, internal inertial telemetry from motion sensors, and deterministic motion data from the robot controller. By combining these streams, the framework measures the difference between commanded motion and actual physical execution, a metric known as execution drift. The current implementation validates a real-time telemetry pipeline using a Raspberry Pi vision system, an onboard inertial measurement unit, and controller-integrated robot state data. To ensure accurate synchronization across sensors operating at different sampling rates, the system uses complementary filtering and strict network time alignment. This work establishes the foundation for a scalable digital twin platform that supports predictive maintenance, anomaly detection, and real-time manufacturing process verification.

Garrison, Keaton, Woodward, Ainsley, Chang, Eaden, Sandifer, Sophie, "Bird Diversity in Cloudbridge, Costa Rica" (Martin Stone)

The cloud forests of Costa Rica, which are high-altitude, tropical forests, house high amounts of biodiversity and species found nowhere else. Therefore, deforestation of these areas can be very harmful to the earth's biodiversity. Successful reforestation efforts are crucial in restoring these unique habitats. Cloudbridge Nature Reserve, of the San Jose province of Costa Rica, has been reforesting cattle land in the Talamanca Mountains for the past twenty years. The goal of this project is to gauge the success of the reforestation of the reserve through the surveying of birds, an important bioindicator, especially when having very specific living conditions. Current research has found forest type, such as forests that has been reforested and forest that have never been deforested, has no significant effect on bird activity. Birds were surveyed using point counts that were conducted in various forest types within cloud bridge. Any species that was observed was then put into a category based upon how specialized of an environment it requires. It was found that highly-specialized species were found most often in forest the had never been deforested. This demonstrates that reforestation efforts have not yet created new habitats for highly specialized birds.

Gerdes, Samantha, "The Impact of Content Creation on The Language Learner: A Study of Self-perception, Language Skills, and Content Strategy" (Ke Peng)

In my poster presentation, I will share findings from my project examining whether creating and sharing Chinese language learning content across social media enhances language proficiency and fosters cross-cultural communication skills. Utilizing an action research methodology, the project involved producing and distributing video content across multiple platforms, including TikTok, Instagram, REDnote, and YouTube. Data was collected by tracking audience engagement metrics and maintaining a personal reflection journal to document insights and challenges throughout the production process. The key results indicate that the project successfully established a small community of language learners and directly contributed to the improvement of my Chinese proficiency. Furthermore, the online audience played an active role in this development, with followers providing feedback and suggesting more accurate vocabulary for specific contexts. These findings highlight the significance of content creation as a dynamic tool for language acquisition, demonstrating how social media can be leveraged for meaningful cultural exchange and practical skill development.

Gibbs, Caelen, "The Intersection of Dance and Religion: How Dance in Culture Creates a Global Image in Japan" (Meghen McKinley)

Dance has been both a spiritual practice and a cultural expression, and its ability to act as a conduit between bodily ritual and cultural identity has been a long-standing phenomenon. This project seeks to explore the relationship between dance and religion in Japan, and how sacred and traditional forms of dance contribute to the global cultural image of Japan. The focus of this research is on traditional forms of Japanese dance, such as Kagura, a Shinto ritual dance, and Bon Odori, a Buddhist ritual dance celebrated during the Obon holiday. This research will analyze the function of religious dance in Japanese society and its global cultural image, and how this relates to its ability to preserve spiritual values and cultural narratives in a globalized world. By exploring the aesthetic qualities and cultural narratives of Japanese religious dance, this research will argue that spiritual dance traditions play a vital role in shaping Japan's global cultural image as a nation that is deeply rooted in its cultural heritage and its ability to find beauty in ritual and discipline. This research will also explore how globalization has led to a shift in cultural narratives and spiritual values, and how this has resulted in a cultural identity that is represented throughout the world as a symbol of Japan's national identity.

Gilani, Ismail, "Heterodinuclear Metal-organic Coordination Polymers as Catalysts for Photoreduction of Carbon Dioxide in Visible Light" (Bangbo Yan)

The growing human population underscores the need for sustainable energy production. Currently, this is largely achieved by burning fossil fuels, which releases large amounts of CO₂ and pollutes the atmosphere. Photocatalytic reduction of carbon dioxide under sunlight holds great promise as a solution to both challenges, since it converts CO₂ into usable energy. Semiconductor-based catalysts have been employed, but their wide band gaps and reliance on UV light make them inefficient at harnessing solar energy. Heterodinuclear metal-organic coordination polymers have shown strong potential as efficient photocatalysts for carbon dioxide reduction. This study aims to develop solid state materials with extended structures as heterocatalysts via self-assembly, targeting enhanced catalytic activity and improved efficiency. Reported here are the synthesis, crystal structures and catalytic properties of new compounds constructed from osmium complexes and 3d transition metal complexes.

Goff, Jasey, "“From Struggling to Stay Above the Waves, to Creating the New Generation of Swimmers”" (Jeremy Logsdon)

This Educator's Rising Moment reflects the experiences that shaped my calling to become an educator. From a young age, I knew I wanted to teach, not because I understood curriculums or standards, but because I understood the power of encouragement. I experienced academic challenges that often left me feeling anxious, discouraged, and unsure of myself. During those moments, the support of compassionate teachers made the difference. Their patience and belief in my potential helped me realize that struggle does not equal inability. Those experiences formed the foundation of my teaching philosophy. I believe meaningful learning begins with connection. Before students can grow academically, they must feel seen, valued, and safe. Loving a student does not mean lowering expectations; it means building trust so expectations can be met with confidence. When educators choose consistency and compassion, they create space for resilience and progress. Tomorrow's breakthroughs begin with today's patience. As a future educator, I am committed to recognizing quiet

struggles, fostering confidence, and creating a classroom environment where every student feels supported. Just as others once believed in me, I will strive to be the steady presence who helps students believe in themselves.

Goodman, Noah, Smith, Emma, Ezell, Kaley, Delgado, Elsa, Young, Sonia, Pounders, Vance, "The Immediate Effects of Computerized Dynamic Posturography with Perturbation Training on Limits of Stability in Older Adults" (Sonia Young)

Introduction: Limits of Stability (LOS) refers to the maximum distance individuals can move their center of mass within their base of support. Because LOS declines with age, fall risk increases in older adults. The Bertec® Balance Advantage® Computerized Dynamic Posturography and Immersive Virtual Reality™ system (Bertec) is a reliable and valid tool to assess and train LOS. Perturbation training has demonstrated effectiveness in reducing fall risk. The purpose of this study is to investigate whether immersive virtual reality (IVR) with perturbation training improves LOS in older adults. We hypothesize that IVR will improve LOS in older adults. Methods: Twenty-seven older adults aged 65+, with at least one fall in the past year, will be recruited for an explanatory, crossover design. Participants will have their order of conditions counterbalanced over two sessions. During each session, the LOS will be administered three times, followed by a six-minute IVR perturbation or control intervention, with LOS immediately reassessed. Results: Data will be analyzed using descriptive statistics and a 2 × 2 mixed ANOVA, with post hoc testing if significant interaction is found. Discussion: Findings may support physical therapists' use of IVR perturbation training to improve LOS in older adults with a history of falls.

Gordon, Samuel, Naik, Prthu, Novikov, Ivan, "Rolling With Viscosity: Studying Fluid-filled Cylinder Oscillations On A Tautochrone Ramp" (Ivan Novikov)

In this project, we studied the oscillations of a rolling cylindrical container filled with fluids of varying viscosity on a tautochrone ramp. The goals of the project are 1) to determine how liquid viscosity affects the container's dynamics via measurement of the oscillation period, and 2) to improve a Raspberry Pi-based data acquisition system (DAQ) to record rotational motion. The coordinates of the cylinder during oscillation were extracted from video captured by a stereoscopic camera system connected to a Raspberry Pi 4. We developed a DAQ system using Python that tracks the cylinder's center and determines its position, velocity, and acceleration. In this presentation, we will discuss the experimental setup, present data collected across various viscosities, explain the software developed to determine cylinder position, and compare our experimental and simulated results.

Goss, Erika, McMurtrey, Nina, Wulfekuhle, Blake, McDavid, Preston, Lynch, Brody, Gott, Grant, Mazariegos, Jimmy, Matlock, Kaleb, Graham, Tyler, "Design And Development Of A Three-wheeled Electrically Assisted Human Powered Vehicle For The Asme E-hpv Challenge" (Benjamin Dinan)

This poster presents the design, implementation, and validation of a three-wheeled electrically assisted human powered vehicle developed for the ASME e-Human Powered Vehicle Challenge as part of a Mechanical Engineering capstone senior project. The vehicle was designed by a team of ten students and will compete in the April competition hosted in Dallas, Texas. The goal was to create a lightweight, structurally safe, and performance optimized vehicle capable of meeting strict competition requirements while improving rider efficiency and system reliability. A structured concept selection process guided

architectural decisions, including frame fabrication, wheel configuration, braking system, and transmission strategy. Finite element analysis validated rollover protection system performance under prescribed loading conditions, and subsystem testing was conducted to evaluate braking capability, maneuverability, and electrical safety. The final vehicle integrates a custom steel frame, tadpole 3-wheel configuration, mid drive electric assist system, and continuous variable transmission. Testing will confirm structural compliance, effective braking, and handling performance. All while limiting the vehicle weight to below 28 kg. This capstone engineering project demonstrates the integration of mechanical design, structural analysis, and electric powertrain systems to produce a competition ready platform and provides a foundation for continued performance development and student led engineering innovation.

Gross, Christopher, "Enhancement Of Methylene Blue-mediated Photodynamic Therapy Via Copper Nanoparticles Synthesized By Pulsed Laser Ablation In Liquid" (Ali Er)

Photodynamic therapy (PDT) utilizes photosensitizers to generate reactive oxygen species (ROS) for antimicrobial applications, yet its efficacy is often limited by incomplete bacterial eradication. This study investigates the use of copper nanoparticles (CuNPs) as a cost-effective alternative to noble metals for enhancing ROS production. CuNPs were synthesized in propylene glycol using Pulsed Laser Ablation in Liquid (PLAL), resulting in stable, non-aggregated particles (~5 nm) with a surface plasmon resonance peak at 330 nm. The interaction between CuNPs and the photosensitizer Methylene Blue (MB) was evaluated using ABMDMA as a singlet oxygen indicator. While initial chemical assays suggested an inhibitory effect on MB-mediated ROS production, preliminary antimicrobial experiments demonstrated that the addition of CuNPs significantly increased the overall effectiveness of MB against bacteria. These findings suggest a synergistic antimicrobial potential, though further research is required to distinguish between direct CuNP cytotoxicity and genuine PDT enhancement. This work highlights the potential of high-efficiency, low-cost nanophotosensitizers for localized infection control.

Guercio, Harmony, Durkee, Josh, "Disaster Science Operations Center: A State Hub for Disaster Research and Resilience" (Josh Durkee)

The Disaster Science Operations Center (DSOC) at WKU functions as a multidisciplinary operations initiative that integrates meteorological expertise with disaster and emergency management across public, private, government, and academic sectors to enhance preparedness, mitigation, and response. Through collaborations within the Meteorology Program, students are provided with operational experiential learning and research opportunities as a force-multiplier for emergency agencies and private industry with pre-event planning and real-time decision-support. Outside of private industry events, recent research efforts have focused on disaster resilience, noting seven of the top twelve counties in the U.S. with the highest number of federal disaster declarations between 1990 and 2022 were in Kentucky. As such, DSOC is participating in a five-year multi-university National Science Foundation EPSCoR research project aimed at improving disaster mitigation and response for the state of Kentucky. Initial results indicate all 120 counties in Kentucky experience weather-related disasters, particularly in the western and eastern regions. Damaging winds and floods lead the hazard types, overall. Disaster frequency and associated disaster declarations by year appear to have a sinusoidal pattern, suggesting a potential predictive periodicity pattern. This research aims to improve hazard mitigation planning for Kentucky, while DSOC serves as the state hub for disaster resilience efforts.

Gurbandurdyev, Begench, Annamuradov, Berdimyrat, Allamyradov, Yaran, Gross, Brayden,

"Enhanced Photodynamic Antibacterial Activity Using Plal-synthesized Gold Nanoparticles and Efflux Pump Inhibition" (Ali Oguz Er)

Gold nanoparticles (AuNPs) have been investigated as a potential antimicrobial agents to improve methylene blue (MB)-mediated photodynamic therapy (PDT) against *Escherichia coli*. AuNPs were synthesized using the pulsed laser ablation in liquid (PLAL) method with different wavelengths and frequencies. Our results show that the highest concentrations of AuNPs were obtained at 50 kHz. UV-Vis and fluorescence spectroscopy analyses verified the formation of AuNPs and the surface plasmonic properties of the nanoparticles, which were in accordance with the results obtained from the transmission electron microscopy (TEM) analysis. Photobleaching assays revealed that AuNPs significantly enhanced the production of singlet oxygen compared to MB alone. Moreover, the addition of the efflux pump inhibitor INF-55 significantly enhanced the antibacterial effect of MB/AuNPs while maintaining the level of reactive oxygen species (ROS) production. In vitro results showed that the combination of INF-55 and MB/AuNPs deactivates 59% more bacteria than the combination of MB/AuNPs. Molecular docking results revealed that INF-55 has a higher binding energy than MB in interacting with the AcrB efflux pump, which verifies the potential of INF-55 as a competitive inhibitor in the retention of MB in the bacterial cells.

Hale, Lauren, "Generating Phenotypes Resulting from the Targeted Knockdown of V-ATPase in *Drosophila Melanogaster*" (Joseph Marquardt)

Vacuolar-type H⁺ adenosine triphosphatases (V-ATPases) are evolutionary conserved ATP driven proton pumps that acidify intracellular compartments. Important in cellular processes such as protein degradation, signal transduction, and ion balance, V-ATPase has been shown to play a crucial role in disease progression and development. To investigate the role of V-ATPases in *Drosophila melanogaster* development, the GAL4-UAS system with RNAi was used to knockdown *Vha16-1*, a subunit of V-ATPase, in a tissue-specific manner. Targeted tissues included the wings, eyes, fat bodies, nervous system, and the body. Knockdown in various tissues resulted in specific phenotypes. These phenotypes suggest that V-ATPases play a vital role in *D. melanogaster* wing development. To understand their role in wing development, these phenotypes will be characterized using a variety of methods such as immunohistochemistry.

Hall, Jonah, "Mid-south Ice Damming" (Zachary Suriano)

Ice damming events represent an understudied winter weather hazard across the Mid-South United States despite their potential to damage infrastructure and pose risks to public safety. This project investigates the spatial and temporal characteristics of ice-damming conditions across the Mid-South using long-term surface meteorological observations from approximately 370 weather stations covering the period 1994 - 2025. Variables collected include daily maximum temperature, minimum temperature, snowfall, snow depth, and precipitation, with a particular focus on snow depth. This dataset provides a multi-decadal record that allows for a detailed examination of how frequently ice-damming conditions occur across the Mid-South and how they vary geographically. The results will help identify regional differences in event frequency between states and across varying landscapes. These findings will contribute to the development of a regional climatology of ice damming conditions and help determine

whether these events occur frequently enough to warrant mitigation measures within the Mid-South. In Kentucky, where building codes addressing ice damming are absent, this research may provide foundational evidence supporting the development or modification of building standards aimed at reducing structural damage and improving resilience to winter weather hazards.

Hawkins, Alexandria (Lexie), Ash, Hayden, Duckworth, Garren, "The Development and Impact of a Student Run Mobility Clinic" (Beth Norris)

INTRODUCTION: Student-run mobility clinics provide students with the opportunity to apply classroom knowledge in a real-world setting, bridging the gap between academic learning and clinical experience. The primary purpose of this study is to establish a DPT student-run mobility clinic and evaluate its effectiveness from both DPT students and the clinic participants perspectives. **METHODS:** Project investigators will establish a student-run mobility clinic using WKU DPT facilities. The clinic will be open to all WKU students and staff. The mobility screen will consist of 5 tests that are scored simultaneously by a DPT student and a mobile application. Experience surveys will be completed by DPT students before and after screening clinic participants and by clinical participants after receiving the screening service. **RESULTS:** Individual item scores in the experience survey will be compared across the two time periods to assess the impact of the mobility clinic on student perceived proficiency, confidence and clinical readiness. Cohen's kappa coefficients will determine the agreement between student-rated mobility scores and scores obtained from the Symmio mobile application. **DISCUSSION:** Results from this study will provide insight into how student involvement in a mobility clinic impacts their confidence to perform clinical skills and clinical readiness.

Haynes, Lily, Tooley, Nadia, Boateng, Ama, Lickenbrock, Diane, "Analyzing Differences in Parenting Between Mothers and Fathers: Associations Between Parental Beliefs and Behaviors in Early Infancy" (Diane Lickenbrock)

Parental beliefs and behaviors play critical roles in shaping infants' development in the early stages of life. Examining maternal and paternal differences, as well as infant responses, within the parent-infant dyad, is crucial in predicting parental dynamics (Tissot et al., 2024). Parental sensitivity describes how parents interpret and react to infant needs effectively (Marjolein et al., 2019). Parental efficacy and satisfaction are two additional markers that contribute to parenting behaviors. The current study aimed to examine the differences between maternal and paternal efficacy, satisfaction, and sensitivity in early infancy from a larger longitudinal study (n = 103 families). Parental efficacy and satisfaction were rated by mothers and fathers (Johnston & Mash, 1989). Parental sensitivity was rated by trained, reliable coders during a dyadic infant-parent face-to-face play task (Still-Face Paradigm; Braungart-Rieker et al., 2014; Tronick et al., 1978). Findings revealed differences in mothers and fathers reports of efficacy, $t(93) = -2.16$, $p = .017$, satisfaction, $t(92) = -2.16$, $p = .016$, and observed sensitivity, $t(82) = -2.454$, $p = .008$. Mothers were higher in satisfaction and sensitivity; fathers were higher in efficacy. The results demonstrate the unique interactions and roles mothers and fathers play in infants' development and in the parent experience.

Heckler, Jaime, Ratcliff, Camille, Hisler, Isaiah, Lundy, Caleigh, Ledwidge, Dr. Patrick, "Direction-informed Cueing Effects on Plantar Flexion Response Conflict" (Dr. Patrick Ledwidge)

The focus of this poster is to determine whether anticipatory cues aid motor preparation and execution of lower-limb responding to evaluate cognitive-motor mechanisms when performing rapid responses. 16 participants completed a Standing Flanker task, responding to a middle flanker arrow via plantar flexion (heel release) with two-foot pedals. Trials were planned (cued) or unplanned (not cued), followed by a left or right plantar flexion response in congruent (e.g. <<<<<) and incongruent conditions (e.g. <<><<). There are 8 randomized blocks of 24 trials equally varied by anticipation (planned/unplanned), congruence (congruent/incongruent), and direction (left/right), totaling 192 trials. Findings show that during planned conditions, there were no reaction time differences between congruent/incongruent stimuli. Though, the right limb produced slower reaction times. In unplanned conditions, there was a noticeable difference between congruent/ incongruent reaction times, but no right/left differences. We are exploring the source of the right reaction time delay and intend to identify if there is a trend to right limb RT delays for each participant through examining average RTs across each block. Given the task duration, fatigue could be an explanation as to why this is occurring and may reflect attentional processing delays within cognitive-motor control during rapid responding.

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: Are PFAS present within karst groundwater systems in Bowling Green, Kentucky? Which PFAS has the highest concentration in Bowling Green? Which Bowling Green site has the highest PFAS concentration? This study will collect water samples from various karst groundwater systems in south-central Kentucky to determine PFAS prevalence, namely in and around the City of Bowling Green and Crumps Cave Research and Education Preserve. Basic analyses will be conducted in the field, but samples will be further analyzed in a laboratory setting 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. PFAS contamination investigation and research in urban south-central Kentucky karst groundwater systems will greatly influence and contribute to public and environmental health remediation techniques and policies.

Henry, Dylan, Krishnani, Sanam, Ashley, Noah, Hetzer, Katy, Nguyen, Van Thuan, "Sex-Based Differences in Neuroinflammatory Responses in Chronic Sleep Fragmentation in Mice" (Noah Ashley)

As the obesity crisis expands across developing countries, the prevalence of obstructive sleep apnea has risen dramatically. This chronic condition involves periodic episodes of hypoxia and sleep fragmentation (SF), which trigger inflammatory responses in the brain and peripheral tissues. Most studies evaluating sleep fragmentation have focused on males, though females are also affected. Given known sex differences in immune function, we examined the inflammatory responses of female and male C57BL/6J mice following varying durations of chronic sleep fragmentation (CSF; 1, 2, 4, and 8 weeks) or control conditions with no sleep fragmentation (NSF). Sleep disruption was induced using an automated cage system in which a sweeping bar moved across the cage floor every 2 minutes for 12 h/day (8 a.m.–8 p.m.). Brains were collected, and the hypothalamus, hippocampus, and prefrontal cortex were dissected for analysis of interleukin-1 β (IL-1 β) and tumor necrosis factor-alpha (TNF- α) gene expression via RT-PCR. In

the hypothalamus, males under CSF exhibited a significant TNF- α peak at Week 4, whereas females showed no major differences between NSF and CSF conditions. Males also demonstrated distinct IL-1 β peaks under CSF, indicating heightened inflammatory sensitivity. In the hippocampus, females displayed a strong, short-lived surge in both cytokines under CSF, while males showed faster resolution of inflammation compared to controls. In the prefrontal cortex, females exhibited dramatic, highly variable TNF- α and IL-1 β spikes under CSF, whereas males displayed more moderate, transient increases. These results demonstrate that chronic sleep fragmentation induces region- and sex-specific neuroinflammatory responses, revealing differential inflammatory responses between male and female mice.

Hensley, Remi, "Stress Impact in Horses After Hay Exposure in Pasture" (Debra Shoulders)

Background: The temporomandibular joint (TMJ) in horses plays a critical role in mastication, facilitating the grinding and processing of forage. TMJ sensitivity often manifests as pain or discomfort during mastication as well as when ridden. Pasture grazing allows for a more natural low intensity chew stroke while the drier and more course hay requires more forceful and more numerous chew strokes. This study explores the acute and short-term effects of hay introduction on TMJ sensitivity in horses, addressing a gap in understanding transient versus persistent responses. **Materials and Methods:** This observational study involved 42 horses from the Western Kentucky University (WKU) herd. The herd consists of 34 mixed-breed Arabian and Quarter Horses with an average age of 10 years (ranging from 2 to 25 years). Dental procedures were performed on all individual horses on August 1, 2025. TMJ sensitivity was assessed at 3 time points: November 3, 2025 (grazing only) 3 days post hay production (November 8, 2025) and 10 days post hay introduction (November 17, 2025). Sensitivity was scored bilaterally on the WKU TMJ scale of 0 (no sensitivity) to 3 (severe sensitivity). Statistical significance of changes in sensitivity was evaluated using Fisher's exact test for paired comparisons (baseline vs. 3 days, 3 days vs. 10 days, baseline vs. 10 days), with p-values computed to assess the likelihood of observed trends occurring by chance. No interventions beyond standard care were applied; ethical considerations included non-invasive palpation to minimize distress. **Results:** Baseline TMJ sensitivity was low: 8.82% (3/34) on the left side, 11.76% (4/34) on the right and 14.71% (5/35) overall. At 3 days post hay introduction, sensitivity surged to 32.35% (11/34) left, 52.94% (18/34) right and 58.82% (20/34) overall. By 10 days, it declined to 15.15% (5/33) left, 12.12% (4/33) right and 18.18% overall (6/33). The increase of TMJ sensitivity from baseline to 3 days was statistically significant ($p = 0.0000153$) as was the decrease from 3 to 10 days ($p = 0.0000153$); however, baseline vs. 10 days showed no significance ($p = 1.0$). **Discussion:** The marked transient increase in TMJ sensitivity following hay introduction underscores the biomechanics impact of dietary changes, likely due in part to altered chewing dynamics. Herd dynamics and feeding time may also contribute to TMJ sensitivity and warrant future studies. **Take Home Message** Horses are impacted by dietary changes. Care takers should make gradual dietary changes to reduce discomfort for their horses.

Hernandez, Michael, Schultz, Faith, Robertson, Morgan, Best, Hayley, Freeman, Dylan, Polly, Silvio, Crandall, Jason, Schafer, Mark, "Longitudinal Effects of Repeated Bingocize® Participation on Functional Performance: A 12-month Pilot Study" (Mark Schafer)

Falls are common concerns for older adults, highlighting the need for accessible community-based

exercise programs across the country. Bingocize® is an evidence-based program that combines exercise and health education and has demonstrated short-term benefits. However, little is known about outcomes when individuals participate in multiple sessions. This pilot study examined functional outcomes following participation in Bingocize® offered over three semesters. Four participants completed pre/post functional testing each workshop, and a linear mixed-effects model examined changes over time while accounting for repeated measurements within participants. Paired comparisons compared Semester 1 pre-test to later post-tests for participants. From Semester 1 pre-test to Semester 2 post-test, participants showed small improvements in sit-to-stand performance ($d = 0.26$) and left-hand grip strength ($d = 0.85$), while right-hand grip strength remained similar ($d = -0.11$). Timed Up-and-Go showed a large effect size ($d = 0.86$) but reflected slightly lower completion times. From Semester 1 pre-test to Semester 3 post-test, participants showed large improvements in left-hand grip strength ($d = 1.11$) and moderate improvements in right-hand grip strength ($d = 0.49$), while sit-to-stand performance did not change. Results suggest possible strength improvements with repeated participation. Further studies with more participants are needed to determine long-term effects.

Hetzer, Kathryn, Krishnani, Sanam, Henry, Dylan, Nguyen, Van Thuan, Ashley, Noah, "Assessment of Sex Differences in the Peripheral Inflammatory Response to Chronic Sleep Fragmentation" (Noah Ashley) Obstructive sleep apnea is characterized by recurring events of airway collapse, intermittent hypoxia, and perturbations in sleep continuity, known as sleep fragmentation (SF). One consequence of SF is increased pro-inflammatory responses, but most studies have been on males. Sex differences in immune function and inflammation are commonplace, but it is unknown whether males or females differ in their inflammatory response to chronic sleep fragmentation (SF). In this study, we examined the inflammatory response of female and male C57BL/6J mice to varying durations of chronic sleep fragmentation (CSF; 1, 2, 4, and 8 weeks) or control conditions (no sleep fragmentation (NSF)). Mice were exposed to an automated sleep fragmentation cage that involves a sweeping bar that moves across the bottom of the cage every 2 minutes for 12 h/day, starting at lights on at 8 am and ending with light off at 8 pm. NSF mice were exposed to the same type of cage, but received no bar movement. After exposure to these chronic conditions, mice were euthanized and the following peripheral tissues collected: liver, spleen, heart, and white adipose tissue (WAT). RNA was isolated from these tissues and reverse transcribed into cDNA to assess interleukin-1 (IL-1) and tumor necrosis factor-alpha (TNF- α) gene expression using RTPCR. In liver tissue, female mice expressed increased pro-inflammatory cytokine genes compared with controls (but not in males). Both sexes exhibited increases in inflammatory gene expression in heart and adipose tissue except for female TNF in adipose. In spleen, males exhibited increased TNF and IL-B gene expression after 8 weeks of CSF, but this effect was not seen in females. These results imply that these sex differences are tissue specific and are likely regulated by hormonal and or genetic differences between the sexes.

Hicks, Emma, Al-Halah, Kendall, "Blind Loyalty to the Sunk-cost Decision of an Angry Leader" (Young-Jae Yoon)

Leadership success depends not only on leader characteristics but also on how group members respond to leader behavior. One important member trait is group loyalty, defined as emotional attachment and commitment to one's group. Loyal members are typically expected to support collective goals and help

leaders make sound decisions. However, loyalty may have unintended consequences when leaders make irrational choices, such as those driven by the sunk cost fallacy, where individuals continue investing in failing projects to justify prior investments. Prior research offers mixed conclusions, suggesting that loyalty can either blind members to poor leadership or motivate dissent to protect group welfare. We propose that these outcomes depend on how members perceive the leader's own group loyalty. Drawing on trait activation theory and the similarity-attraction principle, we argue that leaders who display loyalty through commitment and self-sacrifice activate members' dispositional loyalty, increasing trust and vicarious justification. Across two online experiments (N = 330), participants evaluated a university leader facing a sunk cost decision. Results showed that member group loyalty predicted conformity to the leader's decision only when the leader was described as loyal; this relationship disappeared in a control condition without loyalty cues. These findings suggest that a combination of loyal leaders and loyal members—often viewed as ideal—may increase vulnerability to biased decision-making.

Hiler, Ryan, Suriano, Zachary, Fuquay, Zachary, "Rain-on-snow Ablation: Synoptic Conditions and Trends in the Ohio River Basin" (Zachary Suriano)

Events where rain falls on snow can cause a snowpack to rapidly melt. This rapid melting can generate large amounts of runoff and can lead to flooding events which can substantially impact communities. Forecasting these events can become more improved by determining rain-on-snow events caused by various weather patterns and how they change over time. This research evaluates these events and their nature and patterns across the Ohio River Basin from 1981-2024, including describing sea level pressure, temperature, and different radiative fluxes and their respective average values and trends assessed over time for each weather pattern causing rain-on-snow. Results determined five different weather patterns where rain-on-snow occurs with each having unique atmospheric conditions and frequencies. Of all nine of the variables assessed, each type of weather pattern saw a historically significant trend during the time frame of 1981-2024 in at least one of these nine variables. These significant trends also indicate that the change in these atmospheric conditions translates to the changes in energetic fluxes as well as the location and intensity of the snowmelt. The overall results conclude that there is a notable downward trend in the frequency of rain-on-snow events with time with mixed trends within the nine variables with respect to snowmelt intensity.

Honeycutt, Alexander, "Examining the Synoptic and Mesoscale Environment of the March 2, 2012 Eastern Kentucky Tornadoes" (Xingang Fan)

On March 2nd, 2012, a devastating tornado outbreak occurred across the greater Ohio Valley, with two particularly notable tornadoes in eastern Kentucky, West Liberty, and Salyersville. Both storms produced EF-3 damage, resulting in substantial structural loss and long-lasting societal impacts. These tornadoes were part of a larger regional outbreak associated with a highly dynamic and volatile atmospheric environment. This study examines the West Liberty and Salyersville tornadoes to develop a comprehensive understanding of the synoptic- and mesoscale mechanisms that contributed to their development, intensity, and longevity. This region has never historically seen long-track EF-3+ Tornadoes in this part of the Appalachian Plateau, making this case a complete outlier. Through this analysis, this project will highlight the ingredients and interactions necessary for the formation of two destructive EF-3

Tornadoes. Ultimately, the goal is to contribute to a better understanding of severe weather dynamics in the complex terrain of eastern Kentucky.

Huber, Michael, "Huber's Distillery" (Shahnaz Aly)

The goal of the project was to give the customers a unique experience. I've conducted case studies and field studies on distilleries. The site for this project is in an isolated area, away from city life, so that people could be educated about the bourbon making process, but they could also enjoy the outdoors in the process. An outdoor area was added to the distillery. Most distilleries have many things in common with one another, but the one thing not found was an allocated spirit's bar. Therefore, this was added to the design to bring life to the project. While most distilleries are on a much larger scale, a smaller design was required. Therefore, instead of having multiple buildings revolving around the production process, the chosen design added a processing lab so that there is enough room for production without an overbearing amount of equipment.

Hughes, Maysn, Lowman, Charlie, "Geoheritage of Western Kentucky University's Campus: From Ancient Seas to Modern Hilltops" (Royhan Gani)

Western Kentucky University (WKU) is located adjacent to Mammoth Cave National Park, the world's longest known cave system, a World Heritage Site designated by UNESCO. Similar to Mammoth Cave, the hill that hosts WKU's campus is built of the same soluble limestone, capable of forming caves and sinkholes. However, the geoheritage significance of the campus has not been investigated. Using traditional field procedures, aerial drone imagery, and ArcGIS analysis of high-resolution (61 cm) digital elevation models (DEMs), we mapped eleven limestone outcrops across campus. Stratigraphically upward, we logged Ste. Genevieve Limestone capped by Girkin Limestone. Field investigation revealed numerous sedimentological structures and marine fossils throughout outcrops, suggesting the campus area once lay on a warm, shallow sea floor. Structural joints in several outcrops concentrated at the top of The Hill offer insight into the post-depositional evolution of the campus landscape. Water widened joints into narrow slots (grikes) and exposed limestone blocks (clints). Preserving campus outcrops can be a valuable resource for WKU general education geology courses and for local K-12 field trips. A geoheritage trail across campus would link science with daily life, build community pride, and remind visitors that caring for our land starts with understanding its deep history.

Hunt, Carlie, "Franklin Botanical Conservatory and Event Garden: Where Architecture Frames Nature" (Shahnaz Aly)

The following project involved the design of a botanical garden and event center designed to serve both the local community of Franklin, Tennessee, and visitors from the greater Nashville region. The conservatory functions as a public garden throughout the week while also accommodating high-end weddings and once-in-a-lifetime celebrations. Curated plant collections act as agents for education, environmental engagement, and wonder for visitors of all ages. The structure is designed to frame nature and soften the boundary between interior and exterior, allowing architecture and landscape to operate as a unified experience. Rooted in Franklin's cultural heritage and supported by regional tourism, this project explores the community's need for a nature-infused civic destination and investigates how architecture can balance elegance, education, and economic contribution within a single, timeless form.

Hunter, Matthew, Lamont, Brice, "Intrinsic vs. Performance Goals: Effects on Anxiety, Attention, and Task Performance" (Steven Winger)

The purpose of this study was to contrast how intrinsic vs performance goals impact anxiety, attention, and performance across two different tasks. Methods: Seventy-three participants completed a treadmill task and a video game driving task (F1) under intrinsic and performance goal conditions. Participants took anxiety measures before each task and attentional focus measures after each task. Results: Participants had significantly higher anxiety levels in the performance goal trial compared to the fun trial across both tasks. Differences in attentional focus varied across tasks and goal conditions. Participants reported significantly more positive self-talk and less external distraction during the performance goal trial for the treadmill task. In contrast, participants reported significantly more negative task-relevant thoughts and less irrelevant thoughts during the performance trial for the driving game. Participants walked significantly faster during the performance goal trial for the treadmill task. Conclusions: Overall, goal type had a significant impact on anxiety and selective attention across both tasks; however, performance differences were only observed for the treadmill task. Proposed explanations for the results and applications will be discussed.

Ismail, Jade, "Estrogenic and Antiandrogenic Signaling Pathways in Transfeminine Gender-Affirming Hormone Therapy: Molecular Mechanisms, Physiological Outcomes, and Epidemiology" (Aaron Wichman)

Gender-affirming hormone therapy (GAHT) for transfeminine individuals combines estradiol administration with suppression of androgen signaling to induce feminizing physiological changes. Despite widespread clinical use, its effects are often described phenomenologically rather than as coordinated cellular signaling processes. This work examines how estradiol signaling reshapes gene expression and tissue physiology across organ systems. Estradiol activates estrogen receptor α and β , producing genomic transcriptional regulation through estrogen response elements and rapid non-genomic signaling via PI3K/AKT and MAPK pathways. Concurrent androgen suppression, achieved through androgen receptor antagonism and hypothalamic–pituitary–gonadal axis inhibition, reduces androgen-dependent transcription and shifts gene networks toward estrogen-dominant signaling. These molecular changes produce integrated tissue-level remodeling. In bone, estrogen regulates osteoclast activity and supports osteoblast survival. In the cardiovascular system, endothelial nitric oxide signaling alters vascular tone and lipid metabolism. In adipose tissue, estrogen influences adipocyte differentiation and metabolic signaling. Epidemiological evidence links GAHT to improved mental health outcomes, yet long-term risk assessment remains limited due to underrepresentation in longitudinal studies. Framing GAHT from receptor signaling to systemic physiology highlights the need for mechanistic and inclusive research to improve clinical guidance and public understanding.

Jackson, Andrew, Wright, Shiloh, "Defining the Roles of Stn1's Winged-helix Domains in Cst Mediated Telomere Maintenance and Genome Stability" (Jason Stewart)

CTC1-STN1-TEN1 (CST) is a heterotrimeric protein that has roles in telomeric maintenance, DNA repair, and mitigating replication stress. CST loss or dysfunction leads to premature telomere shortening, resulting in the genetic disorders Coats plus and dyskeratosis congenita. Dysregulation of CST is also associated with an increased risk of certain cancers. STN1 subunit of CST is comprised of two regions, an

N-terminal OB-fold domain and a C-terminal region that contains two winged-helix-turn-helix (wHTH) motifs. The wHTH domains of STN1 are implicated in protein-protein interactions. However, their precise roles in CST function are not fully understood. The goal of this project is to elucidate the roles of the STN1 wHTH domains. To do this, we are investigating the functional consequences of removing the wHTH domains and whether they are involved in CST-related protein-protein interactions. First, previously created STN1-knockout lines were transduced with deletions of the STN1 wHTHs to examine their role in telomeric maintenance. Second, protein-protein interactions are being examined through co-immunoprecipitation to see if our mutants affect CST complex formation and interaction with telomere and DNA repair proteins. Through this work, we will characterize the important roles of the STN1 wHTH domains in telomere maintenance and genomic stability.

Jayaraman Suresh, Malleshwar, Lin, Anthony, "Mathematical Modeling of Diabetic Foot Ulcers with Individual Patient Data" (Richard Schugart)

Diabetic foot ulcers (DFUs) are a serious complication of diabetes and are a leading cause of non-traumatic lower-limb amputations. Identifying the biochemical factors that drive wound healing has direct implications for patient care. This work uses a system of four ordinary differential equations to model the dynamics of matrix metalloproteinase-1 (MMP-1), tissue inhibitor of metalloproteinases-1 (TIMP-1), extracellular matrix (ECM), and fibroblasts throughout the healing process based on previously collected data. The model, previously fit to averaged patient data, has been extended to individual patient trajectories using nonlinear mixed-effects modeling, producing both population-level and patient-specific parameter estimations. A structural identifiability analysis was first conducted on all 12 parameters to confirm which parameters are uniquely identifiable from ideal data. Fisher Information Matrices and Coefficients of Variation values were then used to assess parameter sensitivity. Currently, parameters found to have negligible influence on model output are being fixed at nominal values, and mixed-effects modelling is being rerun on the reduced system. This approach improves the reliability of patient-specific estimates and will help guide future clinical data collection in wound-healing research.

Jennings, Delaney, "New Leaf" (Shahnaz Aly)

This project proposed a women's shelter designed to provide a safe, supportive, and dignified environment for women and children as they transition into the next phase of their lives. The architecture prioritizes emotional and physical security while fostering empowerment through thoughtful spatial design. Biophilic principles and abundant natural light are integrated throughout the building to promote well-being, reduce stress, and strengthen occupants' connection to nature. Modern, energy efficient technologies are incorporated to support sustainable performance and long-term operational resilience. Comfort, safety, and adaptability guide the design strategy; ensuring the shelter remains relevant and responsive to evolving needs over time. Above all, the project sought to create warm, home-like spaces that feel nurturing and inviting. By balancing aesthetics, function, and longevity, the design embraced a human centered approach that supports healing, stability, and renewed independence.

Jennings, Noah, Polk, Jason, "Hydrogeologic Tracing to Improve Karst Watershed and Floodplain Planning for Jennings Creek, Kentucky" (Jason Polk)

Jennings Creek is a stream that runs through the City of Bowling Green, Kentucky, and serves as a conduit

to the Barren River, frequently shifting between surface stream flow and subsurface flow. The behavior of flow is dependent upon various factors characteristic of a karst environment, including multiple spring inputs along the flowpath. These spring inputs contribute to the flooding of Jennings Creek and the surrounding areas. Utilizing water level loggers to record water level data at multiple sites along the creek and conducting dye-tracing of newly identified sites with subsurface flow contribute to an overall understanding of Jennings Creek hydrology. Collected data is being used to construct a stage-discharge relationship and work towards developing flood management strategies in the City of Bowling Green.

Jerome, Sophie, Milam, Lily, Woodward, Matthew, "Attitudes Toward Use of Support Networks in Survivors of Childhood and Adulthood Sexual Assault" (Matthew Woodward)

Trauma can cause isolation, stigma, distrust within relationships, and aversion toward disclosure which may tarnish victims' attitudes about utilizing support networks. Negative network orientation, or attitudes about the expected benefit of using social support networks, has been identified in trauma victims and has been found to predict lower levels of social support. Little is known about how exposure to sexual assault (SA) impacts negative network orientation. The purpose of this study was to compare attitudes about use of support networks among survivors of childhood SA, adulthood SA, and survivors of both childhood and adulthood SA, specifically examining between-group differences in perceived usefulness of help-seeking, experience with help-seeking, and mistrust of others. This study examined data from a sample of 616 individuals with lifetime SA exposure. ANOVA analyses indicated significant differences between individuals who experienced both childhood and adulthood SA and individuals who experienced only adulthood SA in perceived usefulness of help-seeking and history of help-seeking. No significant differences were found between groups in mistrust of others. Findings suggest efforts are needed to improve attitudes regarding use of supportive social networks in times of need among cumulative sexual trauma survivors, as these individuals are at enhanced risk of negative outcomes.

Keerpestein, Emma, "A Community Hub: Designing A Clubhouse in Bowling Green, Ky" (Shahnaz Aly)

The rise in people playing golf, pickleball, working out, and shopping resulted in the design of a clubhouse with more amenities offered than most. The clubhouse is located in Bowling Green located next to Crosswinds Golf Course. Research was conducted on activities and interests of anyone, no matter their age or gender, that were popular at the time and considered how they could be combined into one building that still flowed together. The project included amenities such as restaurants, event spaces, shopping, indoor pickleball, golf simulators, fitness center, spa, and more! In addition, there are two retail shops that are sure to intrigue most crowds. Every individual would be able to find something they enjoy at the clubhouse. Whether you are coming to enjoy one of the many amenities, getting dinner, or just enjoying our large lobby bar, you are sure to feel included in the community. By adding these amenities, it brought many different crowds together for a mix of people coming together. Overall, the design aims to satisfy different individuals and create a sense of community.

Kennedy, Jacob, Gardner, Madison, "Creation of a Machine Learning Supported Cell on an Academic Budget" (Greg Arbuckle)

Creation of a Machine Learning Supported Cell on an Academic Budget is an oral paper presentation that explores the development of a real-time predictive maintenance architecture, supported by a machine

learning framework within an academic research environment. The Fourth Industrial Revolution, often referred to as Industry 4.0, has introduced data-driven technologies such as artificial intelligence, machine learning, and the Industrial Internet of Things into modern manufacturing. These technologies allow machines, sensors, and controllers to continuously communicate and generate data that can support predictive maintenance systems. Our goal is to demonstrate how to create a real-time predictive maintenance architecture supported by a machine learning framework, and how we intend to use this real-time cell data to develop an effective digital twin of the Fanuc robot. A campus-based IIoT network was implemented that integrates robot, controller, cameras, inertial measurement units, raspberry pi's, and the projects own dedicated server rack. For our project, a Fanuc robot was fitted with inertial measurement units and ArUco markers, enabling comparison between physical robot motion and data-driven digital simulation to identify deviations and predict performance variance between Fanuc and our Digital Twin created in Unity, all of which was done on an Academic Budget.

Key, Abbigail, "Hidden Influences: Evaluating the Influence of Regulatory Capture on Kentucky's Environmental Policies" (Jacqueline Basham)

Regulatory capture is recognized as the process in which regulated industries manipulate the agencies that are supposed to control them. This term derives from George Stigler, who was a renowned economist at the University of Chicago. His theory of capture—proposed in 1970—provides fundamentals for capture throughout economic policy; however, capture is not subjective. In fact, today many professionals have raised debates on environmental regulatory capture, where regulators have begun serving the regulated industry rather than the public or the environment. Lawmakers in the state of Kentucky, for example, have recently produced environmental legislation that demonstrates a push for lax environmental governance; thus, providing regulatory relief for industries that boost the state's economic margins. Related to this information this study will explore if environmental regulatory capture threatens Kentucky. This presentation is organized accordingly to answer this question: establishment of regulatory capture with accepted examples of capture; an analysis of former and present environmental legislation from Kentucky; a discussion of the legislation in relation to the established definition of regulatory capture; and concluding with a discussion of possible questions surrounding the reversal of capture, moving forward, and if environmental regulatory capture presents potential for environmental and public health problems in Kentucky.

Keynon, Matthew, Day, Martha, Owens, Melanie, "When Physics Hits the Road: Teaching Momentum Through Traffic Collision Analysis" (Martha Day)

Inquiry-driven models are best used for enhancing the curriculum through authentic, community-connected problem-based learning. The unit is centered on the Legacy Cycle, addressing momentum and the Law of Conservation of Momentum. Instructional design immerses students in traffic collision analysis using real-world data and the local police department's traffic division. The unit is structured within the 5E inquiry framework and aligned with the Next Generation Science Standards. Scaffolds within the unit display conceptual understanding through data analysis, investigation, and evidence-based reasoning. Student engagement is centered on collaboratively evaluating claims, interpreting authentic data, and defending conclusions using physics principles. The intentional curriculum design, supported by the community and within authentic contexts, demonstrates increases in student

engagement, conceptual thinking, and scientific reasoning. With highlights on model applicability and scalability across UTeach courses and secondary classrooms, offering ready-to-use resources to empower educators and enhance instructional rigor, relevance, and real-world connections.

Keyton, Addison, "Feature Inventories as Windows into Speleogenesis: A Comparative Study of Two Caves in Hart County, Kentucky" (Patricia Kambesis)

Cave feature inventories provide a rapid, repeatable way to document subterranean geomorphology and to interpret speleogenesis from field-observable evidence. This project applies a standardized feature inventory to two small caves located outside Mammoth Cave National Park, Kentucky. In each cave, records of the distribution and relative abundance of diagnostic features including passage morphology, sediment and sediment banks, breakdown rooms, domes, mineralogy, and secondary carbonate deposits were taken. In parallel, the stratigraphy of the bedrock units hosting each cave were identified to evaluate lithologic and bedding controls on passage development and breakdown. Both caves contain active water but receive recharge from different sources so the inventory also documents hydrologic indicators to help link present-day flow conditions to preserve morphological signatures. Inventory results are georeferenced to survey lines and compiled into structured databases to compare the two caves and identify feature assemblages that distinguish dominant formation and modification processes. Contrasts in the proportion and connectivity of phreatic versus canyon passages, the extent of sediment storage, and the prevalence of breakdown and speleothem development reflected differences in hydrologic routing and host-rock stratigraphy. The results of this study aim to provide insight into the development of karst formations around the Mammoth Cave area.

Kidd, Evan, Biswakarma, Kamal, Alavi, Charlie, "SPI-based Re-regionalization of Kentucky Drought Regions" (Zachary Suriano)

The current drought monitoring framework in Kentucky is divided into 15 regions based on its Area Development District (ADD). Since ADDs are based on economic influence rather than climatological trends, the current drought monitoring regionality may not be optimal for capturing drought effects. We propose a new regionalization of drought, using the Gridded Monthly Standardized Precipitation Index (SPI) from the United States Drought Monitor (USDM) through Principal Component Analysis (PCA). The components of the PCA analyzed explain ~70 percent of the variation within the commonwealth. The result of the K-means cluster testing on PCA data also revealed 10 drought regions are optimal for SPI significance, confirmed by the elbow and silhouette method. Temporal analysis has revealed a slightly wetter trend for most of the Commonwealth. Seasonal analysis also shows that the driest months occur most in meteorological Autumn. The PCA and K-means clustering resulted in geospatial regions. ArcGIS pro from the Environmental Systems Research Institute (ESRI) was used to cut and smooth polygons into easy-to-read maps. The results of our analysis elucidate that the 10-region climate-based framework better capture drought dynamics in Kentucky and may provide a stronger foundation for drought response and management.

Kim, Jiwoo, Bromwell, Sydney, Garg, Vedant, Thornton, Judah, "Communities of Microinvertebrates in Bromeliads" (Martin Stone)

Climate change has contributed to drastic environmental shifts, necessitating research in bioindicators.

Bromeliads are neotropical epiphytes with phytotelmata (water-holding tanks) that support aquatic life of protozoa, which mediate nutrient recycling that contributes to microbial growth. However, current literature is limited to Brazil and non-protozoa. Thus, we aimed to analyze how various environmental factors affect microinvertebrate communities in tank bromeliads in Costa Rican dry season. 0.6 mL water samples of bromeliads (N = 16) at the Costa Rican Cloudbridge Nature Reserve were collected. Temperature, dimensions (height x width), and height above ground were measured for each bromeliad tank. A microscope at 40x lens was used to observe and record the presence of protozoan species. A previous study was used to compare wet season data. The rainy season supported more complex communities. Elevation, leaf input, and tank size were the most influential factors in shaping morphospecies distribution. The impact of temperature was generally species-specific. This study serves as a foundational preliminary study on protozoa morphospecies in Costa Rica by identifying those most sensitive to specific environmental factors. Such understanding at the micro-level relates to macroenvironments, which relate to forest health, as bromeliads are excellent bioindicators that serve as short-scale models for long-term climate change.

King, Kelsey, Domingos-Luz, Leandro, Lo, Edward L., Silva, Aguinaldo, Kuerten, Sidney, Pinheiro, Ulisses, McGlue, Michael M., "Occurrence of Freshwater Sponges in Lake Chacororé and the Cuiabá River (Mato Grosso, Brazil)." (Giliane Rasbold)

Freshwater sponges (Porifera: Spongillina) are sessile filter-feeding animals that serve as indicators of ecosystem and water quality health. This study examined the composition of freshwater sponge species in two connected water bodies in the Barão de Melgaço subregion of the Pantanal wetlands: Lake Chacororé and the Cuiabá River in Mato Grosso, Brazil. Sponge specimens were collected using a Van Veen grab sampler during the dry season in August 2023, directly from rocks at the bottom of both locations. The sponges were treated with hydrogen peroxide (35%) to expose their skeletal structures, which were identified to the species level using optical microscopy. These novel results showed distinct sponge communities at each site: Lake Chacororé contained *Eunapius fragilis* (Leidy, 1851), whereas the Cuiabá River contained *Tubelis variabilis* (Bonetto & Ezcurra de Drago, 1973), *T. repens* (Hinde, 1888), and *Corvospongilla seckti* (Bonetto & Ezcurra de Drago, 1966). These differences between the lentic and lotic environments likely reflect variations in water flow, current velocity, substrate type, and local environmental conditions. Additionally, sediment samples from the lake floor are being analyzed to identify the potential for additional sponge species and provide further insight into sponge biodiversity and ecosystem conditions in the Pantanal.

Kirkus, Charlie, "Hospitality as Cultural Expression: Architecture Rooted Through Place, Music, and Community" (Aly Shahnaz)

Boutique hotels have increasingly become cultural anchors within urban environments, serving as both destinations and reflections of local identity. This project examined the development of a boutique hotel in Louisville, Kentucky, rooted in regional identity, cultural expression, and contemporary hospitality design. The project explored how industrial architectural forms and materials could balance community engagement with private retreat, creating a residential and welcoming environment for guests while reflecting Louisville's musical and cultural heritage. Sustainability was approached as an integrated design strategy rather than a singular focus. A green roof system was implemented to filter stormwater,

reduce solar heat gain, and improve overall building energy performance. Additional design/sustainability choices included ground heat pumps, daylighting, building massing, spatial organization, material selection, and the overall experience of the building. Architectural studies of the Hutton Hotel in Nashville, the 21c Museum Hotel in Louisville, and the Clermont Hotel in Atlanta informed with key design decisions related to cultural integration, guest experience, and architectural identity. Lessons drawn from these projects were synthesized and applied to the final hotel design, demonstrating how regional narrative, experiential design, and targeted sustainable strategies could be cohesively integrated into a contemporary boutique hotel.

Knott, Samuel, "House Price Prediction" (Lily Popova Zhuhadar)

Accurate property valuation is critical for real estate professionals, buyers, and investors because pricing decisions directly affect profitability, affordability, and risk. This project will develop a predictive model to estimate residential home prices using the House Price Prediction dataset from Kaggle. The dataset includes structural and neighborhood-related features such as square footage, number of bedrooms and bathrooms, property age, and location-based attributes. Because the target variable (house price) is continuous, this study treats the task as a regression problem. Multiple regression approaches—Linear Regression, Random Forest Regressor, and Gradient Boosting Regressor—will be implemented and compared. Model performance will be evaluated using RMSE and R^2 to assess both prediction error and overall explanatory power. A reliable pricing model can improve data-driven decision making, reduce pricing inaccuracies, and support more informed real estate investment and purchasing decisions for a wide range of stakeholders.

Koirala, Sandesh, "Epigenetic Reprogramming in Legionella pneumophila Infections" (Simran Banga)
While Legionella pneumophila, the causative agent of Legionnaires' disease, poses a severe and growing public health threat, understanding how this intracellular pathogen manipulates host cellular mechanisms is essential for developing targeted therapies. However, the specific epigenetic pathways hijacked by the bacterium during infection remain largely underexplored. The main objective of this ongoing research is to elucidate how L. pneumophila exploits host DNA methylation and epigenetically silences key immune genes. Data will be generated using infected in-vitro cellular models. We will broadly evaluate global and promoter-specific DNA methylation changes, assess the expression of critical metabolic enzymes, and measure corresponding levels of inflammatory cytokines. Additionally, we will explore the effects of targeted inhibition on restoring immune function. It is hypothesized that infection-derived hypermethylation at the promoters of essential immune genes, substantially decreasing the production of defensive cytokines. This research aims to demonstrate that L. pneumophila actively reprograms epigenetic silencing, and identifying these unique epigenetic patterns could reveal novel diagnostic biomarkers that help vulnerable patients.

Konichek, Alicia, Kingery, Thomas, Konichek, Alicia, "How Do Agricultural Education Mechanics Teachers at the Secondary Level Identify and Handle Mental Health Issues that are Caused by Their Profession?" (Thomas Kingery)

The need for investigative inquiry in this topic is important in understanding the mental health condition of agriculture mechanics instructors. The agricultural education profession itself is one that can be very

taxing on the mental state of its teachers. According to Adams (1999), high levels of stress can be harmful to teachers and may negatively affect their teaching, personal lives, and, most importantly, their students. The current educational status is not helping to alleviate the stress that modern day teachers face. Adding to the stress of frequent decision making, secondary agriculture teachers work well beyond a 40- hour work week preparing lessons, evaluating student work, coaching career development teams, and supervising student projects (Croom, 2003; Straquadine, 1990; Torres et al.). The teaching profession is one of the most visible professions in the world, and even though significant improvements have been made in student achievement, society continues to expect more from its teachers (Croom, 2003). In order to assist teachers in managing the mental health issues they face from the profession, identifiers need to be discussed so solutions can be developed to help cope with the modern-day stresses involved in the agricultural education profession.

Krishnani, Sanam, Henry, Dylan, Ashley, Noah, Nguyen, Van Thuan, Hetzer, Katy, "Sex-based Differences in Neuroinflammatory Responses to Chronic Sleep Fragmentation in Mice" (Noah Ashley) As the obesity crisis expands across developing countries, the prevalence of obstructive sleep apnea has risen dramatically. This chronic condition involves periodic episodes of hypoxia and sleep fragmentation (SF), which trigger inflammatory responses in the brain and peripheral tissues. Most studies evaluating sleep fragmentation have focused on males, though females are also affected. Given known sex differences in immune function, we examined the inflammatory responses of female and male C57BL/6J mice following varying durations of chronic sleep fragmentation (CSF; 1, 2, 4, and 8 weeks) or control conditions with no sleep fragmentation (NSF). Sleep disruption was induced using an automated cage system in which a sweeping bar moved across the cage floor every 2 minutes for 12 h/day (8 a.m.–8 p.m.). Brains were collected, and the hypothalamus, hippocampus, and prefrontal cortex were dissected for analysis of interleukin-1 β (IL-1 β) and tumor necrosis factor-alpha (TNF- α) gene expression via RT-PCR. In the hypothalamus, males under CSF exhibited a significant TNF- α peak at Week 4, whereas females showed no major differences between NSF and CSF conditions. Males also demonstrated distinct IL-1 β peaks under CSF, indicating heightened inflammatory sensitivity. In the hippocampus, females displayed a strong, short-lived surge in both cytokines under CSF, while males showed faster resolution of inflammation compared to controls. In the prefrontal cortex, females exhibited dramatic, highly variable TNF- α and IL-1 β spikes under CSF, whereas males displayed more moderate, transient increases. These results demonstrate that chronic sleep fragmentation induces region- and sex-specific neuroinflammatory responses, revealing differential inflammatory responses between male and female mice.

Kumar, Sandesh, Rahaman, Md Jiad Ur, Gilfillen, Becky, "Responses of Soil Physical Conditions to Varying Fertilizer Inputs under Tomato (*Solanum lycopersicum* L.) Production" (Navdeep Singh) Soil physical characteristics such as bulk density (pb), porosity (f), and saturated hydraulic conductivity (Ksat) influence water movement, root growth, and crop productivity, yet their response to fertilization in short-cycle crops like tomato (*Solanum lycopersicum* L.) remains poorly understood. This study examined how organic and inorganic fertilizers influence soil physical properties under tomato production. A short-term field experiment (2024–2025) was conducted at WKU's Agricultural Research and Education Complex in Bowling Green, Kentucky with three treatments included, Inorganic Fertilizer

(6-24-24 and 34-0-0 [N-P-K]), Organic Fertilizer (4-6-3 [N-P-K]), and Control (no fertilizer), arranged in a randomized complete block design with three replications. Undisturbed soil cores (8 cm diameter × 5 cm height) were collected at 0–5 cm depth and were analyzed for Ksat, pb, and f. Mean pb ranged 1.21–1.24 Mg m⁻³, while Ksat varied 101.4–183.2 mm h⁻¹, with no significant differences among treatments (p>0.05). These results suggest short-term fertilizer application does not markedly alter soil physical conditions, highlighting the need for long-term, multi-season studies on cumulative impacts of organic and inorganic fertilizer management on soil physical properties in tomato production systems.

Lantz, Evy, "Reframing Self-doubt: Examining Mindset and Self-compassion Interventions in Evaluative Academic Contexts" (Qin Zhao)

Chronic self-doubt is associated with negative psychological outcomes and can cause significant distress in academic contexts. Students experiencing chronic self-doubt may engage in maladaptive coping strategies such as procrastination, avoidance, and excessive social comparison as a means of externally evaluating their competence relative to peers. Despite extensive literature documenting these consequences, research examining effective interventions for chronic self-doubt remains limited. The present study experimentally examines whether reframing self-doubt through mindset-based interventions and self-compassion can reduce its adverse psychological effects and improve performance outcomes. Building on prior research demonstrating that mindsets about self-doubt can be experimentally shifted, this study extends the framework by incorporating a self-compassion condition designed to address psychological outcomes that mindset interventions alone have not consistently improved. Participants will be randomly assigned to one of three conditions: self-doubt-as-resource, self-compassion, or a no-treatment control group. Outcome variables include affect, self-esteem, task engagement, and social comparison orientation, and gender will be examined as a moderator of intervention response. Findings may contribute to the development of brief psychological interventions that help individuals interpret and manage self-doubt more adaptively in evaluative academic environments.

Ledford, Kobe, "Loan Default Data" (Lily Popova Zhuhadar)

Banks can lose significant money when borrowers fail to repay loans, and predicting default risk in advance is challenging. This project uses a loan dataset with borrower information—such as income, loan amount, and credit history—along with the outcome of each loan (repaid vs. defaulted). The analysis applies classification models to identify patterns and key factors associated with loan default. Data preparation includes cleaning, handling missing values if needed, and encoding categorical variables. Model performance is evaluated using confusion matrices and metrics such as accuracy, precision, recall, and ROC-AUC to measure how well the model distinguishes high-risk from low-risk applicants. The results demonstrate how predictive analytics can support stronger loan approval decisions, reduce financial risk, and improve portfolio health by prioritizing applicants who are more likely to repay while flagging those with higher default probability.

Lee, Henry, Byl, Jacob, "Evaluating Renewable Energy Growth Dynamics and their Implications for Climate Change Mitigation" (Jacob Byl)

Accurate long-term forecasting of renewable energy adoption is essential for climate planning and energy

system design. Many transition models implicitly assume sustained exponential growth, yet physical, economic, and infrastructure constraints suggest eventual saturation. This study evaluates the validity of exponential growth assumptions by comparing linear, exponential, and three-parameter logistic models applied to historical renewable energy share data across multiple countries. Model parameters are estimated using nonlinear least squares, and performance is assessed in-sample via root mean squared error (RMSE). In most cases, exponential models achieve lower RMSE, reflecting the early-stage expansion of renewable adoption in many countries. However, exponential growth implies unbounded long-term behavior and frequently produces physically implausible projections when extended beyond observed data. To address this limitation, we implement constrained logistic models incorporating explicit carrying-capacity parameters to represent saturation effects. Although logistic models do not always outperform exponential models in short-term statistical fit, projection analysis reveals substantial divergence beyond 2030–2050. These findings demonstrate that short-term accuracy does not ensure long-term structural validity and highlight the importance of incorporating saturation dynamics in renewable energy transition modeling.

Leon Golib, Salvador, "Risk Stratification in Auto Insurance: A Predictive Modeling Framework" (Lily Popova Zhuhadar)

Insurance companies face ongoing pressure to manage risk while maintaining competitive pricing. One of the most important challenges is identifying policyholders who are more likely to file claims before losses occur. This project addresses that problem by developing a predictive model using the Car Insurance Claim Prediction dataset (#23), which includes driver demographics, vehicle characteristics, and policy-related variables. The target variable is a binary outcome indicating whether an insurance claim occurs. To model this behavior, the analysis will apply Logistic Regression as the primary classification approach. This model was selected because it balances predictive performance with interpretability, allowing insurers to understand how specific factors influence claim probability instead of relying on complex black-box methods. Model performance will be evaluated using metrics such as accuracy, precision, recall, and confusion matrices to ensure practical decision-making value. The expected impact of this analysis is a clearer framework for risk assessment and customer segmentation. Predicting claim likelihood can support stronger underwriting decisions, more informed pricing strategies, and better resource allocation across insurance operations. This project shows how a practical and interpretable model can turn insurance data into insights that support smarter business decisions across organizations.

Ley, Elena, "Assessing Student Learning and Engagement in an Introductory Physics Lab for Life Science Students" (Scott Bonham)

The life science physics labs at WKU are largely confirmation labs, where students perform labs to get specific results that confirm what they have been taught. This type of lab has been shown to be ineffective for student learning and can often suppress engagement. Instead, labs should focus on developing experimentation skills. We are assessing and documenting student engagement and learning with the current curriculum via observations of laboratory sections and an end-of-course survey. Initial observations suggested that many students were not very engaged in the lab, with significant time devoted to filling out the lab manual. Survey responses indicated that students valued collaboration and

data interpretation but felt that TA preparation, the lab manual, and making connections to the lecture course and with their majors could be improved. Building on these findings, we are continuing to observe lab sections and are conducting a systematic analysis of student work to further examine how students engage in the labs. A departmental committee has developed new learning objectives for a revised curriculum based on input we received from faculty groups from life science departments on what skills are most important for their students.

Macy, Emma, Gallagher, Ethan, Link, Kim, "Answering the Call: Connections Between Volunteerism and Mental Health" (Ritchie Taylor)

Teens are experiencing increased rates of depression and anxiety. One contributing factor is disconnection from community. Adolescents currently volunteer less than previous generations, yet research has shown that adolescents who volunteer regularly report lower rates of depression and an overall greater sense of well-being. Fire departments across the United States have experienced large decreases in volunteers. This highlights a mutually beneficial opportunity. The purpose of this project is to explore how volunteerism impacts mental health. The project examined the fire service as a model of community-based volunteerism. Researchers interviewed 10 firefighters regarding their motivations for joining the fire service, benefits to serving the community, and what they believe community members should know about their service role. Interviews were then written into short stories that were accompanied by a portrait of the interviewee. These stories and portraits were displayed at an event where community members viewed and reflected upon how the stories impacted them. Event attendees were asked if they currently volunteered, if they felt volunteering improved their overall health, if they were aware of the connection between volunteerism and mental health, and if they intended to volunteer in the future. Additionally, they were asked about the impact the event had on them personally.

Macy, Jay, "Health Risks and Regulations of Drinking Water" (Jacqueline Basham)

Water quality serves as one of the most critical components of public health due to the importance and necessity of safe drinking water. While consumers may often view all commercial drinking water sources as safe for consumption, it is important to note possible risks that are specific to each type of drinking water. This poster presentation will explore the possible risks associated with three types of drinking water. Contaminants can be introduced into drinking water sources throughout both collection and filtration processes. Tap water, while being the most highly regulated and used water source within the United States, can still be found with contaminants like lead and copper due to aging infrastructure or industrial pollution. Filtered water can also present health issues if filters are not properly cared for, along with some filters' inability to remove harmful contaminants. Contamination from wildlife, agricultural runoff, and other pollutants can also influence the quality of Spring Water, which marketing centers around the natural traits it carries. While every type of drinking water may pose its own possible risk to public health, proper maintenance, consistent regulations, and further public awareness can help decrease these possibilities of harm to the public.

Mageed, Laila, "Azure Vista" (Shahnaz Aly)

The intent for the project was to develop a free-form resort that embodied architectural curvature, would captivate guest, and fit into its surrounding nature. Driven by a passion for free-form and unconventional

design, this resort was created to feel effortless yet strikingly beautiful. Its curvature embraces the mountainous landscape, and its form is woven into the contours of the site. Anchored atop the mountains, Azure Vista is visible from the valleys and the ocean shoreline below. Standing as a prominent feature of Orange County, California, Azure Vista is an unmistakable landmark. This resort serves as a luxurious stay, designed to accommodate a diverse range of guests. Its design integrates a variety of amenities, from swimming pools and spas to children's entertainment centers and event spaces. Framed by the mountains and the ocean, this open-design resort offers breath-taking scenery in every direction. Its restaurant and spa accommodations alone, offering high-end service, is a travel destination for many visitors.

Marcum, William, Carmichael, Maria, Marcum, William, Farley, Norman, Carmichael, Maria, "Linear Perspective as a Source of Information About Environmental Slant" (Farley Norman)

Twenty-five observers (ages ranged from 19 to 80 years) judged the slant-in-depth of a rectangular (98 x 120 cm) physical surface, where the actual slants varied from 20 to 65 degrees. The rectangular surface possessed narrow wooden slats oriented along the longer axis; a column of LED's (light emitting diodes) ran along the center of each lengthwise-oriented slat. When viewed by an observer in lighted conditions, the physically parallel slats of the slanted surface appeared to converge (in a projected image, such as a retinal image) due to the effects of linear perspective. Likewise, when viewed by an observer in the dark, the six columns of LED's also converged in the observers' retinal image. The observers' task was to adjust the orientation of a line on a computer monitor until its orientation matched the perceived slant of the rectangular surface in depth. Linear regressions obtained for each observer in both full-cue and dark conditions showed that the observers (both younger and older) could perceive environmental slant almost as well in the dark (when only linear perspective information was available) as in fully lighted conditions (average correlation coefficients were 0.952 and 0.932 for lighted and dark conditions, respectively). The results clearly demonstrate that linear perspective is a powerful and effective source of information about environmental slant.

Mason, Lance, "Predicting Whether a Product Shipment Is Delivered on Time" (Lily Popova Zhuhadar)

On-time delivery is a key performance metric in e-commerce because delays reduce customer satisfaction, increase support costs, and signal inefficiencies in the fulfillment network. This project uses the E-Commerce Shipping dataset from Kaggle (10,999 shipment records) to predict whether a shipment will be delivered on time and to identify the operational factors most associated with late delivery. The dataset includes variables such as warehouse block, mode of shipment, customer care calls, product importance, discount offered, prior purchases, and product weight. The target variable, Reached on Time Y.N, is binary: late (1) vs. on time (0). The analysis will follow a standard workflow: data cleaning, handling missing values (if present), encoding categorical predictors, scaling numeric features when appropriate, and splitting the data into training and test sets. The project will check for class imbalance and use imbalance-aware techniques if needed. Multiple classification models will be trained and compared, including Logistic Regression (baseline and interpretability) and Random Forest (nonlinear relationships and feature interactions). Performance will be evaluated with confusion matrices, accuracy, precision, recall, F1-score, and ROC-AUC, with attention to the cost of predicting "on time" when a shipment is actually late. Results will highlight key predictors and provide actionable recommendations to reduce

delays.

Matthews, Ava, Srivastava, Ajay, "Isolating the Role of V-ATPase in Metastasis of the Air Sac Primordium in *Drosophila*" (Joseph Marquardt)

During tumor metastasis and normal development the basement membrane (BM), a specialized form of extracellular matrix, is remodeled. The air sac primordium (ASP) is the larval precursor of the dorsal thoracic air sacs in *Drosophila melanogaster*, a structure that supplies oxygen to the flight muscles. ASP development proceeds in response to certain signals, culminating eventually in the invasion of larval wing imaginal disc. As such, the wing imaginal disc is a model for invasive cellular behavior. Our study attempts to understand the role of a proton pump, V-type ATPase (V-ATPase), in the development of the ASP. We created a generation of *D. melanogaster* larvae with downregulated V-ATPase in the ASP through RNA interference. Employing immunohistochemistry and fluorescence microscopy, we analyzed the structure of the ASP by visualizing GFP and the respective target protein (E-Cadherin, Armadillo, or DLG) indicated by Alexa Fluor 546. We will present our findings that shed light into the role of the V-type ATPase in ASP development with implications for better understanding of tumor metastasis.

Matthews, Brian, Bradder, Sarah, "Microstructural Analysis of the Heat-affected Zone in Laser Cut Alloys" (Benjamin Dinan)

Microstructural Analysis of the Heat Affected Zone in Laser Cut Alloys is a poster presentation examining how fiber laser cutting influences the heat-affected zone HAZ, hardness variation, and microstructural transformations in low-carbon steels. The project investigates how thermal input during laser cutting alters material behavior in AISI 1075 steel. Cutting was performed using a GWIKE M3 Ultra system equipped with a 1200 W fiber laser operating at full power, with parameters adjusted to modify heat input during processing. Cross-sectional samples were mounted, ground, polished to a one-micron finish, then etched and prepared for metallographic analysis to evaluate HAZ size and phase changes. Microhardness testing was conducted using Vickers indentation under a 500 g load and 13 s dwell time to quantify hardness variation across the cut edge. Preliminary results and supporting literature indicate that increased thermal input reduces grain size in the weld metal and HAZ while increasing hardness, and that HAZ dimensions decrease with optimized frequency control. These findings highlight the strong relationship between laser parameters and microstructural response, providing insight for improving cut quality and mechanical reliability in structural steel applications.

McCorkle, Kelsie, "Ballistic Testing of Upper Jaws in Scale and Non-scale Feeding Lepidophages Using a Spring-loaded Rail Gun" (Steve Huskey)

Scale-feeding fishes possess a remarkable adaptation for dislodging nutritious scales from their prey. Many scale-feeders have extraoral teeth that protrude from their upper jaws. This study examined morphological differences among extraoral dentition in scale-feeding and non-scale-feeding characiforms. We assessed the efficiency of scale removal among several independent lineages of scale-feeding fishes. We predicted that obligate scale-feeding fishes would be more effective at removing scales than facultative or non-scale characiforms. We employed micro-CT imaging and 3D morphometrics to analyze the morphological variation in extraoral dentitions. For dynamic performance testing, we created 3D models of the upper jaws and used a spring-loaded rail gun to simulate the

ramming action. The 3D-printed jaw models were affixed to an actuated bolt and then launched at freshly euthanized fish to test the effectiveness of scale removal. We conducted tests on seven species, each undergoing 21 trials on Ecoflex gel, and tested for species effects against euthanized sand perches to assess scale dislodgement. We reveal that obligate scale feeders dislodged more scales than facultative and non-scale feeders, indicating that their specialized dentition is more effective for this feeding strategy.

McGaha, Marietta, Carden, Mykah, Domingos-Luz, Leandro, Lo, Edward, Silva, Aguinaldo, Kuerten, Sidney, Pessenda, Luiz Carlos Ruiz, McGlue, Micheal, "A ~5,000-year Paleoecological Record Of Wetland Change In Lake Chacororé, Brazilian Pantanal" (Giliane Rasbold)

This study reconstructs ~5,000 years of ecological change in Brazil's Pantanal using a 106-cm sediment core from Lake Chacororé, Mato Grosso. An age-depth model was built using seven radiocarbon (¹⁴C) dates. Siliceous microfossils (diatoms, sponge spicules, and phytoliths) were extracted via 35% hydrogen peroxide oxidation and used as paleoecological proxies. Three distinct paleoenvironmental phases were identified. From ~5020 to ~4200 cal yr BP, high sponge spicule abundance (*Tubella* sp., *Radiospongilla* sp., and *Dosilia* sp.), low diatom presence, benthic-dominated assemblages (planktonic/benthic ratio 0.1–0.39), and greater C4 mesic plants indicate shallower water conditions. Between ~4200 and ~1300 cal yr BP, abundant diatoms, high planktonic/benthic ratios (2–9), centric diatom dominance, and reduced sponge spicules reflect a shift toward deeper, open-water conditions, with C4 mesic plants. From ~1300 cal yr BP to the present, the predominance of *Tubella variabilis*, *Drulia* sp., and *Radiospongilla amazonensis*, lower diatom presence, reduced planktonic/benthic ratios (0.2–1.85), and increasing C3 grasses and tree/shrub phytolith morphotypes, reflects a return to shallower, littoral-influenced conditions with notable vegetation change.

McKeehan, A.J., "Reimagining the Church as a Community Centered Space" (Shahnaz Aly)

The senior architecture capstone project explored the design of a church as a central place for community connection, engagement, and shared identity. The project investigated how architectural form and spatial layout can foster social interaction beyond traditional worship, positioning the church as a welcoming civic anchor within its rapidly growing city. The design process involved site analysis, program development, and precedent research to understand how sacred spaces can also function as inclusive gathering environments. Key design strategies include flexible gathering and event spaces, daycare areas, and the integration of indoor and outdoor gathering areas to encourage interaction among diverse user groups. The final design proposed a church that supports worship, education, and community activities while reinforcing a sense of belonging and accessibility. By emphasizing openness and inclusiveness, the project demonstrates how church architecture can strengthen social bonds to embrace community life.

McReynolds, Jae, Aguilar, Hector, Clark, Coleman, "Prevalence of Burnout Among Physical Therapists with Various Levels of Experience" (Kurt Neelly)

Introduction: Burnout is highly prevalent among physical therapists (PT) and is influenced by workload, stress, financial burdens, and family support. PTs report moderate to high levels of burnout, as measured via the Oldenburg Burnout Inventory (OLBI) exhaustion and disengagement scales. However, limited

research exists comparing the relationship between burnout and specific clinical experience levels. The purpose of this study is to compare burnout prevalence and related characteristics between PTs with 3–5 years and 10–15 years of clinical experience. Methods: This study was a retrospective, cross-sectional, exploratory design. Licensed PTs from Kentucky, Indiana, and Tennessee were recruited with the assistance of their respective state PT associations to complete a short survey assessing burnout via the OLBI and other factors potentially associated with burnout. Experience level (3–5 years, 10–15 years) served as the independent variable. Paired t-tests were conducted to compare OLBI scores between groups. Results: Statistical analysis will be conducted to compare OLBI burnout scores and associated factors between experience groups. Discussion: This study aims to determine whether burnout differs based on experience level. Findings may provide valuable information and contribute to advancing research on burnout among physical therapists.

Meade, Lily, "Pathways to Suicide Attempts and Nonsuicidal Self-injury in Young Adults" (Amy Brausch)
Problem: Suicide is a leading cause of death for young adults in the United States. Nonsuicidal Self Injury (NSSI) is a prevalent issue among undergraduate college students in America (Taliaferro & Muehlenkamp, 2014). The Card Sort Task for Self-Harm (CaTS) was developed to examine the timeline of events, thoughts, and emotions leading to self-harm behavior. This study used the CaTS to examine timelines leading up to suicide attempts and NSSI. Procedure: This study included 151 college students from a South-Central University ($M_{age} = 20.11$). Most of the sample identified as female (65%), SGM (60%), and white (84%). Over half (61.8%) reported NSSI, and 38.2% reported a suicide attempt within the past two-years. Participants were recruited via a screening survey, and were contacted to participate in the follow up study if they were eligible. Participants were eligible if they had NSSI in the past two years and no history of suicide attempts, or if they had a suicide attempt in the past two years. Participants completed the CaTS individually in the research lab. They selected and positioned relevant cards on a timeline from 6 months before up to 1 hour before the self-harm. Cards represent different thoughts, feelings, events, and behaviors that led up to their most recent NSSI or SA. Results: High frequency cards were determined by examining the frequency that each card was selected by participants overall and in each group. Participants who completed the CaTS for SA and NSSI were found to have some high frequency cards in common such as "I felt depressed and sad" and "I feel exhausted." Over 70% of both groups used both of these cards. Over 86% of the suicide group used the card, "I hated myself." The NSSI group's most frequently used card was "I felt very anxious," where over 79% of participants chose this card. SA group's most used cards were "I felt depressed and sad," and "I hated myself," with both having over 86% of participants using them in their card sort. Of the SA group, 82% used cards staying "I wanted to die"/ "I wanted to kill myself." Conclusions and implications: Both the NSSI and suicide groups shared multiple high frequency cards. The suicide group was more likely to choose cards about wanting to die. For young adults, the overlap between suicide and NSSI factors is large and implies that certain factors can lead to both suicide or NSSI, although anxiety was at a higher frequency for NSSI.

Meador, Cole, "Spatial Transcriptomics Reveals Molecular Pathways Underlying Neural Regeneration in Larval Sea Lampreys" (Hilary Katz)

In mammals, spinal cord injuries typically cause irreversible neurological deficits, whereas larval sea lampreys (*Petromyzon marinus*) exhibit remarkable regenerative capacity following spinal cord

transection. To investigate the molecular mechanisms underlying this recovery, we employed spatial transcriptomics to characterize region- and time-specific gene expression before and after injury. Transcriptional profiles from rostral and caudal tissues at 1- and 3-weeks post-injury were compared against uninjured controls. Differentially expressed genes were ranked by the product of significance and sign of log₂ fold change, then subjected to functional enrichment analysis via Enrichr using GO Biological Process 2021, Reactome 2022, KEGG 2021, and ARCHS4 TFs Coexp gene sets. This revealed distinct spatiotemporal patterns of pathway activation, including upregulation of FGF and Notch signaling in rostral relative to caudal tissue at 1-week post-injury. An additional ranking by log₂ fold change with an adjusted p-value cutoff was analyzed using DAVID, revealing enrichment of specific protein-protein interaction motifs, notably ARM-like domains. Our findings highlight key molecular processes contributing to successful neural regeneration in lampreys and provide insight into potential therapeutic targets for spinal cord injury in humans.

Meadows, Adam, Gilliam, Emma, "Towards Vitamin C Polymerization via Acetal Linkages and Ene-diol Functionalization" (Lawrence Hill)

Towards vitamin C polymerization via acetal linkages and ene-diol functionalization. Ascorbic acid (vitamin C) is a redox-active molecule with antioxidant properties that degrades into smaller molecules after exposure to reactive oxygen species. Incorporating ascorbic acid into polymeric materials may enable selective degradability, which could be useful for drug-delivery systems. This project aims to synthesize ascorbic acid-based monomers, and polymerize them through acetal linkages, ether linkages, and calcium ions. We will then evaluate their antioxidant activity and degradation behavior in the presence of reactive oxygen species. Ascorbic acid modifications were accomplished via acid catalyzed acetalization with acetone, etherification with 1-bromohexane, and ionic precipitation with calcium carbonate. Target structures were confirmed by proton nuclear magnetic resonance spectroscopy. These results demonstrate that ascorbic acid modification is possible at two separate sites, the vicinal diol and ene-diol. Future work will explore using the modification of the vicinal diol to create a monomer with two ascorbic acid functionalities, followed by polymerizing this monomer through modification of the ene-diol sites, and assessing the antioxidant activity and degradation rate of the polymer.

Medley, Christopher, "Predicting Credit Default Risk Using Classification Models"

(Lily Popova Zhuhadar)

Credit risk default can be a major factor in whether the credit lending company is able to stay profitable. This project will highlight multiple classification models that predict whether the customer will default on their financing or not. The data set includes variables such as age, income, and loan amount to predict whether a credit default will happen. The target variable is binary, where 1 signifies that the customer defaulted on their credit, and 0 represents a customer that did not default. Different classification models, such as Logistic Regression, Random Forrest, Gradient Boosting, Neural Networks, and others, will be evaluated. To evaluate the effectiveness of these models, different metrics and visualization tools will be used to show how accurate, or not, the models were at predicting credit default. By effectively implementing this model, the credit company will be able to mitigate its risk when lending. These models will assess risks appropriately while maintaining responsible credit lending.

Menig, Matthew, Bramblett, Trevor, "An Updated Kentucky Snowfall Impact Scale (kysis)"

(Gregory Goodrich)

Background: Kentucky is not a state known for snowstorms or blizzards, but when snowstorms occur in Kentucky they cause massive disruption to transportation networks, commerce, and school systems, especially in rural counties. While the cities of Lexington and Louisville have comprehensive snow removal plans and dozens of snowplows, many rural counties have only a handful of snowplows, if that. Before research can be done to investigate how atmospheric conditions associated with major snowstorms in Kentucky are changing, a historical climatology of heavy snow events and their impacts on populated areas must be completed. Previous efforts to develop a climatology of snowstorms in Kentucky have been done on smaller time scales or with inconsistent methodologies. This project will use methods from the Squires et al. (2014) manuscript on developing a Regional Snowfall Index and will continue previous work by Walker et al. (2008). This study will address the following objectives: Develop a climatology of snowstorms in Kentucky from 1960-2025 Quantify the severity of these snowstorms using the Regional Snowfall Index Quantify temporal trends in Kentucky snowstorms.

Meredith, Christopher, "Predicting Loan Defaults" (Lily Popova Zhuhadar)

Accurately predicting loan defaults is a critical credit risk challenge for financial institutions because lenders must minimize losses while sustaining healthy, profitable loan growth. This project addresses that business need by developing a predictive model that estimates the likelihood a borrower will default, supporting better lending and pricing decisions. The analysis uses the LendingClub historical loan dataset, which contains borrower and loan attributes such as income, employment history, loan amount, interest rate, and credit-related indicators, along with repayment outcomes. The target variable is loan status (e.g., fully paid vs. default), representing the lender's financial risk exposure. Following data preparation steps (cleaning, handling missing values, and encoding categorical variables), supervised classification models—such as Logistic Regression and tree-based methods (e.g., Decision Tree/Random Forest/Gradient Boosting)—will be trained and compared. Model performance will be evaluated using confusion matrices and metrics such as accuracy, precision, recall, F1-score, and ROC-AUC, with attention to the cost of misclassifying high-risk borrowers. The expected outcome is an interpretable, actionable risk-scoring approach that helps banks reduce default-related losses, improve underwriting consistency, and strengthen portfolio performance through data-driven credit decision-making.

Mick, Wyatt, Howard, Caldwell, Vanderstroom, Sebastian, Foley, Owen, Covey, Sav, "Still Here"

(Shaina Feldman)

"Could I still carry some part of my younger self with me without feeling like I'm being haunted by her?" This was one of the first questions that stemmed the creation of Still Here, a short film following a trans man haunted by his childhood. This was drawn from varying experiences and levels of acceptance from myself as a trans adult, as well as from other people I know. My production designer and I worked to create a monster in the film that felt like a physical manifestation of gender dysphoria and the societal expectations that trans people face their entire lives. This monster is not only a representation of these struggles, but a demonized re-imagination of Frank's younger self that stalks him throughout his house. Ultimately, this leads to the dramatic question of the film: can Frank defeat his monsters and accept all

parts of himself?

Mikeworth, Elizabeth, Rich, Timothy, "Boundaries of Belonging: Exploring Public Perceptions of Immigrants in South Korea" (Timothy Rich)

What explains public perceptions of immigrant groups in South Korea? Existing research suggests a public that differentiates immigrant groups, but does not specifically focus on potential for assimilation, the presumed underlying preference of the population. Using an original web survey with an embedded experiment, we assess attitudes toward immigrant assimilation in general and three specific groups: North Korean arrivals, Chinese ethnic Koreans ("Joseonjok"), and non-ethnic Korean immigrants. We find that respondents view North Koreans as more capable and Joseonjeok less capable of assimilating. Ethnic conceptions of national identity as well as authoritarian acceptance are associated with greater pessimism about assimilation. Strikingly, concerns about immigrants' economic, cultural, and social impacts show little variation across groups. This study aims to disentangle the complicated relationship between co-ethnicity and belonging by isolating ability to assimilate as a dimension to be evaluated. These findings suggest that while group identity shapes some perceptions, broader anxieties about immigration remain diffuse and relatively undifferentiated. In this manner, we find that the public creates opinion regarding who belongs more so based on conceptions of the ability to assimilate rather than particular worries about economic competitions, cultural differences, and national security.

Miles, Quade, Polk, Jason, "Climate Pollution Monitoring via an Air Quality Network for the Bowling Green Metropolitan Statistical Area" (Jason Polk)

This study aims to investigate air quality across the Bowling Green Metropolitan Statistical Area (Warren, Edmonson, Butler, and Edmonson Counties) by deploying a network of monitoring systems equipped with Clarity's Node S and Multi Gas Modules. These systems measure key pollutants, including particulate matter (PM), volatile organic compounds (VOCS), Nitrogen Dioxide (NO₂), and other gases. The data collected provides real-time insight into local air quality, enabling a comprehensive understanding of pollution levels in the region. By analyzing spatial variations in pollutant concentrations, the study seeks to identify potential pollution sources and assess their impact on public health and the surrounding environment. The deployment of these sensors will enable monitoring over a large spatial scale, improving the ability to detect pollution events across the BG MSA. The data contribute to ongoing local environmental monitoring efforts while also supporting broader public health initiatives aimed at reducing exposure to air pollutants. Through collaboration with local stakeholders, the goal is to develop actionable strategies for improving air quality. The results of this research will contribute data for environmental management and public health initiatives, ultimately helping inform policies and actions aimed at creating a cleaner and healthier environment across the region.

Miller, Emily, Lucas, Abigail, "Perceptions of Pregnant and Postpartum Women on Pelvic Floor Physical Therapy in a Rural Healthcare Setting" (Ashton McPherson)

Abby Lucas, Student Physical Therapist; Emily Miller, Student Physical Therapist Dr. Ashton McPherson, PT, DPT, PCS Introduction: Pelvic health physical therapy is a subspecialty of physical therapy aimed at promoting pelvic and abdominal health in individuals. Previous studies have demonstrated the beneficial outcomes that pelvic health physiotherapy can provide to those who are pregnant and post-

partum. However, these populations in rural communities have not been surveyed to determine their perceptions of pelvic health physical therapy. The purpose of this study is to determine the perceptions that are held by this population within a rural healthcare setting regarding the benefits, outcomes, and/or perceived risks of pelvic health physical therapy. Methods: In this descriptive, cross-sectional study, a survey will be administered to pregnant and postpartum women who have received pre, peri, or postnatal care at TJ Samson Community Hospital. The independent variables to be compared are the perceptions of women who have received pelvic health care and those who have not. Results: Data will be recorded through a Qualtrics survey, and a Mann-Whitney U statistical analysis will be done on each survey item. Discussion: The study's findings will contribute to the body of literature regarding health care access, specific to the subspecialty of pelvic health physical therapy and the impact in rural communities.

Miller, Keegan, Davis, Amalyah, Boateng, Ama, Lickenbrock, Diane, "Hush, Little Baby Don't Say a Word, Mama's Going to Sooth All Your Hurt: Examining the Association Between Infant Soothing and Reactivity with Mothers and Fathers" (Diane Lickenbrock)

A parent's sensitivity to an infant's distress is a critical aspect of child development (Leerkes et al. 2009). Prior research has historically focused on mother-infant findings, but recent work has begun to examine both mother-infant and father-infant dynamics (Cabrera et al., 2018), revealing parenting differences in how mothers and fathers interact with their infants. The current study examined the relationship between parent soothing and infant reactivity. Parent report of infant temperament at 4-months was used from a larger longitudinal study ($n = 103$ families; Infant Behavior Questionnaire-Revised, Gartstein & Rothbart, 2003). For mothers, soothing was correlated with infant negative reactivity ($r = -.276, p = .007$), surgency ($r = .433, p$

Minter, Hannah, Minter, Hannah, Wichman, Aaron, Brausch, Amy, "Affective Reactivity to Uncertainty: The Role of Intolerance of Uncertainty in Anxiety Responses" (Aaron Wichman)

Intolerance of uncertainty (IUS) reflects a dispositional difficulty tolerating uncertain situations and has been consistently associated with anxiety and worry. However, much of the existing literature relies on correlational or retrospective self-report methods, leaving unclear whether IUS predicts heightened reactivity to experimentally induced uncertainty. The present study addressed this gap by manipulating uncertainty and examining its effects on state anxiety and cognitive uncertainty. The main idea focuses on higher IUS predicting greater post-manipulation anxiety and moderated responses to the uncertainty induction, such that individuals high in IUS reporting elevated anxiety following uncertainty exposure. In contrast, IUS was not associated with increases in cognitive uncertainty. These findings suggest that IUS reflects heightened affective reactivity to uncertainty rather than generalized amplification of uncertainty-related cognitions.

Moreno, Lorenzo, "Scalable Groundwater Flood Forecasting for Urban Karst Environments Using a Hybrid Modeling Approach" (Jason Polk)

Karst aquifers respond to rainfall through fast, nonlinear, and threshold-controlled processes in which storm-driven recharge, subsurface storage exchange, and conduit activation interact to generate groundwater flooding. This study introduces the Karst Aquifer Recharge and Storage Threshold – Hybrid Exchange Learning Model (KARST-HELM), an event-based, physics-informed forecasting framework

designed to produce short-term (1–72 hour) probabilistic forecasts of groundwater flooding in urban karst systems. The model is applied to the Lost River and Jennings Creek basins of Bowling Green, Kentucky. KARST-HELM conceptualizes the karst aquifer as a coupled three-domain system consisting of epikarst storage, matrix storage, and conduit flow, with storm events treated as discrete hydrologic perturbations. High-frequency rainfall, groundwater pressure, and temperature observations are integrated with dye-trace data to constrain subsurface transport behavior and reduce parameter equifinality. Storm-scale hydraulic responses are further resolved using temperature-derived proxies that capture spatial variability in connectivity and conduit activation. These physically interpretable state variables inform probabilistic forecasts generated using gated recurrent unit (GRU) and long short-term memory (LSTM) networks trained on event-based sequences. Forecast outputs are expressed as predictive quantiles (P10–P50–P90) of groundwater level, conduit activation probability, and flood exceedance. KARST-HELM provides an uncertainty-aware framework for forecasting groundwater flooding and diagnosing hydrologic drivers in urban karst environments.

Moseley, Riley, Taher, Salim, Gilmore, Ryan, "Enhancing Driver and Pedestrian Safety at Roundabouts: A Driving Simulator-based Study" (Kirolos Haleem)

This study evaluates the safety risk of driver distraction and different age group performance while navigating roundabouts in Kentucky using a high-fidelity driving simulator. Data collection takes place at the WKU Center for Transportation Research. The study involves 60 participants (with valid Kentucky driver's licenses) evenly split into two groups: "18-54 years young age group" and "55+ years old age group". Participants were familiarized with the driving simulator using a practice route for five minutes prior to the main driving experiment. After completion, participants drove through four different single-lane roundabout scenarios: roundabout with only pedestrian traffic; roundabout with both car and pedestrian traffic; roundabout with only pedestrian traffic, as well as participant distraction; and finally, roundabout with both car and pedestrian traffic, as well as participant distraction. For each distraction scenario, participants were texted "Good day," and were expected to send the same text back, simulating texting while driving (i.e., distraction) within the roundabout. Eye-tracking and video recordings of each participant were collected and are being analyzed. Once data collection is finalized, safety risk metrics will be analyzed from the simulator output, including stopping sight distance (SSD), lane variance, speed variance, and time-to-collision (TTC).

Mulrooney, Kayden, "A Tradition of Secrecy: LGBTQ+ Rights in the American Military from World War II to the Present" (Patricia Minter)

Under the watchful eyes of Uncle Sam, LGBTQ+ Americans were given an ultimatum: fulfill their patriotic duty to serve in the military but live in secrecy. Of the approximately 16 million people that were drafted during World War II, historians estimate that between 650,000 and 1.6 million were gay. This project aims to shed light on a part of American history that was forced into hiding because of the law and social stigmatization. My research examines statutory law, newspaper articles, and the limited amount of published research on the topic to tell this story, as the emphasis on secrecy has caused significant gaps in knowledge. The project differentiates between lesbian, gay, and bisexual individuals and transgender individuals due to the difference in treatment. While LGB people can openly serve in the military, transgender people are not given the same right. My research connects the treatment of gay and transgender people within the military and the advancement of social movements.

Myers, Trace, Bollinger, Katie, Ecton, Amanda, Martin, Christian, Mancini, Anthony, "Feasibility of Virtual Reality Gaming as an Intervention for Subjects with Persistent Low Back Pain" (David Bell)

Introduction: Low back pain is prevalent across the lifespan and can negatively impact physical function and overall well-being. Aerobic exercise has been shown to reduce pain and improve health outcomes. Although Virtual Reality therapy has demonstrated benefits for pain reduction, limited research has examined its ability to achieve a specific target heart rate. The purpose of this study is to determine the feasibility of using a VR gaming intervention to achieve a target heart rate of 110 beats per minute in adults aged 18–65 with persistent low back pain. Methods: This quasi-experimental, prospective study will recruit adults aged 18–65 receiving physical therapy from local clinics and hospitals. After screening and informed consent, participants will complete a 20-minute session of Beat Saber using the Meta Quest 3 with continuous heart rate monitoring via Apple Watch. Heart rate (average and peak), Borg Rating of Perceived Exertion (RPE), and Numeric Pain Rating Scale (NPRS) scores will be collected immediately before and after the intervention. Results: Two-tailed paired t-tests will evaluate pre- to post-intervention changes in heart rate, RPE, and pain outcomes. Discussion: Findings will inform the feasibility of VR gaming for persistent low back pain.

Naik, Prthu, Novikov, Ivan, "Tracking Radiation in a Cloud Chamber Using a Stereo Camera DAQ" (Ivan Novikov)

The cloud chamber is a useful tool to visually see radiation. Cameras and an algorithm can be used to detect tracks and classify particle tracks within the cloud chamber. This is done with a stereoscopic camera system, which allows a 3d view of the cloud chamber. Track characteristics can then be accurately determined. This project used a Raspberry Pi 5 along with a stereoscopic camera system over a diffusion cloud chamber. Multiple videos were taken for two hours each. The code employed instance segmentation to map out the particle tracks and then used 3d reconstruction with the stereoscopic camera system to visualize the particles in a 3d plane. To classify particles, Linear Energy Transfer (LET) was utilized to differentiate between alpha and beta particles. After classification of the particles, their characteristics will be determined, such as track length, angle, and energy deposition. Additionally, Geant4 was used to generate data to train an AI to accomplish the goal of tracking, finding characteristics, and identifying the particle. The AI is planned to extend to identify Physics phenomena

like Compton scattering or delta rays. This research will allow a deeper understanding of how particles move through a medium with experimental results.

Naik, Prthu, Potts, Lincoln, Novikov, Ivan, Strange, Greg, "Developing a Temperature Control System for WKU's Wood Burning Kiln" (Ivan Novikov)

Wood-fired pottery kilns exhibit complex thermal behavior due to flame paths, combustion dynamics, and airflow patterns during extended firing cycles. The WKU Ceramics Club's wood kiln previously relied on a single thermocouple for temperature monitoring, providing limited insight into temperature distribution and making it difficult to achieve consistent firing results. We developed a Raspberry Pi-based system to monitor eight thermocouples positioned throughout the kiln, enabling real-time temperature tracking and comprehensive thermal profiling. The system uses an MCC134 thermocouple interface and cellular modem to transmit data to a central computer, overcoming WiFi connectivity limitations at the kiln location. Data is visualized through the ThingSpeak platform, allowing ceramics students to monitor firing progress remotely. We present results from Spring 2026 test firings that characterize temperature distribution across the kiln volume during complete firing cycles. This data will enable the pottery program to optimize kiln loading strategies and improve firing consistency.

Neagle, Presley, Moore, Olivia, Moore, Olivia, 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. In *Saccharomyces cerevisiae*, this coordinated regulation is exemplified by the kinase Elm1, which regulates the shape of the growing bud by linking cell cycle progression to bud growth. In cells without Elm1, the bud exhibits a dramatic elongated shape. This study investigates a possible downstream effector of Elm1: Ede1, an endocytosis scaffold we have linked to Elm1 using proteomics. Using classical yeast genetics, fluorescence microscopy, and protein expression, this study examined cell shape regulation by Elm1 and Ede1. Results show deletion of both genes causes a more dramatic elongation phenotype and cytokinesis defect. The cytokinesis defect was investigated using Chs2, the chitin synthase that builds the primary septum during cytokinesis and is regulated by Ede1-dependent endocytosis. It was found that Chs2 arrived prematurely at the bud neck and was ineffective in cytokinesis in the double deletion strain. Additionally, Elm1 regulates Ede1-GFP localization at the site of cell division just prior to cytokinesis. Since Elm1 and Ede1 have human homologs, these results could translate to human systems to better understand the complexities of cellular morphology-related diseases.

Newton, Lily, Chhabra, Trisha, Smith, Michael, "A Teleost Model of Melanin's Role in Otoprotection" (Michael Smith)

Lack of melanin is associated with deafness, suggesting that melanin may protect the inner ear. This research examines the protective role of melanin in the inner ear of koi (*Cyprinus carpio*) when exposed to acoustical stress. We hypothesized that black koi, which have higher inner ear melanin concentrations, would exhibit reduced sensory hair cell loss compared to their white counterparts. Fish were exposed to a 150 Hz tone at 155 dB re 1 μ Pa through an underwater speaker for 24 h in 4 groups of 6 fish (control-black; control-white; exposed-black; exposed-white). Following exposure, fish were

ethanized and fixed in 4% paraformaldehyde. The inner ears were then dissected, stained with phalloidin, and mounted and imaged under an epifluorescent microscope. Sensory hair cells were counted in 2500 μm^2 boxes at 7 pre-selected locations along the saccule. Sound-exposure significantly reduced saccular hair cell density in both color morphs, but this reduction was not mitigated in black fish relative to white ones as we predicted. This study was designed to investigate the potential of using teleost models to study the effects of melanin on auditory trauma, to reveal new possibilities for the development of therapeutics for human hearing loss.

Orner, Olivia, Barker, Elana, "Development and Implementation of the Jennings Creek/Lost River Watershed-Based Plan" (Jason Polk)

Developing protection measures to address the complex hydrology of the Jennings Creek watershed in Warren County, Kentucky was completed by establishing the first comprehensive Watershed-Based Plan (WSP) for this region, inclusive of both surface and subsurface runoff inputs. This WSP aims to identify impairments of concern, create a group of community stakeholders, and develop a final WSP framework that aligns with EPA requirements and Kentucky Division of Water. WSV development occurred through water samples collected weekly from March 2023 to March 2024 and analyzed at the WKU HydroAnalytical Lab. Water quality data were processed to determine nonpoint pollutant loadings, potential sources, and reduction measures. Additionally, stakeholders were consulted to identify opportunities for community input and community members were engaged through surveys and educational outreach efforts. Water quality analysis and visual assessment results indicate quantities exceeding regulatory standards for E. coli, nitrogen, phosphorus, suspended solids, trash, and streambank erosion, and the primary sources of contamination were determined to be agricultural and urban runoff, human waste leakage, and urban development causing erosion. These results were used to identify reduction targets and best management practices, providing a foundation for improved management of the Jennings Creek Watershed.

Osabutey, Evangeline, "The Fiction of Cultural Purity: Queerness and Narrative Authority in Ghana" (Kristi Branham)

Ghana is currently confronting legislation that seeks to criminalize not only same-sex intimacy, but advocacy, research, and public and creative expression related to LGBTQ+ identities. Supporters of the proposed anti-LGBT bill frequently defend it through the claims that queerness is "not our culture" but a Western import threatening Ghanaian identity. This assertion does more than justify legal restriction; it narrows the historical and imaginative boundaries of the nation. In this context, the struggle over queerness in Ghana is inseparable from a struggle over narrative authority. This talk argues that the "Western import" narrative functions as an act of foreclosure. By framing queerness as alien, parliamentary discourse authorizes a selective remembering of the past—one that disavows pre-colonial gender complexities and recasts colonial moral codes as indigenous truth. In doing so, it polices to only citizenship but narrative possibility. I contend that literature becomes a crucial site of resistance to this cultural foreclosure. Even in the absence of existing openly gender-fluid representation in Ghanaian literature, literary practice can function as a counter-archive—recovering silenced histories, challenging claims of cultural purity and widening what may be imagined as African.

Osbourne, Ethan, "What Makes a Song Popular?" (Lily Popova Zhuhadar)

Music apps have transformed how listeners discover and listen to music, creating large amounts of data on tracks and popularity. This project focuses on developing predictive and classification models using a Spotify tracks dataset to better understand the factors that influence song popularity. The dataset contains over 100,000 tracks sourced from Spotify, including both categorical and numerical data such as artist name and genre. The primary objective is to model track popularity as either a continuous or a categorical outcome. Supervised learning models, such as linear regression and logistic regression, will be implemented and compared. Model performance will be evaluated using metrics such as R^2 and RMSE for regression tasks, and accuracy and precision for classification tasks. Emphasis will be placed on identifying the most influential audio features that contribute to a track's success. The resulting predictive framework can provide insights for artists, producers, and streaming platforms by identifying the characteristics associated with higher listener engagement and performance.

Pahari, Samir, Gani, Nahid, "High-Resolution Machine Learning-Based Flood Susceptibility Mapping in the North Fork Kentucky River Basin, Eastern Kentucky" (Dr. Nahid Gani)

Flooding is among the most destructive natural hazards, causing not only infrastructure loss but also long-term disruption of livelihoods, essential services, and community recovery. In Eastern Kentucky's Appalachian valleys, flood risk is intensified by steep slopes, confined drainage networks, rapid runoff, legacy land disturbance, and valley-floor settlements that increase exposure. Predicting flood-prone areas in these confined landscapes remains challenging because complex interactions among topography, hydrogeomorphic connectivity, land cover, and subsurface permeability are not easily captured by conventional susceptibility mapping approaches. This study develops a high-resolution flood susceptibility model for the North Fork Kentucky River basin using multiparametric geospatial predictors derived from terrain, land cover, soil, geology, and decade mean annual precipitation data. A balanced flood inventory was compiled from event-focused using satellite observations with FEMA flood hazard datasets. Machine learning approaches, including a convolutional neural network (CNN) and hybrid integration models, were evaluated using cross-validation. Results indicate excellent model performance, with the CNN achieved very high discrimination ability (accuracy = 0.959). Hybrid models further improved classification performance at operational thresholds, enhancing accuracy and flood detection rates. The resulting susceptibility maps provide robust, high-resolution screening for flood-prone areas in confined Appalachian watersheds.

Palumbo, Rachel, King, Rodney, "Discovery and Isolation of Mycobacteriophage Smokels" (Rodney King)

Palumbo, Rachel Discovery and Isolation of mycobacteriophage Smokels (Rodney King) Bacteriophages are the most abundant entities on earth yet, only a small fraction have been isolated and characterized. The goal of this study was to isolate a single bacteriophage from an environmental soil sample using enrichment, serial dilutions, plaque isolation and purification, and amplification techniques to produce a high-titer lysate (1.29×10^9 pfu/mL) that was then processed for downstream genomic and morphologic analysis. Transmission electron microscopy revealed Smokels has a Siphoviridae morphology with an average tail length of 156.8 ± 4.8 nm and a capsid diameter of 46.3 ± 1.5 nm. Restriction enzyme digests produced well defined banding patterns and a large number of fragments from enzymes that have

GC rich recognition sites. Preliminary results from lysogeny experiments suggest that Smokels can form lysogens. This research was part of the SEA-PHAGES program (Science Education Alliance – Phage Hunters Advancing Genomic and Evolutionary Science), a program that provides hands-on undergraduate research to advance biological information about phages. Future experiments such as genome sequencing and confirmation of lysogen formation are recommended to advance the characterization of Smokels and further contribute genomic data to the SEA-PHAGES international database.

Pansuria, Anik, Dhasarathan, Suren, "Stress Hormones and Sleep Architecture in Mice: Establishing a Dose-Response Relationship." (Noah Ashley)

Sleep and stress are deeply interconnected systems, yet the precise relationship between stress hormones and their effect upon sleep architecture remains an active area of investigation. In rodents, corticosterone (CORT) is the primary hormonal mediator of the stress response, serving an analogous function to cortisol in humans. Here, we investigated how subcutaneous CORT injections (0.2 mg/kg, 2 mg/kg, and 20 mg/kg, dissolved in 100 μ L of sesame oil (vehicle)) affect sleep continuity in male C57BL/6J mice, using sleep bout duration as a key metric. Injections were administered at ZT6, which is representative of a middle-of-the-night arousal. By administering CORT, we aimed to simulate a heightened physiological stress state and observe its direct effects on sleep patterns using a non-invasive sleep and wake-tracking system based on piezoelectric technology. Given the parallels between rodent and human stress, findings from this model may offer meaningful insight into the mechanisms by which chronic stress disrupts sleep, with potential implications for understanding stress-related sleep dysfunction in clinical populations.

Patterson, Wilson, "Impact of Bilingual Book Access and Read-Aloud Videos on English Learners' Home Literacy and Parental Engagement" (Leslee Tarbett)

Limited access to book continues to affect many communities. Neuman and Moland (2019) coined the term "book deserts" to describe areas where books are scarce. Many students in our community of Bowling Green experience this lack of access (Hulan & Bailey-Tarbett, 2024). English Learners have additional challenges due to a lack of literacy materials and English being spoken in the home (National Center for Education Statistics, 2020). My FUSE project sought to address those needs by donating bilingual books paired with created read-aloud videos to local area elementary English Learners. The presentation will include information surrounding Home Literacy Environments (HLEs) and their impact on English Learners. This research is foundational for the project because it provided a framework to better understand students' circumstances and strengthen students' HLEs. I will also provide a look into the process of creating high quality educational bilingual resources. I will play a sample from the bilingual read-aloud videos and show what it takes behind the scenes to create effective translanguaging instructional resources. Additionally, I will highlight our ongoing research examining the project's impact in the community and discuss next steps moving forward.

Payette, Thomas, "Kentucky Artificial Intelligence Research: A Situational Awareness Tool for Meteorologists and Emergency Managers" (Joshua Durkee)

Kentucky has experienced various weather hazards, including severe thunderstorms, winter storms, high

winds, and flooding. Emergency management and situational awareness tools are used to improve the visibility of impending and ongoing threats. Traditionally, meteorological workflows involve sourcing data from multiple channels, which can hinder quick decision-making during high-impact situations. This project leverages AI to develop a Kentucky Artificial Intelligence Research (KAIR) multi-source situational awareness system, that collects, processes, and displays critical real-time weather intelligence. By integrating these multi-source datasets, an operational AI-driven product provides forecasters and emergency managers with a consolidated operational overview before, during, and after hazardous weather events. The Disaster Science Operations Center (DSOC) serves as the provisional nexus for operational meteorology and emergency management in support of state emergency operations and various national private industry partners. The DSOC AI Research lab (DSOC AIR) provides the resources to support AI-assisted research-to-operational tools such as KAIR through applied research, hands-on experimentation, and public feedback.

Pham, Elaine, "Restorative Nature & Design: An Architectural Reworking of Behavioral Health Spaces" (Shahnaz Aly)

Behavioral health facilities in Western Kentucky contemporarily are characterized by limited amenities and outdated institutional design, conditions that are inadequate when supporting patient well-being and recovery. As the region continues to face growing mental health needs, there is a critical demand for environments intentionally designed to nurture healing. This architectural design proposes a retirement of conventional institutional models seen within the region currently to a more human-centered architectural framework that prioritizes dignity, comfort, and restoration. The proposed design for the Western Kentucky Center for Behavioral Health and Rehabilitation (WKCBHR) balances form and function, advancing destigmatization through deliberate spatial organization that fosters warmth, openness, and safety. Through the thoughtful integration of materials and the incorporation of intimate secondary spaces oriented towards nature, the project positions architecture as an active participant in the healing process. With consideration of the site's existing context and the integration of biophilic principles, each design element contributes to a space that is both private and intimate, fostering restoration and mental revitalization for patients. Ultimately, WKCBHR reimagines behavioral health infrastructure as a contemporary restorative space centered around functionality, resilience, and providing opportunity for occupants to be grounded in human connection and nature during moments of vulnerability.

Pinkrah, Nana, "Climatology of Severe-Storm Environments in the Ohio River Basin Derived from Era5." (Xiangang Fan)

Severe convective storms pose a major hazard across the Ohio River Basin (ORB), producing tornadoes, large hail, and damaging winds. These events arise from complex interactions among atmospheric instability, moisture, and vertical wind shear, yet the long-term evolution of environments conducive to severe convection in the region remains insufficiently characterized. This study examines the climatology, and spatial distribution of severe-storm environments across the ORB using ERA5 reanalysis data for 1996–2025. A comprehensive suite of thermodynamic, kinematic, and moisture parameters is derived at 6-hour intervals, including convective available potential energy, vertical wind shear, precipitable water, and over 100 derived parameters. Severe weather reports from the NOAA Storm

Events database are mapped to the ERA5 grid using a 40-km spatial neighborhood to construct binary hazard labels. Random Forest models trained on 1996–2020 data estimate probabilistic occurrence of tornado, hail, and damaging wind hazards and are evaluated independently for 2021–2025 with isotonic-calibrated probabilities. Observed climatology indicates tornado and hail activity peak during March–May, while damaging winds maximize in June–August. Model-derived seasonal climatologies reproduce these spatial and seasonal patterns and demonstrate strong discrimination skill (ROC–AUC > 0.90 across hazards), improving understanding of evolving severe-weather risk in the ORB.

Potts, Lincoln, Edwards, Brennan, Salada, Benjamin, "Development of the BaF₂ Large Angle Detector Array Design for Use in NOPTREX Experiment for Precision Angular Correlation Measurements" (Ivan Novikov)

The BaF₂ Large Angle Detector (BaFFLD) array is designed to take measurements of gamma-ray angular correlations in nuclear cascades. These provide information about nuclear structure, which is vital to the NOPTREX experiment which searches for indications of time-reversal violation in the interaction of a polarized neutron on a polarized target. To measure the gammas, BaF₂ scintillator detectors are chosen as they offer a fast emission component (600 ps decay time), enabling precise timing resolution when identifying individual cascade events. We present the design methodology, simulation results, and initial detector characteristics. The BaFFLD array detector position configurations were optimized using Monte-Carlo ray tracing simulations to best measure angular correlations of gamma-rays. The configuration that could recreate the angular correlation function of the widest range of cascade angular distributions is shown to be the best. The detectors are then planned to be set in place with an 8020 cubic frame with detector holders designed to hold detectors in the side at a proper angle and distance to maintain a spherical distribution. Several BaF₂ detectors have been assembled and energy spectrums and coincidence data of a ⁶⁰Co nuclear cascade were found to validate detector performance for array integration.

Pounders, Hannah, Shackelford, Carroll Ann, Sulejmanovic, Amina, Jerome, Sophie, Dickerson, Dalton, Woodward, Matthew, "Alcohol-Related Differences Among College Students with and without a History of Sexual Assault." (Matthew Woodward)

Experiencing sexual assault is associated with higher risk of heavy alcohol use. Sexual assault survivors may utilize alcohol to avoid reexperiencing the traumatic event. Those who experience sexual assault are more likely to develop PTSD, increasing the likelihood of alcohol use as a coping mechanism. The goal of this study is to examine the difference in alcohol-related outcomes in sexual assault survivors and non-sexual assault survivors. Data was collected from an online survey administered to undergraduate students (n= 820). Questionnaires assessed sexual assault history, drinking quantity, drinking-related problems, and alcohol use disorder symptoms. Independent samples t-tests revealed that those who have experienced sexual assault demonstrated significantly greater alcohol-use related problems and alcohol use disorder symptoms compared to those who have not experienced sexual assault. No difference was found for the average number of drinks consumed per week. Results highlight that individuals who experience sexual assault are at increased risk of the negative consequences of drinking, despite no significant differences in the amount of alcohol consumed. Findings suggest that sexual assault survivors may be especially in need of interventions aimed at reducing negative outcomes related

to drinking.

Purvis, Robert, "Worm: Simulating DNA Oligomers with Induced Central Bends Measured Under Dry Afm Conditions" (Kevin Williams)

Cis-diaminochloroplatinum(II) (cisplatin) is a chemotherapeutic drug which, in part, works by binding to and distorting DNA. The platinum distortion sites are recognized and subsequently bound by high mobility group and TATAA-box proteins. Downstream, this causes either physical blockage of transcription or low availability of proteins needed for transcription, both resulting in death of the given cell. The bend angle caused by cisplatin is measurable and variable for its given analogs. It has been hypothesized that distortion site proteins may display a bend angle preference (i.e. a bend angle which is optimized for protein binding). Thus, data on cisplatin analog-induced bend angles is needed to determine this relationship. woRm is an R package which simulates DNA polymers under two-dimensional worm-like chain conditions which approximate the behavior of DNA oligomers that have undergone dry AFM deposition. Using a drunkards walk protocol to simulate the initial polymer, a central bend angle (estimating cisplatin action) is induced using a simple rotation matrix. Worm-like chain parameters are then derived from the simulated polymers to be later compared to experimental data obtained via atomic force microscopy.

Rackliffe, Maya, Ward, Rhis, Ricketts, Adley, Reusch, Kate, Marshall, Ian, Ricketts, "Changing Beliefs About Anxiety: Effects on Anxiety but Not Memory" (Qin Zhao)

Prior research has shown that participants who were told that they would be called upon to read aloud words showed reduced memory for words (Brenner, 1973). The negative effect of presentation anticipation on memory seems to be mediated by thoughts about one's upcoming presentation and performance anxiety, which disrupts encoding (e.g., Caron et al., 2021). The purpose of this study is to further test ways of reducing pre-presentation memory deficit. Specifically, if shifting people's mindset about anxiety alleviates its negative impact on pre-presentation memory performance. METHODS: A 2x2 factorial experiment was conducted involving two independent variables: anxiety mindset (anxiety is debilitating vs. anxiety is enhancing) and guided notetaking (yes vs. no). Participants completed measures of anxiety, thoughts, and memory for pre-presentation information. RESULTS: Participants primed with the anxiety-is-enhancing mindset reported significantly more positive anxiety-beliefs and reduced anxiety levels than those in the anxiety-is-debilitating condition. Participants who received a guided note page reported lower pre-presentation anxiety than those who received a blank page. However, priming conditions or guided notetaking did not affect memory performance. CONCLUSIONS: While mindset interventions may alter beliefs about anxiety and reduce anxiety levels, they may not be sufficient to improve pre-presentation memory performance.

Radford, Jalyn, "Developing a Severe Weather Risk Distribution Methodology Using Atmospheric Reanalysis Data and Gaussian KDE/Logistic Regression" (Xingang Fan)

Severe thunderstorms pose a significant threat to the safety of the citizens of the United States (U.S.). Improving the analysis and forecasting of notable inclement weather events is paramount to advancing scientific knowledge and protecting life and property. The following research aims to curate a climatological risk distribution model utilizing ERA5 reanalysis data through a case study of the severe

weather outbreak of June 25/26th, 2023, followed by a 30 year (1996-2025) climatological analysis. With a special focus on modern advancement in severe weather prediction, influential atmospheric variables, such as convective available potential energy (CAPE), the significant tornado parameter (SigTor), and the supercell composite metric, are derived from the ERA5 reanalysis data. These variables are then analyzed via the Gaussian Kernel Density Estimation (KDE) and Logistic Regression (Logit Function) to create a risk distribution method that is adjusted for verified storm reports, with a buffer of 0.25° (25 km). For public use, the Risk Distribution is a simple 1 to 5 scale, indicating risk levels of Low (1), Elevated (2), Moderate (3), High (4), and Extreme (5). This methodology will lead to further analysis of the atmospheric patterns found in both linear and discrete severe weather configurations.

Rahaman, Md Jiad Ur, "Soil Hydraulic Behavior as Influenced by Long-term Tillage and Nutrient Management." (Navdeep Singh)

Farmers face critical decisions regarding tillage and fertilizer combinations, as these practices substantially impact soil structure, hydro-physical characteristics, and crop performance. To optimize these decisions, a long-term (20-year) field experiment is being conducted at Western Kentucky University's Agricultural Research and Education Complex to evaluate how different tillage practices and nutrient sources influence the soil structure and hydro-physical properties of a Crider silt loam soil. The study utilizes a randomized complete block design with four replications and a 2×3 factorial arrangement: two tillage types (conventional and no-till) and three nutrient sources (inorganic fertilizer, half poultry litter and half inorganic, full-rate poultry litter). Following corn harvest in fall 2025, undisturbed soil cores (8 cm diameter and 5 cm height) were collected from the experimental plots at 0-5 cm depth. These samples are being analyzed for soil physical and hydraulic attributes such as soil moisture characteristics, plant available water, and saturated hydraulic conductivity. Results will provide insights into how different tillage practices and nutrient sources affect soil structure, informing sustainable management practices to optimize soil physical health and long-term crop productivity.

Rai, Pramesh, "The Lillian Hearld Community Center: A Safe and Inclusive Space" (Shahnaz Aly)

The Lillian Herald South Community Center was developed to provide a safe and inclusive environment where people of all ages gathered and participated in community activities. In response to the growing needs of Bowling Green, Kentucky, the project addressed the demand for accessible public space that supports connection, wellness, and opportunity. The design incorporated flexible multipurpose rooms, classrooms, fitness areas, and open gathering spaces that served both youth and adults. Timed scheduling strategies allowed shared spaces to function efficiently, while floor separation created clear zones for different age groups and activity levels. This organization improved safety, reduced noise conflicts, and enhanced overall circulation throughout the building. Natural lighting, durable materials, and intentional spatial planning created a welcoming and secure atmosphere. Louder, high-energy spaces were separated from quieter study and meeting areas to maintain comfort and usability. The completed facility successfully supported recreational programs, educational activities, and social engagement for the surrounding community. Ultimately, the project strengthened community bonds and promoted healthy lifestyles. The Lillian Herald South Community Center stands as a reflection of Bowling Green's continued growth and its commitment to inclusivity, safety, and long-term community development.

Ralston, Ellie, "Seed and Soil" (Shahnaz Aly)

This architecture capstone project includes a life science lab complete with a live-in bunker and genome vault. The bunker, a reactive structure designed to shelter the harbingers of a new world, is separated from the lab by its proactive counterpart, the genome vault, which holds the seeds, embryos, and cultural archives needed to reconstitute society and biodiversity in a doomsday scenario. The design concept emulates a plant. The above-ground structure, bursting in green hues and lively movement, is supported by the hidden underground structure that holds the tools necessary to sustain above-ground life, similar to roots. The roots contain carefully planned, long-term, off-the-grid energy systems with hydroponic/aeroponic farming systems, waste-to-compost cycles, a geothermal energy grid, and the use of local and green materials. This project was an exercise in thoughtful design, sustainable practices, and uninhibited creativity.

Ramirez, Alejandro, "Comparing Cannabis Product Use Among Kentucky College Students" (Jenni Teeters)

Cannabis is the most used federally illicit drug among youth in the United States, with approximately 25% of young adults (ages 18-25) reporting having used cannabis within the past 30 days. Intoxicating hemp-derived products (IHDPs) are a new category of federally legal cannabis products that contain less than 0.3% Δ 9-THC, containing cannabinoids such as Δ 8-THC. Due to their federal legality, IHDPs have rapidly proliferated though many states regulate IHDPs consistent with traditional cannabis. Kentucky is unique in that it has implemented little regulations. This study aimed to fill an important literature gap by comprehensively measuring Kentucky young adult use of IHDPs compared to traditional cannabis. An online survey was distributed to college students across the state of Kentucky: 647 eligible responses were included for this analysis. Both lifetime use of IHDPs (40.3% vs 47.8%) and past-year use of IHDPs (26.0% vs 28.7%) were less frequent than traditional cannabis. In Chi-Square tests, only past-year traditional cannabis use was associated with age ($p = .002$). In Chi-Square tests, traditional cannabis and IHDPs both were associated with use of other substances (all p 's $< .05$). These results reveal novel similarities and differences between distinct cannabis products categories for future investigation.

Randall, Gabby, Gambrel, Mikayla, "Ethics of AI in Education — For Teachers & Students" (Jeremy Logsdon)

This presentation examines the ethical implications of artificial intelligence use in education through an Ethical Dilemma Scenario presented by Educators Rising. While much of the current discourse surrounding AI in schools focuses on student misuse, this presentation shifts attention to educators' use of AI and the ethical questions it raises. The scenario centers on Mr. Percy, a teacher whose frequent use of AI prompts concern from students and parents, particularly when students question why AI use is acceptable for teachers but restricted for learners. Through ethical analysis of this scenario, the presentation explores issues of consistency, fairness, and professional responsibility in educational practice. The presenters argue that ethical AI use requires clear boundaries and intentional modeling by educators. AI should function as a supportive tool for efficiency and exploration, not as a replacement for professional judgment, instructional design, or critical thinking. The presentation concludes by advocating for transparent, principled guidelines that promote ethical AI integration while maintaining

trust and integrity in the classroom.

Ravenscraft, McKenna, Webb, Cansas, "Estrangement in Later Life: A Pilot Study of Older Women Estranged from their Adult Children" (Gayle Mallinger)

Intergenerational estrangement between mothers and their adult children represents a growing yet underexamined issue in social work practice. As demographic shifts extend life expectancy and increase reliance on informal support networks, the absence of adult children in the lives of aging mothers creates a significant gap in elder care provision. This research calls upon Risk and Resilience and Ecological Systems Theories to explore how individual, relational, and societal dynamics influence estrangement and maternal well-being. The method employed to investigate this increasingly prevalent phenomenon is a pilot study that utilized client data from the Barren River Area Development District (BRADD). BRADD serves ten counties throughout Southcentral Kentucky, providing services to seniors age 60+ such as homemaking, personal care, and home-delivered meals. Client files were reviewed to identify cases of estrangement, as well as demographic information, protective and risk factors, and potential consequences for elder care policy. This data offered a nuanced understanding of how estranged mothers navigate aging without traditional familial support, ultimately revealing gaps in public aging services. Exploration of these gaps allows human service professionals to advocate for expanded programs and create recommendations for legislation reform.

Raymer, Hunter, "Student Academic Stress in Real World" (Lily Popova Zhuhadar)

Academic stress is an increasing concern across high school, undergraduate, and postgraduate populations, affecting mental health, academic performance, and overall well-being. Many institutions lack data-driven tools to proactively identify students at risk. This project develops a predictive model to identify students experiencing high academic stress using the "Student Academic Stress Real World Dataset" from Kaggle. The dataset contains 141 anonymized survey responses and eight variables capturing academic, environmental, and behavioral factors. Predictors include academic stage, peer pressure (1–5), academic pressure from home (1–5), study environment (noisy/peaceful/disrupted), coping strategy, bad habits, and academic competition (1–5). The target variable, Stress Index (1–5), reflects self-reported stress. For modeling, Stress Index will be converted to a binary outcome: 4–5 = high stress; 1–3 = low/moderate stress. A Logistic Regression model will estimate the probability of high stress. Categorical variables will be encoded, and performance will be evaluated using accuracy, precision, recall, F1-score, and a confusion matrix, with emphasis on recall to capture high-stress students. Model interpretation (coefficients/odds ratios) will identify the most influential predictors to support early interventions and student well-being initiatives.

Reynolds, Landon, "Owensboro First Baptist" (Shahnaz Aly)

The design for Owensboro Baptist Church blends traditional Baptist architectural character with modern functionality to support worship and ministry growth. A red brick exterior paired with a stone base creates a sense of permanence, stability, and connection to historic church design. These materials communicate strength and timelessness while maintaining a warm, welcoming presence. The steeple and cross act as strong vertical elements symbolizing spiritual guidance and establishing the church as a recognizable landmark within the community. The floor plan is intentionally organized to separate

worship spaces from support and ministry areas. The sanctuary serves as the primary focal point and features a curved seating layout to improve sightlines and acoustics. This arrangement fosters a more engaging worship experience and strengthens the sense of unity among the congregation. Surrounding wings house classrooms, fellowship areas, and administrative offices, allowing the church to accommodate diverse ministries and community programs. A covered entrance supported by columns provides a welcoming transition into the building and encourages fellowship before and after services. Multiple rooflines and gable forms reduce the perceived scale, making the church feel inviting and approachable while maintaining architectural presence and dignity.

Ricketts, Rina, "Stability Over Flexibility? Beliefs about Morality and Psychological Well-Being" (Qin Zhao)

Prior research suggests that cognitive flexibility is linked to better mental health and psychological well-being (Kashdan & Rottenberg, 2010). For individuals with a strong moral identity, values such as fairness, honesty, and compassion are central to their self-concept (Goering et. al., 2024). Building on this work, this study examined whether moral flexibility functions similarly to cognitive flexibility in enhancing psychological well-being. **METHODS:** Participants were randomly assigned to a fixed or flexible morality priming condition by reading materials emphasizing moral fixedness or adaptability. Participants then completed validated measures of psychological well-being, positive and negative affect, and moral injury. **RESULTS:** Counter to hypotheses, the fixed morality group (vs. flexible morality) reported lower negative affect, lower moral injury, greater environmental mastery, greater purpose in life, and greater satisfaction with life. **CONCLUSIONS:** These surprising findings suggest that the adaptiveness of flexibility may depend on the domain in which it is applied, highlighting the distinction between cognitive and moral belief systems. Fixed morality may function less as inflexibility or rigidity and more as a psychological anchor, providing individuals with a sense of consistency and integrity, which are central to psychological well-being.

Riley, Kevin, Dines, Grace, Brotzge, Jerry, "Climatology of Solar Radiation Across Kentucky Using Observations from the Kentucky Mesonet" (Jerry Brotzge)

In atmospheric sciences, one of the key drivers of weather is solar radiation. The purpose of this research study is to identify and explain a 15-year climatology of solar radiation across the state of Kentucky. A solar radiation climatology is useful in many ways, such as in solar energy production and agriculture. Data were collected from the Kentucky Mesonet, a state-wide weather monitoring network of 86 stations, which measures a variety of atmospheric variables including solar radiation in real-time. Solar radiation data were evaluated over a 15-year period, 2010-2025. Using Python coding, spatio-temporal trends were analyzed. The results show interesting solar radiation variability across hourly, daily, monthly, seasonal, and annual time scales. Annual to monthly variability will be highlighted.

Risteski, Ljubomir, Kambesis, Patricia, "Utilizing Structural Lineament Mapping with Digital Elevation Models for Understanding Speleogeneic Patterns in the Mammoth Cave Plateau" (Patricia Kambesis)
Lineament analyses provide a valuable framework for understanding the structural controls on karst development, groundwater flow, and surface–subsurface interactions in karst terrains. In the Mammoth Cave region of south-central Kentucky, the intersection of mapped faults, joints, and fracture zones with

topographic lineaments strongly influences the orientation of cave passages, sinkhole alignments, and conduit-dominated aquifers. By integrating remote sensing of 10-inch resolution Digital Elevation Models (DEM), ArcGIS-based lineament mapping, and ongoing field verification, this study highlights the role of regional structural trends in the Mammoth Cave Plateau in guiding speleogenesis and level development within the Mammoth Cave Plateau. The results indicate that lineaments of NE–SW and NW–SE trending orientation exert some directional influence on conduit orientation, thereby influencing both the hydrologic regime and the geomorphic expression of the Mammoth Cave Plateau. These findings show the importance of structural mapping in karst terrains, providing an interpretive framework for predicting anisotropic groundwater flow, delineating zones of enhanced vulnerability, and refining conceptual models of karst aquifer dynamics. In addition, this research demonstrates that lineament analyses offer an essential tool for advancing both theoretical understanding of karst evolution.

Rodriguez, Jeremiah, "Predicting Parole Violations" (Lily Popova Zhuhadar)

Parole boards must make difficult decisions about whether an incarcerated individual is ready for early release. If the decision is incorrect, the individual may violate parole or reoffend, undermining public safety and the goals of rehabilitation. This project uses a dataset from the 2004 National Corrections Reporting Program, focusing on a subset of parolees who served six months or less and had a maximum sentence of 18 months. The dataset includes demographic and case characteristics such as age, race, gender, state, time served, and offense type. The target variable is violator, a binary outcome where 1 = parole violation and 0 = successful completion. Because the goal is to predict a yes/no outcome, this study will develop binary classification models. A Logistic Regression model will be built as a baseline, followed by a Decision Tree model to capture potential nonlinear relationships and improve predictive performance. Models will be evaluated using a confusion matrix and key metrics such as accuracy, precision, and recall. The goal is to demonstrate how predictive analytics can support parole decision-making by providing an objective risk estimate, potentially reducing repeat offenses and improving community safety.

Rose, Helen, Brotzge, Jerald, "Evolving Impacts of Tropical Systems on Kentucky's Climate: A Regional Comparison of Precipitation, Flooding, and Drought Impacts" (Jerald Brotzge)

Historically, Kentucky's climate has been uniquely affected by tropical systems, bringing drought-ending rains but also sometimes floods and severe weather. Nevertheless, these influences are often overlooked as Kentucky is located relatively far inland. Although coastal areas often suffer the greatest damage and garner the most attention, inland impacts from tropical systems can be significant (e.g., Knight and Davis 2009, Kovach and Konrad 2014) and, at times, at least as damaging as those along the coast. This study examines the atmospheric and hydrological impacts of tropical systems across Kentucky, illustrating how a region far removed from the coast can experience both beneficial and detrimental effects. Of the 1386 systems that formed in the Atlantic Basin between 1895 and 2022, 248 tropical systems (18%) impacted Kentucky. This study reviews the temporal and spatial impacts of these storms. It showed a significant difference in impact across seasons and in how the regions of Kentucky are affected. For example, the average total rainfall for flood issuance for CDs 1-4 was 40, 48, 43, and 28 mm, respectively. The average in CD 4 is significantly smaller, indicating that CD 4 is more susceptible to flooding than the other climate divisions (attributable to its complex terrain).

Rowland, Jacob, Berkley, Jaxton, "Factors Affecting Hydroplaning and Wet Pavement-Related Crashes Involving Commercial Motor Vehicles in Kentucky" (Kirolos Haleem)

Hydroplaning and wet pavement-related crashes involving commercial motor vehicles (CMVs) are understudied, especially regarding the contributing factors affecting the severity of these crashes. This study analyzes CMV-involved crashes (2014–2023) in Kentucky due to hydroplaning and wet surface events. A natural language processing (NLP)-based technique was employed to extract 1,187 hydroplaning and wet pavement-related crashes involving CMVs. Three approaches were used: Chi-square test of independence, odds ratio (OR) analysis, and association rule mining (ARM). ARM is a data mining approach that can identify intricate associations (interactions) between the variables. ARM was employed to generate rules for minor injury “BC” CMV hydroplaning and wet pavement-related crash outcomes. Head-on collisions, aggressive driving, very young (16-20 years) and old (≥ 60 years) at-fault drivers, peak afternoon (3:30 pm-6:59 pm) periods, and truck percentage $\geq 4\%$ were associated with fatal and injury (FI) (KABC) outcomes. The ARM results yielded 22 rules and showed that the presence of vertical gradient was a contributing factor in hydroplaning events involving CMVs, which when accompanied by middle-age at-fault drivers (31-59 years old) and no aggressive/distracted driving, was associated with minor injury “BC” outcomes. The study suggests data-driven countermeasures to improve CMV safety due to hydroplaning and wet pavement-related events.

Ryan-Kessler, Shea, "Assessing the Symptomology of Autistic Students in Higher Education" (Peyton Collins)

Autistic college students often report elevated mental health concerns, including anxiety and stress, compared to their neurotypical peers. This project utilized the Counseling Center Assessment of Psychological Symptoms (CCAPS) to evaluate symptom presentation among autistic students in higher education. The sample included 30 students enrolled at Western Kentucky University and participating in the Kelly Autism Program. Findings indicated that students receiving services through the Kelly Autism Program demonstrated symptom levels comparable to national CCAPS norms, suggesting that program supports may help mitigate mental health disparities.

Sanchez, Jady, Gunter, Phillip, Guinn, Jenna, Bewley, Jeffrey, "Establishing Current Holstein Udder Conformation: A Multi-Herd Survey of Linear Classification Traits" (Phillip Gunter)

This study establishes baseline data on Holstein udder conformation to evaluate and recalibrate linear classification trait definitions. Between August and December 2025, 359 lactating Holstein cows were sampled from three commercial dairy herds. Five udder measurements were collected in milking parlors using a transparent grid tool by a single trained technician: front and rear teat length, front and rear teat spacing, and teat diameter. Measurements were photographed, labeled by cow identification, and digitally extracted using FIJI (ImageJ) software. Statistical analyses were conducted using R software ($\alpha = 0.05$). Mean front and rear teat lengths were 4.55 cm (SD 0.86 cm) and 3.81 cm (SD 0.79 cm), respectively, both considerably below the Holstein USA classification ideal of approximately 5.72 cm (25 points on the 1-50 scale). Front teats were significantly longer than rear teats by 0.74 cm ($P < 0.001$). Mean rear teat placement scored 33.4 points (SD 8.2 points), indicating closer spacing than the ideal target of 25 points and trending toward the "close" and "crossed/touching" categories. These findings suggest existing linear classification trait definitions may require recalibration to accurately reflect

contemporary Holstein udder conformation and improve genetic evaluation systems.

Schintgen, Niklas, Carden, Mykah, Whitehead, Samuel, Yeager, Kevin, McGlue, Michael, Dilworth, John, Thigpen, Ryan, Schweitzer, Sydney, "Preliminary Charcoal Analysis of Late Holocene Fire Activity at Jackson Lake, Grand Teton National Park" (Giliane Rasbold)

Wildfires significantly impact human health, forest structure, and ecosystem dynamics. Although Grand Teton National Park has experienced numerous fires, its long-term fire history remains poorly understood. This study reconstructs Late Holocene fire activity in the Jackson Lake area, Wyoming, using sediment cores analyzed at 5 cm resolution. Macroscopic charcoal particles ($>106 \mu\text{m}$) were extracted by wet sieving and quantified to assess past fire activity. An age-depth model based on radiocarbon (^{14}C) dating established the temporal framework for charcoal accumulation rates. Between 3,240 and 400 years BP, charcoal peaks were less frequent, indicating relatively low fire frequency and intensity. The highest accumulation rate during this interval occurred around 3,000 years BP, reaching $4.8 \text{ particles cm}^{-2} \text{ yr}^{-1}$. In contrast, the last 400 years show a marked increase in both fire frequency and intensity. These findings reveal significant shifts in regional fire regimes during the Late Holocene, likely driven by climate variability and changing environmental conditions. However, the current 5 cm resolution may limit the precision of these interpretations. Continued analysis at 1 cm resolution is essential to refine charcoal accumulation rates, improve temporal precision, and potentially redefine identified fire events and trends.

Schrock, Cassidy, Justice, Dylan, "Safety Effectiveness Evaluation of Retroreflective Backplates in Kentucky Using Multiple Techniques" (Kirolos Haleem)

Studies contrasting the effectiveness of retroreflective backplate (RRB) treatments using different comparative methods are limited. This study comprehensively investigates the safety effectiveness of RRBs on both total and distraction-related crashes in Kentucky using different before-and-after comparative analyses. These were naïve, equivalent property damage only (EPDO) rate, and comparison group methods. A sample of 35 signalized intersections (mostly 4-legged) with RRB treatments in Kentucky were analyzed, using three years in each of the before and after years. The research team carefully selected comparison group sites with similar geometric features to the treatment sites (e.g., similar number of legs, through lanes, median type, and exclusive turn lanes) to provide unbiased results. The safety effectiveness of the installed RRB treatments was assessed in terms of crash reduction factors (CRFs) for both total and distraction-related crashes. The study found that RRB installations were associated with significant reductions in distraction-related crashes by 21.49% (naïve), 40.49% (EPDO rate), and 7.61% (comparison group), respectively. However, total crashes significantly increased as found by the more reliable EPDO rate (-36.25%) and comparison group (-8.37%) methods. The results suggest that while RRBs improve signal visibility and better alert distracted drivers, they might trigger unintended behaviors that could increase total crashes.

Schuler, Alyssa, Kidd, Evan, Menig, Matthew, Nemon, Amy, Gripshover, Margaret, Brotzge, Jerald, "Development of the Climatological Library of the Commonwealth of Kentucky (CLoCK)" (Jerald Brotzge)
Currently, Kentucky has a rather limited climatological record. While weather records date back to 1895, systematic archives of high-impact events were rare. National Weather Service tornado records date

back to 1950, but most severe weather features were not tracked until the mid-1990s. Nevertheless, local and state media often captured these events in daily newspapers, and using these data, we can recreate a more accurate historical archive. To compile a more complete record of Kentucky's climate and high-impact weather events, the Kentucky Climate Center (KCC) proposed creation of the Climatological Library of the Commonwealth of Kentucky (CLOCK). Development of the CLOCK has focused on two primary areas: (1) Historical, which focuses on the collection, interpretation, and extraction of relevant data, largely from newspapers; and (2) GIS visualization, which aims to transform the quantitative print data into spatiotemporal mapping for both researchers and the public alike. To start, we have focused on improving the tornado archive between 1900 to 1950. Dedicating time to building such a library is crucial not only to the sciences, but to preserve key parts of our collective and local histories. This presentation will present the methodologies and early results of this work.

Schuurman, Julia, "Effects of Performance Activity and Firocoxib Administration on Temporomandibular Joint (TMJ) Sensitivity in Collegiate Western IHSA Horses" (Paige Smith)

TMJ sensitivity may affect horse comfort and performance, but limited research has evaluated how common activities influence TMJ sensitivity in collegiate horses. Riding, hauling, and showing are routine stressors for horses used in lesson programs. The study aimed to determine whether riding, hauling, and/or showing increased TMJ sensitivity in collegiate horses and whether administration of firocoxib reduces sensitivity. Eight collegiate horses from WKU were evaluated for TMJ sensitivity. TMJ sensitivity was assessed by applying 2–5 lbs of pressure along TMJ nerve and scoring the horse's reaction from 0–3. Measurements were taken before and after hauling, riding, and showing. Horses were their own controls and sensitivity scores were compared between untreated events and treated events. Results showed mild increases in TMJ sensitivity following hauling and riding, particularly at the end of show days. Average sensitivity scores remained low but increased slightly after activity and decreased after rest. When horses received firocoxib, sensitivity scores appeared slightly lower overall and increases following activity were smaller than untreated measurements. Findings suggest performance activities contribute to mild TMJ sensitivity in collegiate horses and anti-inflammatory treatment may help reduce discomfort, highlighting importance of monitoring TMJ sensitivity to support welfare and performance in collegiate equestrian programs.

Seavers, Michael, "Identifying the Optimal Number of DataLoader Workers for CPU-GPU Concurrency in Asynchronous Deep Training Pipelines" (Qi Li)

Efficient CPU-GPU concurrency is critical for maximizing performance in deep learning training pipelines, yet selecting the optimal number of DataLoader workers remains largely empirical. This paper introduces a framework for identifying the optimal worker count in asynchronous deep training pipelines by integrating a new architectural metric, SM:CC:W—the ratio of GPU Streaming Multiprocessors (SMs), CPU cores (CC), and DataLoader workers (W). By jointly analyzing elapsed time, GPU/CPU utilization patterns, and workload distribution across major components of the data pipeline, the framework provides a principled mechanism for understanding and optimizing CPU-GPU overlap. We evaluate the approach on five single-machine systems with diverse CPU-GPU configurations, including three local machines and two Google Colab platforms. Our results demonstrate that the new metric, combined with the proposed performance analyses, reliably identifies worker counts that maximize GPU utilization while

avoiding CPU bottlenecks. Beyond guiding DataLoader tuning, the framework offers broader insights into how architectural characteristics shape concurrency behavior in modern deep training systems.

Self, Aaron, Phillips, Katie, "Assessing the Quality of Mobile Apps Used in Outpatient Orthopedic Physical Therapy Practice." (Beth Norris)

Introduction: Digital technology use in physical therapy clinical practice is expanding. Research related to digital technology has primarily focused on the reliability and validity of mobile apps. Limited research has investigated the quality of mobile apps. The purpose of this study is to examine the quality of orthopedic physical therapy-related mobile apps using the User Version of the Mobile Application Rating Scale (uMARS). Methods: This descriptive methodological study will systematically search the US Apple and Google Play stores for low-cost apps viable for orthopedic physical therapy. Two student physical therapists and two physical therapists will evaluate each app using three subscales of the uMARS: Engagement, Functionality, and Aesthetics along with a Subjective Quality section. A directory of the available apps will be created. Data Analysis: Subscale items are rated on a 5-point scale, and mean scores will be calculated to determine the total app quality. Descriptive statistics will present reviewer responses related to the subjective quality of each app. Final scores from the uMARS will be compiled with summaries of usability. Discussion: The findings will support the development of a database to guide the integration of digital tools into orthopedic physical therapy.

Senig, Mackenzie, Bledsoe, Lee Anne, Singer, Autumn, "Using Limestone Dissolution Kinetics to Evaluate the Evolution of the Cathedral Domes Complex, Mammoth Cave, Kentucky" (Chris Groves)

This work reports on an initial yet critical phase of a project that explores use of an untried method using cave morphology data within a section of the Mammoth Cave System to potentially obtain ancient climate data for the area of Kentucky above the cave. Mammoth Cave and the landscape/aquifer system it lies within has evolved over millions of years. Records of past climate variation have been identified in features within caves including speleothems, sediments, and morphology of passages. In this research, we are quantifying evolution of the Cathedral Domes vertical shaft complex, a canyon formed within the Mississippian Ste. Genevieve Limestone, to explore what ancient records of climate change might be recorded here focusing on the width of the canyon reflecting drier/wetter conditions. The first question concerns the age of the canyon, to assess what time interval such records might include. Water from Bridal Veil Falls, the 30-m waterfall that formed the canyon, was sampled for temperature, pH, and concentrations of cations/anions. Using the limestone dissolution kinetics rate law (Plummer et al., 1978) a dissolution rate of 1.2 mm/yr was determined. Combined with the length of the canyon, this gives an age estimation of 40,000 years for Cathedral Domes.

Simon, Skylar, "Haven House Concert Hall" (Shahnaz Aly)

The objective of this project was to explore how architecture fosters community, inclusivity, and environmental responsibility through the design of a sustainable concert venue and music school located in Gatlinburg, Tennessee. Gatlinburg experiences seasonal population shifts and dependency on entertainment. This project investigated how a music-centered installation can serve residents and visitors while strengthening local cultural identity. The design emphasized sustainable strategies that are allocated for the Smoky Mountain region, including both passive and active systems. In addition, the

project included research-driven acoustic design to create high quality performance and educational spaces. By studying spatial acoustics, material performance, and audience-performer relationships, the architecture aimed to enhance the shared musical experience. Music has historically served as a unifying impact across cultures and backgrounds. This project proposes that an inclusive, accessible, and environmentally responsible performance space can act as social infrastructure, bringing diverse populations together while promoting sustainability and long-term community growth. Keywords: architecture, sustainability, acoustics, community, inclusivity

Sitz, Gregory, "Developing an Integrated Flood Modeling Approach for FEMA Floodplain Mapping in Karst Watersheds" (Jason Polk)

Recent flood events in south-central Kentucky have highlighted limitations in existing floodplain mapping approaches, particularly within karst terrains. Karst landscapes, which are characterized by sinkholes, sinking streams, conduits, and caves, are inhabited by approximately 16% of global populations. In these systems, rapid subsurface flow and complex surface-groundwater interactions challenge traditional hydrologic and hydraulic modeling techniques developed primarily for fluvial-dominated environments. As a result, modeled flood extents in karst regions often fail to accurately represent observed floods, increasing risk for infrastructure, property, and public safety. This study applies hydrologic analysis and predictive modeling to the Lost River and Jennings Creek groundwater basins in Warren County, Kentucky. Continuous water level monitoring from surface streams and groundwater wells will be integrated with high-resolution precipitation datasets to characterize storm response dynamics and conduit activation thresholds. Hydrograph analyses and model calibration will use real storm events to evaluate discrepancies between simulated and observed floods in FEMA and karst flood models. Sensitivity testing of key parameters will be performed to determine data requirements necessary for regulatory-grade flood mapping in karst environments. Research outcomes will be the development of a transferable framework outlining minimum data standards, calibration, and performance metrics for improving floodplain mapping in karst systems.

Siyanbola, Emmanuel, "Hybrid Deep Learning for Bitcoin Volatility and Value-At-Risk Forecasting" (Lukun Zheng)

Accurate tail-risk forecasting is a practical necessity for institutions exposed to Bitcoin's extreme volatility. Classical approaches such as GARCH models and Historical Simulation struggle to capture nonlinear dependencies, sudden regime shifts, and the information content of on-chain blockchain metrics. This thesis first establishes that neural network models materially improve forecasting accuracy over these traditional baselines, then introduces a hybrid deep learning architecture that combines modality-specialized Transformer and LSTM encoders to seek further gains. Because market price data are sparse and event-driven while on-chain metrics are dense and cumulative, a single generic architecture is suboptimal. The proposed dual-stream design aligns encoder choice with data structure and uses multitask learning to jointly optimize volatility and quantile predictions. Empirical validation on 2,438 daily observations from May 2017 to May 2025 shows large performance gains of neural models over classical methods, including a 94% RMSE reduction versus GARCH(1,1), and improved VaR calibration. Within the deep learning class, architectural specialization adds further but smaller gains: a 4.8% improvement over naive feature concatenation and a 0.5% RMSE improvement over the best

standalone Transformer. Post-hoc calibration further aligns empirical breach rates with nominal targets. These results support a two-stage conclusion. Neural modeling drives the main performance improvement, while hybrid architecture refines performance further for deployment-focused risk forecasting.

Smith, Avery, "Behind the Letters: An Ethnographic Study of WKU Greek Life Advisors" (Kate Hudepohl)
This ethnographic project looks at how Greek advisors at Western Kentucky University (WKU) help run and support fraternity and sorority life on campus. By doing ethnographic research, I wanted to understand what their jobs are really like and how they balance university rules with the traditions and independence of Greek organizations. The study focuses on how advisors keep things running smoothly, as well as how much behind-the-scenes effort goes into keeping WKU's Greek community active, organized, and connected. This project was done as a final for the course ANTH 399, Field Methods in Ethnography.

Solley, Andrew, "Predicting Car Prices for Carvana" (Lily Popova Zhuhadar)

Accurately pricing used vehicles is a persistent challenge in the automotive industry and a key driver of profitability, inventory management, and competitive positioning—especially for online retailers such as Carvana. This project uses the Carvana – Predict Car Prices dataset from Kaggle to develop a predictive model that estimates an individual vehicle's resale price based on detailed attributes, including make, model year, mileage, trim, and other vehicle features known to influence market value. Because the target variable (vehicle price) is continuous, the task is modeled as a regression problem. Multiple algorithms—Linear Regression, Random Forest Regression, and Gradient Boosting Regression—will be trained and compared to determine which approach produces the most accurate and reliable price estimates. Model performance will be evaluated using Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R^2 . In addition, a feature-importance analysis will identify the variables that contribute most to price variation, helping explain model predictions and supporting practical pricing decisions. The expected outcome is a data-driven pricing framework that improves vehicle-level forecasting and supports better buy/sell decisions. While many studies focus on aggregated market trends, this project emphasizes vehicle-specific prediction, offering actionable insights for pricing strategy and operational efficiency in used-vehicle retail.

Spencer, Jaden, "Right Mind Studio: Atlanta Creative Hub" (Shahnaz Aly)

The Atlanta Creative Hub or Right Mind Studio is a Mixed use Cultural Space made with the intent to support artistic production, performance, and showcase all in one environment. The building houses an art gallery, performance hall, maker spaces, and educational studios that are available to both the public and local creative community. Each wing is connected to a central spine that allows them to operate by themselves but in a unified manner. The design focuses on how architecture can bring people together, stay easy to access, and keep spaces organized while following building codes.

Spinks, Eliza, "Empower, Educate, Engage: Recruiting the Next Generation of Family and Consumer Sciences Leaders at Western Kentucky University" (Angela Gott)

Family and Consumer Sciences (FCS) programs nationwide face a critical need to recruit the next

generation of educators and professionals. This project highlights recruitment strategies implemented through Western Kentucky University's Family and Consumer Sciences program to increase awareness of FCS career pathways among high school students. The primary goal of this initiative is to strengthen the pipeline of future FCS educators and applied human sciences professionals while promoting opportunities available at Western Kentucky University. Recruitment efforts included interactive outreach activities at leadership conferences, presentations at regional high schools, participation in FCCLA events, and hands-on demonstrations that showcase real-world applications of FCS disciplines such as culinary arts, family studies, and human development. Through these experiences, students were introduced to WKU's programs, career pathways within Family and Consumer Sciences, and the impact of the field on individuals, families, and communities. Early outcomes indicate that experiential recruitment and direct engagement with prospective students significantly increased awareness of FCS career opportunities and interest in pursuing related degrees. The findings highlight the importance of intentional outreach and partnerships between secondary and postsecondary education to sustain the future of Family and Consumer Sciences while expanding recruitment efforts at Western Kentucky University.

Spivey, Atiana, "Increasing Medical Rights Awareness Among Immigrant Communities" (Jessi Thomsen)
My project focuses on increasing medical rights awareness in immigrant communities by creating and providing medical education documents free of charge. This is done in the form of wallet-sized cards, which will hopefully be stocked in both immigrant serving organizations and local hospitals. These cards are based off of existing constitutional and immigration right cards. I have analyzed the language of these cards to further determine the best practices to create my medical rights cards as well as examined many Kentucky laws in order to establish what information should be on the card. The next phase is to actually create said cards, stock them in the relevant areas, disperse a quality control survey and finally create a second version that will suite the community's need exactly.

Staggs, Ashley, "Reducing Chronic Absenteeism: Applying Improvement Science in an Elementary School Context " (Wes Cottongim)
Using improvement science, this dissertation examined strategies to reduce chronic absenteeism at the elementary school where I serve as the school counselor. When the study began in 2023, the school's chronic absenteeism rate was 31%, representing an increase of more than 10 percentage points from pre-pandemic levels. The study began with a root cause analysis (RCA) that included surveys, interviews with stakeholders closest to the problem, and analysis of local attendance data to identify contributing factors and student populations experiencing disproportionate rates of chronic absenteeism. This phase employed a convergent parallel mixed-methods design. Following the RCA, two intervention phases were implemented using an explanatory sequential mixed-methods design. Each intervention targeted a subgroup identified during the RCA and used parent involvement events to educate and engage families about attendance expectations and the importance of regular school attendance. Although the findings are specific to this local context, the RCA process offers a model for other educators seeking to understand absenteeism in their settings. Preliminary attendance data suggest that parent education and engagement were associated with improved attendance, while qualitative findings added nuance and depth to the most meaningful aspects of the interventions.

Stevenson, Jennifer, "Student Choice Creative Lecture" (Jeremy Logsdon)

This creative lecture examines the role of student choice in modern education and its impact on student engagement and learning. Drawing on the historical development of formal schooling, including the influence of the 19th-century Prussian model, the presentation considers how educational systems have evolved alongside growing understanding of how students think and learn. Using examples from contemporary classroom practices and educational theory, this lecture explores how incorporating student choice into instruction can increase motivation, agency, and meaningful learning. The presentation argues that education should move beyond one-size-fits-all models and instead prioritize flexible, student-centered approaches that support diverse learners. The lecture concludes by emphasizing the importance of intentional instructional design that empowers students to take an active role in their learning and supports more equitable educational outcomes.

Stewart, Melanie, "Investigating Function Translation to Make Upper Division Math Courses More Relevant for Prospective Teachers" (Nicholas Fortune)

In this poster I address the longstanding problem of the perceived relevance of upper division math courses for prospective secondary school teachers. Through a multi-year design-based research approach, our team is reimagining a Dynamical Systems and Modeling course and investigating ways to make the course more relevant to prospective teachers. In this poster I report on the impact of these efforts on students' relational understanding of why a particular function is a horizontal shift to the left of another function, a high school topic that is often only instrumentally taught and understood. Analysis of beginning and mid-semester assessments indicate significant growth in our students' ability to provide meaningful explanations. I also report on students' perspectives on classroom activities that influenced their reasoning.

Stolz, Nathan, "Mt. Juliet Community Hub: Bridging Expansion & Belonging" (Shahnaz Aly)

The Mt. Juliet Community Hub introduces a multifunctional facility designed to meet the needs of the city's long-standing demand for a centralized gathering space. Organized into three primary categories – recreation, gathering, and dining – the Hub features multi-use sport courts, a fitness center, flexible meeting and event spaces, common spaces, and local restaurants. The goal of this project was to create a singular space that supports all essential human activities – socializing, moving, working, and eating – while integrating a minimalistic, modern-industrial design approach to the structure. With Mt. Juliet's rapid expansion driven by Nashville growth, residential development has outpaced investments in community wellness. This Community Hub aimed to bring an innovative approach to the issue of community development in the greater Nashville suburbs.

Strader, Natalie, Gani, Nahid, "Building a California Critical Minerals Sample Library for NSF-Funded Prospectivity Mapping" (Nahid Gani)

This project aims to develop a California critical minerals sample library to support NSF-funded research on rare-earth element (REE) prospectivity mapping in the Mojave Desert. The Mojave Desert includes the Mountain Pass Mine District, a major global repository of REE. U.S. efforts to expand domestic REE supply for clean-energy development are driven by economic, military, and public welfare needs. A key first step is identifying which REE-hosting minerals may be present in the study area. By organizing a

sample library, we can efficiently and economically acquire geologic reference material to better identify REE-bearing minerals in the Mojave Desert while utilizing resources already available at the university. Using the U.S. Geological Survey (USGS) list of critical minerals as a guide, samples were selected. In total, 40 samples were collected, representing 43 of 60 USGS critical minerals. Samples were cataloged in a spreadsheet and dedicated website with collection locations. Selected specimens were also 3D scanned to create interactive models for remote teaching and outreach, and for rapid visual comparison during prospectivity mapping. This small but comprehensive library of physical and digital reference samples can now serve as a resource for identifying target minerals during REE prospectivity mapping in the study area.

Summers, Riley, Polk, Jason, "Risk Assessment of Heavy Metals from Stormwater and Sedimentation in Class V Injection Wells in Urban Karst Groundwater Systems" (Jason Polk)

Sedimentation and heavy metal contaminants resulting from stormwater runoff lack regulation in urban karst groundwater settings. In urban karst regions where landforms like caves, sinkholes, and underground rivers serve as threat multipliers for hazardous environmental conditions, the lack of understanding of these interactions can become hazardous. This study focuses on the relationship between heavy metals, sedimentation, Class V Injection Wells, and the risk these have on the environment and people living within them. Class V Injection Wells are for non-hazardous materials, but due to storm events, pollutants can enter groundwater systems through these features without water quality mitigation, leading to interactions between the groundwater and hydrological systems. Through the sampling of sediment cores, first flush samples, source identification, statistical, and spatial research, a comprehensive risk assessment provides insight into how stormwater monitoring and best management practices can be restructured based on environmental needs. The outcomes of this work provide datasets aiming to bridge the gap between scientific understanding and the practical management of groundwater resources in urban karst areas, and findings can directly inform the refinement of Best Management Practices (BMPs) and Municipal Separate Storm Sewer System (MS4) protocols in karst regions as MS4 permits increase in normalization.

Taylor, Matthew, "The Black Patch War: America's Only Populist Revolt" (Katherine Lennard)

In the three quarters of a century between Appomattox and Pearl Harbor the United States was racked by nearly constant internal violence. While there has been much written on the struggles of the trade unions and terror which Klan and its kith wrought upon the land, a third origin of political radicalism has been nearly forgotten: Populism. An agrarian ideology in an increasingly industrial nation, Populism flourished for a moment in the West and South before dramatically collapsing at the dawn of the new century. But in the tobacco fields of Kentucky and Tennessee this short-lived ideology formed the backbone of a nearly forgotten struggle. Using the lessons learned from the failure of the Populist Party and its ancestors, the farmers and planters of the "Black Patch" would unite in opposition to the low prices brought about by a powerful trust, culminating in America's only Populist revolt.

Tellez, Kat, King, Rodney, "Study & Characterization of Mycobacteriophage BennyP" (Rodney King)

Bacteriophages, or phages, are a subtype of viruses that specifically infect prokaryotes. Phages are the most plentiful biological entity on the planet. Despite their abundance, relatively little is known about the

diversity of phages. Therefore, we sought to explore the genetic diversity of phages present in Kentucky soil. We used *Mycobacterium smegmatis*, a common soil microbe, as the host. Mycobacteriophage BennyP was successfully isolated from a soil sample collected from Bowling Green, Kentucky. To analyze the morphology of the plaques, the phage was plated and compared to the plaques of other phages. BennyP plaques appear turbid which suggests the phage has the ability to integrate into the genome of the host, forming a lysogen. The genomic DNA of BennyP was isolated, and its DNA sequence was recently determined. Although the genome has not been annotated, sequence alignments have already shown that it belongs to cluster A6. Members of this cluster are temperate, meaning they have the ability to form lysogens. In conclusion, our data strongly suggests that BennyP is a temperate phage and can form lysogens. Future research includes looking for genes in the genome of BennyP that are involved in lysogeny and attempting to create lysogens in the laboratory. Keywords: Bacteriophage, diversity, research, characterization, *Mycobacterium Smegmatis*

Thigpen, Micah, Polk, Jason, "Climate Vulnerability and Equity Assessment for Lexington-Fayette County, Kentucky" (Jason Polk)

A detailed Climate Vulnerability Assessment that includes a karst component was undertaken for the Lexington-Fayette Urban County Government (LFUCG) region, which addresses the growing risk of climate impacts in a vulnerable karst landscape. As Kentucky's climate shifts, communities may face increased exposure to hazards such as extreme heat, flooding, and severe storms. Using geographic and socioeconomic data to pinpoint regions where environmental threats and social vulnerability coincide by combining geographic information systems (GIS) with demographic and exposure factors, this study identifies community vulnerabilities and areas that may be disproportionately affected by climate-related risks. The goal of this research is to better understand patterns of climate vulnerability and identify areas to support climate adaptation and resilience planning. The results of this study aim to provide valuable insights for local planners, policymakers, and community organizations working to reduce risk and improve extreme climate preparation through more informed decision-making, and promote strategies that strengthen resilience in the midst of a changing climate.

Thomas, Sophia, Arora, Aanyaa, "The Connection of Yeast to Tumors: Exploring Boi1/Boi2's Role in Cell Cycle Control and Cancer" (Joseph Marquardt)

The regulation of the cell cycle is essential for maintaining cell health and preventing cellular diseases like cancer. The budding yeast *Saccharomyces cerevisiae* is used as an eukaryotic model because of its rapid cell cycle and ease of genetic manipulation. Elm1, a protein kinase, has been shown to regulate the mitotic exit, however, the process behind the connections remains a mystery. A recent proteomic screen identified the polarity protein Boi1 as a potential Elm1 substrate. In this study we investigated Boi1 and paralog Boi2 for their effects on the Mitotic Exit Network (MEN). Microscopy revealed that Boi1 and Boi2 localize to septin structures with similar timings to MEN phosphatase, Cdc14. The absence of Boi1 leads to premature Cdc14 recruitment while the removal of Boi2 had more subtle effects on the cell cycle timing. These results highlight distinct but similar roles for Boi1 and Boi2 in coordinating septin architecture with MEN signaling. Boi1 appears to play a more dominant role in the regulation of the cell cycle, while Boi2 refines the coordination of mitotic exit events. This research helps provide new information about how polarity proteins collaborate with signaling networks to ensure proper cell division

and similar regulatory mechanisms in humans.

Thompson, Sarah, Miller, Kelly, Essary, Faith, Hendricks, Lisa, Simpson, Emma, "VR Climate Science Modeling: Extreme Heat on WKU's Campus" (Michael Galloway)

A significant challenge in climate science modeling is visualizing data in a way that is both scientifically accurate and accessible to a broad audience. By leveraging virtual reality's (VR's) immersive capabilities, this project will enable users to experience climate scenarios firsthand rather than relying solely on traditional 2D maps or numerical models. The VR Extreme Climate Scenarios project will have an interactive 1:1 replica of Western Kentucky University's campus, which users can explore and learn about how different climate scenarios affect WKU's campus. The data needed to create these climate scenarios will be pulled from various climate science case studies and repositories. Climate scenarios will include extreme heat, flooding as a result of rainfall, and snow and ice. In each of these scenarios, users will be able to interact with WKU's campus to discover the safe and unsafe places to be on campus and will be able to see a visual simulation of the event. This VR environment will serve as a long-term educational resource, fostering interdisciplinary collaboration between climate scientists, engineers, urban planners, and emergency management professionals.

Thorn, Emma, Marquardt, Joseph, "Coordination of Cell Growth by Two Yeast Kinases to Control Cell Shape" (Joseph Marquardt)

Cell shape and growth during division in *Saccharomyces cerevisiae*, budding yeast, is controlled by kinases, which are enzymes that catalyze reactions by adding phosphates to change protein function. These changes 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, which regulates cell growth and polarity. This study explores the differences in cell shape and growth regulation through the total deletion or kinase activity ablation of Ste20 and Elm1 using traditional yeast genetics, image analysis via fluorescence microscopy, spot growth assays, and western blots to examine the protein expression of Ste20/Elm1 in wild type and deletion cells. 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. Western Blot data indicates that Ste20-GFP is destabilized in *elm1Δ* strains, indicating a possible phosphorylation event. Both kinases have human homologs, allowing these results to relate to human disorders, which displays uncontrolled cell growth/division.

Thornton, Judah, DeMarse, Aron, "Evaluating Pain Through the Face: Human and Machine Coding of Genuine and Posed Pain Expressions" (Andrew Mienaltowski)

Facial expressions communicate the intensity of pain that we experience. Past research has identified specific facial cues commonly activated in response to pain. Observed cue strength can vary by context, like the source of pain or even the sex of the individual displaying it. For instance, observers detect pain more readily in male faces than in female faces. Even when trained to attend to a narrow set of facial cues, human coders show lower than expected agreement when rating facial actions. The aim of the current study was to use OpenFace, an open-source platform for automated facial action unit detection,

to investigate how pain-related facial cues unfold over time in individuals experiencing real pain or posing pain expressions. We sought to determine if automated detection reproduces known sex differences in sensitivity to pain cues and whether the facial pain signatures of men and women differed. Additionally, we evaluated whether each sex's posed pain expressions better matched pain evoked from physical pressure or laser stimulation.

Tobbe, Pyper, Pinkrah, Nana, Adhikari, Sanskar, "A Comparison of Atlas 14 to Precipitation Frequency Statistics Derived from the Kentucky Mesonet" (Zachary Suriano)

Extreme precipitation poses increasing risks to infrastructure, water resources, and public safety. In the United States, NOAA Atlas 14 provides the standard precipitation frequency information used for these applications; however, it does not incorporate observations from the Kentucky Mesonet (KYMN), a dense network of automated weather stations established after Atlas 14 development. This study derives precipitation frequency statistics from KYMN observations collected from 2015-2024 and evaluates how they compare with Atlas 14 estimates across Kentucky. Annual maximum precipitation (AMP) series were constructed for durations ranging from 5 minutes to 24 hours and modeled using a Gumbel extreme value framework to produce statewide IDF curves for return periods from 2 to 100 years. Results show that KYMN-derived intensities exceed Atlas 14 estimates for frequent events (2–10-year return periods), particularly at short durations (≤ 30 min), where differences approach ~5–15%. Conversely, KYMN estimates are systematically lower for rare events (≥ 50 -year return periods). These findings indicate that Atlas 14 may underestimate design rainfall for short-duration events while providing higher estimates for long-return extremes. Incorporation of Mesonet observations into future updates (e.g., Atlas 15) could substantially improve precipitation frequency assessments for Kentucky and similar regions with dense modern monitoring networks.

Trudelle, Claire, Khouriyeh, Hanna, Silva, Luiz, "Effect of Partially Replacing Beef with Texturized Plant Proteins on Cooking Performance and Color Change in Beef Hybrid Patties" (Luiz Silva)

Beef supplies quality protein while vegetables provide micronutrients required for a balanced diet. Since beef is costly, hybrid products that partially replace animal protein with vegetable proteins, namely Textured Soy Protein (TSP) and Textured Pea Protein (TPP) are being developed. This study examined the effect of partially replacing beef with TSP, TPP, or combinations on physiochemical characteristics of beef hybrid patties. Six formulations were tested; a control without plant protein (BEEF) or 30% beef replaced with differing ratios of TSP/TPP: 0:4, 1:3, 2:2, 3:1, and 4:0. Each formulation was prepared and replicated over three consecutive days. Patties were evaluated for cooking performance and color change after cooking or retail display. After cooking, BEEF patties had the lowest diameter ($P = 0.017$) and area ($P = 0.009$) compared to other formulations. Cooking loss percentage was similar across all formulations averaging 5.59% ($P = 0.635$). An interaction was observed for color redness ($P = 0.003$), showing that raw BEEF patties have greater redness and less after cooking. Compared with other formulations, BEEF treatment had greater redness reduction after six days of display ($P = 0.039$). Our results indicate that plant proteins shrink less during cooking and help preserve the redness of patties.

Uwazie, Chibuzor, Schlabach, Candice, Zhang, Rui, "Synthesis, Characterization and Kinetic Investigation of a High Valent Iron Oxo Phthalocyanine Complex" (Rui Zhang)

Cytochrome P450 enzymes, a superfamily of heme proteins containing an iron–porphyrin core, have served as a model for selective oxidation catalysis. Consequently, numerous synthetic metal complexes, including metalloporphyrins and metalcorroles, have been developed as biomimetic catalysts for diverse chemical transformations. In addition, non-natural metal phthalocyanine (MPc) complexes have attracted attention due to their structural similarity to heme-based macrocycles, remarkable redox and optical characteristics, and the relative ease of large-scale synthesis. In both enzymatic and synthetic systems, a high-valent metal–oxo intermediate typically acts as the key reactive species responsible for oxygen atom transfer (OAT). Although substantial advances have been made in the synthesis of metal phthalocyanine complexes, further efforts are required to fully characterize their metal–oxo intermediates. In the present study, a novel phthalocyanine iron-oxo complex was synthesized and characterized by ESI-MS, including isotope-exchange experiments. The resulting iron–oxo species exhibited broad reactivity toward organic substrates, including phenol, sulfides and amines.

Walker, Kennedy, "COVID Literature in School Psychology" (Sarah Bonis)

The COVID-19 pandemic led to widespread societal shutdowns beginning in March 2020 in the United States and continues to have lasting effects on education. Early studies indicated that although teachers and administrators generally felt competent in their roles, they were concerned about inequities in student access to resources and the long-term impact of online learning. Families reported worries about academic skill delays, the quality of virtual instruction, increased caregiving responsibilities, and maintaining emotional well-being. Children most affected included young learners, students with disabilities or preexisting academic challenges, and those in home environments unsuitable for distance learning. These disruptions contributed to widening academic delays and increases in challenging behaviors, particularly for vulnerable populations. This project examines how COVID-19 has been addressed within school psychology scholarship. Articles published since 2019 in major school psychology journals were reviewed, yielding 64 articles referencing COVID-19 or coronavirus. These articles will be coded as empirical or nonempirical, aligned with NASP Practice Domains, categorized by primary population focus (students, families, or educators), and analyzed for key recommendations for school psychology practice. Coding will be completed by October, with results prepared by November.

Watkins, London, Sutton, Avery, "Is Generation Z Desensitized to Violence or Is Desensitization a Normative in Every Generation" (Reagan Brown)

Is Generation Z desensitized to violence or have all generations experienced desensitization to violence through different exposures? Oral Paper Presentation If presented a certain level of violence to different generations through research and experimentation, will Generation Z and lower be more desensitized due to violent video games and media or will Millennials and older generations be more desensitized due to physically seeing acts of violence more? Independent Variable- violence (levels: video games, violent videos, etc.) Dependent Variable-age and desensitization (reaction to violence and level of desensitization to it.) During the experiment, the reaction to violence will be measured by presenting a video clip of something violent, and/or then making the participant play a violent video game. Definition of Sensitization and Desensitization in this experiment: Sensitization: anger, anxiety, discomfort. Physically reacting to the material with distress, disgust, or discomfort. Reactions could also be sadness or even spacing out to not physically deal with what is being presented. Desensitization would just be the

opposite. The person would accept what is in front of them as “normal”. Lack of reaction, no physical discomfort.

Wells, Preston, "Climatology and Variability of Snowpack Depleting Ablation Events across the CONUS" (Zachary Suriano)

The process of snowpack ablation plays a major role in managing and maintaining the hydrological climate. However, large-scale ablation events, particularly rain-on-snow (ROS) events, can have detrimental impacts on human property and services, such as increased flooding and infrastructure damage. This study presents a climatology of snowpack events and analysis of snow ablation across the contiguous United States (CONUS) using high-resolution gridded datasets fitted to the criteria of snow ablation events from 1981 to 2023. There is a particular focus on the total completion aspect of ablation events during a defined snow-season period (Oct-Sep) and the implications of the variability in snowpack depletion. Overall, we seek to identify the spatial and temporal trends for snowpack ablation events, such as ROS and non-precipitation (NP) ablation events, and compare the frequency and magnitude with ablation climatology. Preliminary results depict differences in how depletion events vary spatially across subregions of the CONUS for ROS and NP ablation, differing in both occurrence and magnitude.

West, Graycee, Bruce, Jaelyn, "Mothers' Descriptions of Early Social Communication Skills in Autistic Preteen Girls Without Intellectual Disability" (Jenny Burton)

Autism spectrum disorder (ASD) is a developmental condition defined by challenges in social communication skills. As of 2025, an estimated one in thirty-one children are impacted by ASD, with boys being three to four times more likely to be diagnosed than girls. Identification of early challenges in social communication (i.e. use of language, facial expressions, gestures, etc.) is essential for timely and accurate diagnosis, and helps establish priorities for treatment services provided by speech-language pathologists. This qualitative research study investigated maternal descriptions of early social communication skills in their preteen daughters with autism without intellectual disability (n=8; M=10 years, 4 months) using semi-structured individual interviews. The results of these interviews, as well as clinical implications, will be discussed.

Wheeler, Evan, "Kentucky Steam Heritage Roundhouse & Museum: Where Tradition Inspires Modernity" (Shahnaz Aly)

This project added a Roundhouse-style structure to the existing Kentucky Steam Heritage Corporation (KSHC) complex. The new facility included a light repair shop, museum and classroom areas, a model railway exhibit, a restaurant, and offices. Located in Irvine, Kentucky, a town historically rooted in coal, timber, and tobacco industries, the project supported local efforts to diversify the economy. It sought to enhance KSHC's contribution to Irvine's economic development, offer educational opportunities for the citizens of the Commonwealth, and provide ample space for growth. The modern design of the building, while honoring Kentucky's railway legacy, accommodates all necessary facilities and supports expansion, whether for collections or staffing. The building has a traditional roundhouse look, with brickwork and clerestory windows, combined with modern features such as large curtain-wall windows, an additional floor, and a steel framework supporting a green roof. The design emphasizes sustainability with thermal massing and geothermal systems, aiming to attract visitors and educational groups through

a distinctive blend of industrial and contemporary architecture.

Wilkins, Kaymin, "The Relationship Between Peer Exclusion in Childhood and the Fear of Abandonment in Adults with Borderline Personality Disorder" (Sarah Bonis)

Borderline personality disorder (BPD) is characterized in the DSM-V as a pattern of irregularities in interpersonal relationships and sense of self. Therefore, this study aimed to examine the relationship between the experience of peer exclusion during childhood and the prevalence of fear of abandonment in adults with BPD. Data were analyzed from a total of 274 participants between the ages of 18-35. Participants completed a series of questionnaires: McLean Screening Instrument for BPD, the Borderline Personality Questionnaire (BPQ), the Social Peer Rejection Measure (Ignore subscale), and Ostracism Experience Scale for Adolescents (OES-A). A Pearson's correlation was used to analyze the relationship between PE and FOA. There was a positive, moderate relationship found to exist between PE and the BPQ for adults with BPD. This indicates that as the prevalence of peer exclusion in childhood increases the severity of fear of abandonment in adulthood increases. These findings urge further research on how experiencing exclusion in social settings can affect a child as they develop into adulthood. Additional results and implications will be discussed on the poster.

Williams, Riley, Savage, Savannah, Hunter, Matthew, Cole, Christine, Steed, Garrett, Burks, Lauren, Stukenborg, Mary Claire, "Understanding the Links Between Performance Anxiety And Psychological Safety with One's Coach in Olympic Weight-Lifting" (Steven Wininger)

Maladaptive performance anxiety is prevalent in high-risk sports like weightlifting and combat sports, yet often goes unaddressed. Psychological safety with one's coach is vital due to the risks involved in strategic decision-making. This study examines relationships between perceptions of psychological safety with one's coach and performance anxiety with Olympic weightlifters. Thirty-five weightlifters (63% females) completed a survey where performance anxiety and related constructs were assessed using the Performance Anxiety Inventory (PAIN) (Wininger, et al., 2023) and a modified version of Edmondson's (1999) psychological safety survey. Survey completion was incentivized. Psychological safety was positively related to confidence ($r = .33$) and negatively related to behavioral anxiety ($r = -.28$) and threat appraisals ($r = -.28$). Psychological safety was negatively related to cognitive anxiety, specifically during these time-to-event intervals: hours before, minutes before, during, and after the event (r ranged from $-.26$ to $-.30$). Furthermore, psychological safety was negatively correlated with the endorsement of both outcome goals ($r = -.25$) and avoidance goals ($r = -.27$). Findings suggest there are meaningful relationships between perceptions of psychological safety with one's coach and performance anxiety. Implications of these findings, along with ideas for future intervention-based research, will be discussed.

Williams, Sean, "Exploring the Inconsistencies in the Rankings of Five Card Draw Poker" (Dominic Lanphier)

In 5 Card Draw Poker, the rank of hands is calculated based on the probability of attaining that hand, as well as the rank and suit of the individual cards in your hand. We say that Hand A is stronger than Hand B when fewer hands outrank Hand A than outrank Hand B. It is reasonable to expect that Hand A is ranked higher than Hand B when Hand A is stronger than Hand B. However, we show that there are (numerous) examples when Hand A is stronger than Hand B, but Hand B outranks Hand A. This points out some

inconsistencies in the regular rankings of 5 Card Draw Poker. Our procedure for determining the stronger of two hands primarily involved calculating how many higher-ranking hands each hand eliminated (ex. how many straights a 2 pair hand eliminated). By comparing the number of superior hands that were no longer possible given the known cards, we were able to evaluate which hand had the greater relative strength. This research has the potential to change the way people look at poker and other games that involve comparing two hands of cards or other items.

Wilson, Jordan, Morales, Hannah, Haga, Camden, Morales, Hannah, Metzgar, Emma, "Reduced Facial Cue Strength Introduces Nuance Into Observers' Emotion Judgements" (Andrew Mienaltowski) Emotion recognition studies often include multiple-choice label selection tasks. The current study follows up a previous study in which participants freely labeled the emotional states of adult actors. Participants less accurately labeled older actors' emotions, using emotion words that were less directly relevant to the emotion expressed. However, the labels reflected greater lexical complexity. We hypothesized that this might be due to emotion being portrayed with weaker facial signals in older age. We manipulated the facial cue strength of the younger actors from the original study, presenting young adult observers with dynamic facial expressions of anger, disgust, fear, happiness, and sadness at moderate and high intensities. Across three segments of the experiment, observers provided an emotion label, rated expressive intensity, and then selected one emotion label from five options to best characterize the expression portrayed by each stimulus. For lower intensity stimuli, observers offered labels that were less directly relevant to the emotion portrayed, rated expressive intensity at lower levels, and selected fewer correct labels in the multiple-choice segment of the emotion perceptions task. Consistent with the interpretation that findings from earlier work were driven by weaker expressive cues, observers faced a greater challenge inaccurately characterizing the actors' emotion at lower intensities but offered labels with greater lexical complexity to capture the actors' emotional states.

Wodrig, Noah, Lightfoot, Roy, Gallagher, Caroline, Chen, Leah, "Quantifying CO2 Sequestration By Trees in Cloud Forest Growth Plots" (Martin Stone)

In the atmosphere, carbon dioxide concentrations are rising due to industrial activity intensifying global climate change. As a result, the importance of forest ecosystems as natural carbon sinks increases. This study quantified carbon dioxide sequestration by trees across three forest plot types: planted, natural regrowth, and old growth, within the Costa Rican cloud forest of Cloudbridge Nature Reserve. Trees were collected from 20 by 25-meter plots and only included individual trees with diameters greater than or equal to 10 centimeters. The circumference was taken at breast height and was measured using a tape measure; the tree height was estimated with a clinometer. Carbon dioxide equivalent was calculated using two-tailed t-tests. The results showed a positive correlation between both the circumference and height among carbon dioxide sequestration; circumference demonstrating a stronger relationship with carbon dioxide than height. The highest average carbon dioxide equivalent appeared in the old growth, followed by natural regrowth, and planted plots. However, the differences among the plot types were not statistically significant. These findings support the hypothesis: increasing biomass of a tree means both height and circumference are positively correlated with the extent of carbon dioxide sequestration in trees; emphasizing forest conservation and natural regeneration for climate change mitigation.

Wofford, Kaitlynn, Heath, William, Richardson, Aidan, "Reliability of the ActivForce2 in Assessment of Rate of Force Development in Collegiate Level Baseball Players" (Penny Head)

INTRODUCTION. Rate of force development (RFD) refers to how quickly a muscle can produce force. Accurate assessment of RFD is clinically relevant in baseball players due to the high-velocity demands of throwing. The purpose of this study is to establish the within-session and between-session reliability of the ActivForce2 handheld dynamometer for assessment of shoulder internal and external rotation RFD. **METHODS.** An explanatory methodological design will be used to prospectively assess within- and between-session reliability of the ActiveForce2. Collegiate baseball players (ages 18-26) will be recruited locally via convenience sampling. The ActiveForce2 will be used to measure RFD during isometric shoulder internal and external rotation using standardized positioning and belt stabilization. Two trials of each motion will be performed during two sessions separated by no more than 7 days. **RESULTS.** Within- and between-session reliability for each dependent variable will be estimated using intraclass correlation coefficients (ICC) with 95% confidence intervals. Standard error of measurement and minimal detectable change scores will also be calculated. **DISCUSSION.** Information from this study will contribute to credibility of the ActivForce2 and promote confidence in clinicians to track rehab progress. This study will support clinicians in monitoring shoulder RFD which can influence return to play decisions.

Woodson, Benjamin, "Trends and Influencing Factors in Weather-Related Fatalities in Kentucky from 1900 To 2025" (Jerry Brotzge)

High-impact weather hazards, such as extreme heat and cold, floods, lightning, tornadoes, and severe winds, are a threat to human life and rather common to Kentucky. However, exactly how dangerous these hazards are to Kentuckians, and how these dangers have changed over time, is unknown. To address this knowledge gap, this study reviews known fatalities from natural weather hazards from across Kentucky between 1900 and 2025. Data were analyzed to better understand the trends, circumstances and contributing factors to those deaths. A database of known victims and associated metadata was created per hazard, drawing from historical newspaper archives, state death certificates, and NOAA records. Victims are listed individually, along with the circumstances surrounding their death, and other relevant metadata. These data were then analyzed across hazard type to better understand the exact causes of death and any mitigating circumstances associated with the event. Preliminary results highlight hazard vulnerabilities but also increasing resiliency to natural hazards across Kentucky with time. For example, fatalities associated with extreme temperatures decreased significantly with time likely due to improved access to much improved indoor heating and cooling. Lightning fatalities also decreased sharply over the 125-year period, most likely due to the decline in outdoor work such as agriculture. This database will form a key resource for others for understanding hazard mitigation across Kentucky.

Wright, Johnathan, "Identity Fusion Predicts Stronger Negative Relationships Between Liking of the Two Main Political Parties" (Aaron Wichman)

We examined the relationship between attitudes toward Democratic and Republican political parties, and how Political Identity Fusion with one's party moderates this relationship. Participants completed measures assessing their liking for Democratic and Republican parties and their level of political identity fusion. Regression analyses consistently demonstrated that the negative association between liking for

one party and the other intensifies to the extent that people are fused with their party. This effect proved robust to the addition of control variables such as Right Wing Authoritarianism (RWA), Opposition to Equality (OEQ), Group Based Dominance (GBD), and Rosenberg Self-Esteem (RSE). The finding that identity fusion intensifies the inverse relationship between liking for opposing political parties remained consistent and significant even after controlling for these established psychological constructs. This research underscores the powerful role of identity fusion in exacerbating partisan divides

Wu, Amber, "Trigonometric Matrices on Time Scales" (Ferhan Atici)

In this presentation, we introduce different variations of a method for constructing matrix-valued cosine and sine functions defined on some isolated time scales. The method derives a formula based on the Jordan canonical form to compute each term of a Jordan block in the matrix-valued cosine and sine of a given square matrix A . We further explore some trigonometric identities between matrix functions. To illustrate the utility of our approach, we present some examples.

Yang, Ryan, "Utilizing Machine Learning Techniques to Predict Diabetes Based on Health Indicator Data" (Huanjing Wang)

Diabetes mellitus is a chronic condition that affects glucose regulation, often due to insufficient insulin production by the pancreas, leading to elevated blood sugar levels. Diabetes onset can often be difficult to detect and track, as symptoms are often subtle or misdiagnosed. This study develops and evaluates multiple machine learning models to classify individuals into different stages of diabetes progression (none, prediabetic, diabetic) and to identify key predictive features. Using a preprocessed 2021 Behavioral Risk Factor Surveillance System (BRFSS) dataset hosted on Kaggle, we developed several machine learning models: Decision Tree, Random Forest, AdaBoost, XGBoost, LightGBM, Multilayer Perceptron (MLP), and TabNet. Removing prediabetic cases and using binary classification generally improved accuracy and AUC scores, while resampling with Adaptive Synthetic Sampling (ADASYN) to address class imbalance further enhanced model performance. The LightGBM model achieved the highest accuracy (~85%) and AUC value (~0.82). We used SHAP analysis to quantify feature importance and uncover insights in demographic and behavior factors associated with diabetes. Models consistently ranked General Health, Age, and High Cholesterol among the top contributing factors. This study provides potential methods for preemptive early diagnosis of diabetes using health indicator data alone, leading to early prevention and treatment.

Young, Zachary, "Association Between Sleep Duration/Quality and Physical Performance in College Students" (Jean Chen)

Sleep duration and quality are essential components of overall health and well-being, particularly for athletes who require adequate recovery to maintain physical and psychological performance. Much research has examined the association between sleep duration/quality and physical performance in elite athletes, which prompted this project to study amateur athletes. Four college students from a university club volleyball team participated in this five-week study. Sleep duration and quality were measured using Apple Watches, which also recorded heart rate (HR) data during practices. Practices were video recorded weekly, and post-practice interviews were conducted to explore perceived effects of sleep on performance. Data were analyzed using descriptive statistics and Pearson correlation coefficients

(quantitative) and interpretive methods (qualitative). Participants averaged 7.5 hours of sleep per night, with practice HRs ranging from 84.8 to 164.6 bpm. A moderate positive correlation ($r = .587$, $p < .05$) was found between sleep duration and maximum HR, suggesting longer sleep was associated with higher practice intensity. Qualitative findings indicated that sleep significantly influenced performance, with participants emphasizing sleep quality over quantity. Other factors affecting performance included academic demands, work, nutrition, and extracurricular activities. These findings suggest sleep has meaningful physiological and psychological effects on collegiate amateur athletes.

Zaboronak, Samantha, Rowland, Naomi, Bledsoe, Lee Anne, Cook, Deb, "Is the Bacterium Helicobacter Pylori in Untreated Kentucky Karst Drinking Water Sources?" (Chris Groves)

Helicobacter pylori (*H. pylori*) is a helical bacterium associated with gastritis, peptic ulcers, and gastric cancer. In general, *H. pylori* is not considered a major concern in U.S. public drinking water sources, which supply about 95% of Kentucky households, because these systems are disinfected through chlorination. However, some Kentucky families rely on untreated groundwater for drinking water supplies, particularly in certain plain communities (Amish and Mennonite) that forgo some modern technologies, including access to treated municipal water sources. This situation is especially challenging in Kentucky's limestone karst landscapes, where surface water is limited and groundwater is vulnerable to contamination. Previous research analyzing over 100 water samples from 11 untreated karst spring family water supplies found that 100% of samples were contaminated with fecal bacteria originating from human and/or animal waste. The presence of *H. pylori* in these water supplies has not yet been determined. A quantitative PCR (qPCR) assay is being developed to detect *H. pylori* in untreated karst drinking water sources. Environmental samples have been collected from several drinking water wells and springs. Control DNA for *H. pylori* was obtained from the ATCC and *Escherichia coli* (*E. coli*) DNA was extracted from spiked samples. Serial dilutions are used to generate standard curves, and qPCR reactions are run on an Applied Biosystems QuantStudio 3 instrument.