

**54th Annual**



**SATURDAY, APRIL 6**

**DOWNING STUDENT UNION**

Western Kentucky University - Bowling Green, Kentucky

**Aina, Olufemi;** "A Review Of The Spatial And Temporal Trends In Precipitation And Temperature Across Kentucky." (Jerald Brotzge)

This study presents a comprehensive and quantitative comparison of temperature and precipitation data collected from three statewide, in situ weather observation networks: the Kentucky Mesonet, the Cooperative Observer program (COOP) as well as its subset - the U.S Historical Climatology Network (USHCN) and the Automated Surface Observing System (ASOS) network. This work assesses the strengths and limitations of each network through identification of biases or discrepancies in the historical records peculiar to each network. Daily maximum and minimum temperature and precipitation records from the Kentucky Mesonet for the years 2011 to 2020 will be compared with nearby (within 25 km) COOP and ASOS stations. Using simple statistical analyses, differences between networks will be quantified and investigated in light of network differences in siting characteristics, instrumentation, and quality control. This is the first of such comparison and results may allow for a more accurate historical record to be developed of the climate across the Commonwealth. In addition, this study will allow for a deeper understanding of the reliability and consistency of these reporting weather observing networks, thereby contributing valuable information to meteorologists, climatologists, and researchers involved in climate studies, impact assessments, and policy formulation.

**Akangbe, Tobi; Nguyen, Van;** "Does Sex Affect Neuromuscular And Motor Coordination Of Mice In Response To Sleep Fragmentation?" (Noah Ashley)

Sleep deprivation is known to reduce productivity by interfering with human motor coordination. Obstructive sleep apnea (OSA) is a disorder characterized by recurring events of throat muscles collapsing, blocking the airway during sleep, intermittent hypoxia, and perturbations in sleep continuity, known as sleep fragmentation (SF). The goal of this experiment was to assess whether there were sex differences in motor coordination of mice following SF. To perform this experiment, a rotarod test was used. C57BL/6J adult male and female mice were first exposed to the rotarod as a baseline measure. Then both sexes were subjected to 24 h of acute sleep fragmentation (ASF) using an automated SF chamber or no sleep fragmentation (NSF). Mice were then subjected to the rotarod apparatus a second time using a paired design. After analyzing the results, there was no effect of sex among NSF or ASF mice. However, there was a significant effect of time (pre vs. post SF). Mice performance improved during the second round. This study provides evidence that mice improve motor coordination over time, but this effect is influenced by neither sex nor SF. Future studies should assess the chronic effects of sleep fragmentation that are more representative of mimicking OSA.

**Akridge, Grasen** "Burnham Park Symphony Hall: Where Animation, Music, And Architecture Blend" (Aly Shahnaz)

In the late 1890s, "The Sorcerer's Apprentice" wove a narrative accompanied by music. In the 1940s, Walt Disney created "Fantasia," an animation synchronizing seamlessly with music, unveiling a profound relationship between sound and visuals. Drawing inspiration from this correlation, my architectural vision encapsulated this essence, rooted in Chicago to honor Disney's legacy. Incorporating brick into the building design served a dual purpose. First, it paid homage to Chicago's history, resonating with the city's journey from the Great Fire. Second, the choice of brick reimagined it as a vibrant element within contemporary architecture. Situated on Lake Michigan, the building's form emulated the fluidity of water, mirroring the ebbs and flows of music. The design captured dynamic variations, with kinetic facades challenging the notion of architecture as stagnant. Architectural contours artistically captured the music's emotional

journey, blurring the boundary between emotion and structure. The building symbolized a transformative resolution, akin to the Sorcerer parting waters. It rectified the perceived shortcomings of modernism, breathing new life into architectural design. Ultimately, the project represented an artistic evolution, redefining the boundaries of modern architecture. Like "Fantasia," it aimed to reintroduce purpose and sentiment to urban landscapes, creating a connection between architecture, music, and emotion.

**Allamyradov, Yaran; ben Yosef, Justice; Kylychbekov, Salizhan; Khuzhakulov, Zikrulloh; Majidov, Inomjon;** Banga, Simran; "Improving The Photodeactivation Efficiency Of Pathogens Using Methylene Blue With Silver Nanoparticles And Efflux Pump Inhibitors" (Ali Er)  
Bacterial antibiotic resistance poses a pressing global health crisis, challenging conventional therapies. Efflux pumps diminish antimicrobial effectiveness by expelling drugs from bacterial cells. Multidrug efflux pumps (MEPs) have been found to transport diverse compounds, including phenothiazinium dyes like methylene blue, out of bacteria. Inhibition of MEPs offers a promising strategy to bolster the efficacy of antimicrobial photodynamic inactivation (PDT). This research adopts a synergistic approach, combining the efflux pump inhibitor (EPI), reserpine, with silver nanoparticles (Ag NPs) and methylene blue (MB) to enhance PDT efficiency. Ag NPs were synthesized via pulsed laser ablation and characterized using TEM, UV-Vis, and PL spectra. *E. coli* was treated with MB, Ag NPs, and reserpine, followed by LED light irradiation. MB was twice as effective, and AgNPs/MB was six times more effective with reserpine during a six minute irradiation. Ongoing experiments on morphological changes will be presented. AgNPs/MB with reserpine could effectively combat bacterial pathogens in open wounds and prosthetic joint infections.

**Allamyradov, Yaran** "The Role Of Efflux Pump Inhibitor In Enhancing Antimicrobial Efficiency Of Ag Nps And Mb As An Effective Photodynamic Therapy Agent" (Ali Oguz Er)  
Efflux pumps are active transporters, which allow the cell to remove toxic substances from within the cell including antibiotics and photosensitizer complexes. Efflux pump inhibitors (EPIs), chemicals that prevent the passage of molecules through efflux pumps, play a crucial role in antimicrobial effectiveness against pathogens. In this work, we studied the effect of EPI, namely, reserpine, on photodeactivation rate of pathogens when used with Ag NPs and methylene blue (MB). Our results show that using reserpine led to a higher deactivation rate than Ag NPs and MB. The mechanism of this observation was investigated with singlet oxygen generation amount. Additionally, different sizes of Ag NPs were tested with reserpine. Molecular docking calculation shows that reserpine had higher affinity toward AcrB than MB. The improvement in bacterial deactivation rate is attributed to blockage of the AcrAB-TolC efflux pump preventing the removal of MB rather than enhanced singlet oxygen production. These results suggest that using reserpine with nanoparticles and photosynthesis is a promising approach in photodynamic therapy.

**Allamyradov, Yaran; Er, Alper;** Banga, Simran; "Formation Of Picosecond Laser-induced Periodic Surface Structures On Steel For Knee Arthroplasty Prosthetics" (Ali Oguz Er)  
The formation of laser-induced periodic surface structures (LIPSS) on mirror-polished 304-grade stainless steel sheets with dimensions 25 mm × 25 mm × 0.8 mm upon irradiation with picosecond laser pulses in air and water environments at different wavelengths, number of pulses, and laser energy densities was investigated. Atomic force microscopy (AFM) and scanning electron microscopy (SEM) were used to characterize the LIPSS. Tunable periodicity

of the LIPSS was observed in both media at different wavelengths and fluence. Fluence was shown to be the main formation parameter of LIPSS; however, the medium was also demonstrated to play an important role. Our results show that LIPSS can be successfully generated on stainless steel in a single-step process and that they can be easily modified by adjusting laser parameters.

**Allen, Julia;** "The Effects Of Tag Positions On The Morphogenesis Checkpoint Proteins"  
(Joseph Marquardt)

The ability of cells to control their shape is of critical importance for maintenance of functionality. In the budding yeast *Saccharomyces cerevisiae*, septins have important roles in regulating cell shape by providing scaffolding at the bud neck to control the shape of a developing bud. There are also checkpoint proteins for the morphogenesis pathway to couple the timing of bud formation to the cell cycle, namely Elm1-Hsl1-Hsl7-Swe1. The timing of these proteins' recruitment to the bud neck is important in understanding the mechanism of the cell shape control pathway and has relied on precise tagging of the proteins. The effects of tag positions on the morphogenesis checkpoint proteins were therefore studied. PCR was used to check for the correct tagging, then images were taken using a fluorescent microscope. The N-terminus of Hsl7 had the most amount of signal at the bud neck while the C-terminus of Elm1 had the least. Then, the cells were organized by size. For all the strains, the large buds show the least amount of signal. This indicates that these proteins show differential visualization at the bud neck and the position of the tag has a significant effect on our ability to ascertain their localization accurately.

**Allison, Mason** "Barren River Lake State Resort" (Shahnaz Aly)

Barren River Lake State Resort Abstract: I have proposed a design for the Louie B. Nunn Lodge at Barren River Lake State Park. It was time for the outdated 60's lodge to be redone in a new contemporary look to gain more attraction and business for Barren River Lake State Park and Marina. This project has added more jobs and largely benefited the economy of Barren County, the City of Glasgow, Kentucky, and surrounding areas. This new modern timber frame lodge resort has included includes a main lobby, reimagined Driftwood Bar and Grille with indoor and outdoor back deck seating, giftshop/bait and tackle, a casino floor for sports betting, a ballroom, and pool. The goal of this project was to keep the same timber frame aesthetic the original lodge has but recreating the resort in a new contemporary way while adding new amenities that has gained a lot of attraction and new business for the State Park and Marina in Barren County, Kentucky. The goal of this project was to keep the heart of the lodge for the thousands of people who enjoy it yearly, but giving give a new facelift and atmosphere to a special place many Kentuckians can enjoy for years to come.

**Allison, Owen** "Barren River Outdoor Sports Recreational Center" (Shahnaz Aly)

I designed a mixed-use outdoor sports recreational center in Bowling Green, Kentucky. Bowling green Green has plenty of fitness gyms, however, Bowling Green is in need of a central outdoor sports hub that outdoor enthusiasts can come to and enjoy what they love. The recreational center offers indoor and outdoor rock climbing, an indoor pool for swimming and whitewater kayaking, a bike repair shop, rental shop for outdoor equipment, pickleball court, outdoor sports store, cafe, fitness rooms and an education classroom. The center has a sustainable design and incorporates green architecture elements. The site location is Mitch McConnell/Riverfront Park. Bowling Green already has plans to revitalize the park with all new

features. The project's goal is to add to Bowling Green's growing downtown area. Bowling Green was founded on the Barren River and this recreational center on riverfront property will help revitalize the downtown area.

**Anderson, Sydney;** "Analyzing Change Detection And Band Ratio Of The Olmstead Quadrangle In Kentucky: Insights For Environmental Monitoring" (Nahid Gani)

This study employs change detection and band ratio analysis techniques to assess data spanning a 24-year period (1999-2023) within the Olmsted Quadrangle, Kentucky. Data sourced from the USGS Earth Explorer includes Landsat 5 imagery for 1999 and Landsat 8 imagery for 2023. Utilizing ArcGIS Pro for analysis, nine distinct images were generated, with three focused on vegetation change detection over the 24-year period and six aimed at identifying iron-rich and clay-rich rock formations. The results reveal a notable decrease in vegetation cover, as well as reductions in iron-rich and clay-rich rock formations. These findings are significant, particularly considering the lack of updates to the geologic map of the area since 1960. The study provides valuable insights into the factors contributing to changes in vegetation and rock formations, thereby informing efforts to update the Olmsted Quadrangle geologic map and contributing to broader environmental monitoring initiatives. Societally, this research aids in understanding the impact of environmental changes on the ecosystem, land use, and land cover patterns, while environmentally, it highlights the importance of monitoring and managing natural resources for sustainable development.

**Annamuradov, Berdimyrat; Khuzhakulov, Zikrulloh; Kylychbekov, Salizhan; Allamyradov, Yaran; Majidov, Inomjon;** "Fabrication and analysis of zirconium thin films on silicon (Si) by pulsed laser deposition" (Ali Oguz Er)

The advanced technological applications of Al/Zr multilayers have demonstrated exceptional capabilities in the Extreme Ultraviolet (EUV) region to detect solar coronal and emission lines as a reflective mirror coating. Therefore, it is critical to understand and characterize the growth process of zirconium within these combinations. Using Pulsed Laser Deposition (PLD), Zr films were deposited on silicon with laser wavelengths of 1064 nm and 532 nm, at substrate temperatures of 25 °C, 300 °C, and 500 °C, and fluences of 0.25, 0.5, and 1.0 J/cm<sup>2</sup>. The 1064 nm wavelength yielded smoother films, with surface roughness increasing with higher fluences. The substrate temperature of 300 °C produced the highest crystallinity. surface characterization analyses using XRD, SEM, and AFM showed the dependence of morphologies on laser parameters. In addition, our computational model supports experimental observation. Overall, PLD was shown to be a feasible method to obtain high crystalline thin films.

**Anthoony, Beth; Rager, Paige; ; Mancini, Anthony;** "Bringing Wellness Into The Dpt Classroom" (Elizabeth Norris)

Introduction: Students enrolled in a Doctor of Physical Therapy (DPT) program commonly experience elevated stress related to an intense academically challenging course load. Incorporating structured wellness activities into curriculum may assist students in managing stress and improving student success and well-being. The purpose of this study is to develop a wellness program to be implemented within the DPT curriculum and to assess the impact of this program on student stress and anxiety. Methods: Investigators will develop Take-5 for Wellness, which will consist of a variety of 5-minute wellness activities that will be incorporated into the curriculum during fall semester 2024. Students will participate in 6-8 weekly, 5-minute wellness activities embedded in DPT courses. Students volunteering to participate in this quasi-

experimental study will complete the Beck Anxiety Inventory (BAI) and the Perceived Stress Survey (PSS) at the beginning, midterm, and end of the semester. Student and faculty experience with the wellness program will be assessed. Results: Student stress and anxiety will be compared across the semester using a one-way repeated measures ANOVA. Conclusion: Implementing a wellness program into the curriculum may provide coping strategies to regulate stress, teach responsibility for self-care, and improve the ability to achieve personal/academic goals.

**Arora, Aanyaa;** "Discovery And Analysis Of Mycobacteriophage Smar" (Rodney King)

The project aimed to isolate and analyze a bacteriophage capable of infecting *Mycobacterium smegmatis*, a soil microbe related to *Mycobacterium tuberculosis*, a significant human pathogen. *Mycobacterium smegmatis* itself is nonpathogenic. A soil sample from Bowling Green was collected for mycobacteriophage enrichment. A spot test was used to detect viable bacteriophages, and a homogeneous population with uniform plaque morphology was established through multiple rounds of plaque purification. The purified phage was named Smar, whose letters stand for the initials of everyone in my immediate family. Electron microscopy examination of a concentrated Smar particle solution revealed that it belongs to the Siphoviridae family. The genomic DNA of Smar was purified, and its concentration was determined using a spectrophotometer. Restriction enzyme digests on the purified DNA were conducted, and the resulting products were analyzed through agarose gel electrophoresis. Notably, the genomic DNA was only cleaved by a subset of the tested enzymes, indicating that Smar is a novel mycobacteriophage. This study contributes to our understanding of bacteriophage distribution and diversity. Genomic analysis of Smar may reveal novel genes whose products may have therapeutic potential.

**Ashley, Asa** "The Dirac Equation In Cantorian Hyperspace" (Valentino Simpao)

Though Einstein's mass-energy equation is derived under the assumption of absolute smooth spacetime, in reality, discontinuity is intrinsic at quantum scales. Further, in recent years it has been shown that fractional and fractal differential equations can describe discontinuous media. Given such, this paper presents a formulation of the Dirac equation in Cantorian-fractal hyperspace through use of the conformable fractional derivative. Herein, we present a derivation by differential geometry in Weyl space through obtaining an invariant Lagrangian and fractional Hamilton-Jacobi equations under the assumptions of Affine Quantum Mechanics, proving the effect of the local fractional operator on the Weyl curvature tensor. Then an ansatz solution may be found, and the bound state solutions for the Wood-Saxon and Yu-kawa potential can be deduced, with the angular wave functions being generated from generalized solid harmonics with ladder operators generating an isomorphism to  $SO(3,2)$ . Subsequently, an exact analytical solution will be found using the GFNU method. Further, the implications of fractional order affecting curvature regarding particle dynamics will be discussed. Finally, we explore the geometric meaning of relativistic particle dynamics in discontinuous media and its relation to E-infinity theory and microphysics, with special application in the development of analytical systems regarding dark energy.

**Askren, Marlana** "Diversity of spider beetles in Argentina: two new species and distributions" (Keith Philips)

Two new species in the genus *Trigonogenius* are described from Argentina. The fauna now includes five species with a new country record for *T. squalidus*. Diagnoses and photos of all species found in Argentina are included. The distribution and species name status of *T. globulus*

(Solier) is discussed, and morphological characteristics are compared between Argentinian and Peruvian species.

**Ateyeh, Mahmood; Majidov, Inomjon; Allamyradov, Yaran; Er, Alper; Khuzhakulov, Zikrulloh;** "Cleaning Of Surgical Tools With High-power Picosecond Laser Pulses" (Ali Er)  
In healthcare, proper cleaning of medical devices is a crucial component in the prevention of disease transmission and patient safety. Mainstream methods, such as mechanical grinding and chemical cleaning, while effective to a degree, have many drawbacks, including requiring many resources, damaging the medical device, and utilizing hazardous chemicals which pollute the environment. Thus, in this research, the practicality of lasers as a safe and environmentally friendly alternative in cleaning medical devices is investigated. Specifically, this study seeks to optimize three critical parameters for picosecond lasers to effectively clean medical devices: fluence, wavelength, and pulse overlap. Surface characterization tools such as Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), and Atomic Force Microscopy (AFM) are employed to precisely and quantitatively analyze characteristics of our sample devices before and after cleaning, such as elemental composition changes, roughness, and contaminant density. In the future, we hope to expand the set of optimizing parameters such as pulse width and dynamic pulse separation to better understand the mechanism behind the contamination removal.

**Baker, Amelia; Shackleford, Josiah;** "Investigating The Ability Of An Interspecies Gene To Rescue Shape Control Defects In Budding Yeast" (Joseph Marquardt)  
The shape of a cell is critical for the full functionality of that cell in an organism. Normal budding yeast cells have a slightly circular shape. The N-methyltransferase protein Hsl7 is required for yeast to yield this circular shape. Removing this gene results in elongation of yeast cells. A related fission yeast species contains an orthologous gene (SKB1) that does not appear to operate in the same cell shape control pathway. We utilized traditional yeast genetics coupled with fluorescent live-cell microscopy to investigate the ability of this fission yeast gene product to rescue an HSL7 gene deletion phenotype. Despite being nearly 40% identical in protein sequence, Skb1 was not able to rescue the normal round shape of cells deleted of the HSL7 gene. This is most likely due to its inability to localize to the bud neck region required for the cell morphology control of the Hsl7 protein. Further work will be necessary to confirm these findings and examine the biochemical capacity of Skb1 to function similarly to Hsl7 in budding yeast.

**Bariteau, Charlotte** "Using A Critical View Of Dance History To Inform Jazz Dance Technique" (Amanda Clark)  
At its root, jazz dance is an American art form that was fundamentally created by African Americans. However, many narratives have been overshadowed by the whitewashing or inconsistent education of dance history. As a result, the dominant perceptions of jazz dance and jazz dance history remain Eurocentric and lack accurate representation. Additionally, jazz dance technique courses are taught from a primarily movement-based perspective and lack proper incorporation of history. This project explores the idea that if dancers can begin to understand the jazz dance technique, they are building from a cultural and historical level, they can begin to think critically and open conversations about diversity in dance. Through interviews with jazz dance scholars, participation in jazz dance classes, viewing of jazz dance movement, and literature review, this project determined strategies dancers and dance educators can use to incorporate a critical view of dance history into their jazz dance practices.

**Barrett, EB; "Extension of 'Do Dogs Know Calculus'" (Dominic Lanphier)**

This project extends Timothy Penning's "Do Dogs Know Calculus" research, where Penning applied the common calculus problem of finding the most optimal or shortest path from A to B, with a horizontal and vertical distance between the two points. While playing fetch by the ocean shore, he discovered his dog seemed to be intuitively traveling the most optimal path to retrieve the ball from the water. For this extension, assume a crossable body of water separates two plots of land with the same surface (such as both are grass or sand). Also, assume the dog's running speed is faster than his swimming speed. A function can model the time it takes for the dog to retrieve the ball by running on land, swimming in the water, and running on land again. Differential calculus was used to find the optimal distances the dog must run and swim to minimize the time. Simplifying the result produced a quartic polynomial, allowing the application of Cardano's equations.

**Basquill, Grace; Rios, Logan; "Soothing Zzz: Exploring Infant Sleep Habits And Soothability" (Diane Lickenbrock)**

Sleep quality during early infancy is crucial for both physical and cognitive development (Pecora et al., 2022). Infant temperament, or individual differences in attentional, motor, emotional reactivity and self-regulation, have been associated with sleep disturbances (Bornstein et al., 2015). For example, infants with low soothability, who are typically less responsive to soothing techniques from caregivers (Garstein & Rothbart, 2003), have been found to experience increased sleep difficulties later in life (Morales-Muñoz et al., 2020). Additionally, poor sleep quality has been associated with increased fussiness and distress (Tikotzky et al., 2010); however, previous research has not specifically examined the association between infant soothability and sleep distress. The current study aimed to examine the associations between soothability, sleep distress, and sleep quality in infants. Mothers (n=79) rated their infants' soothability and sleep habits (sleep distress, sleep quality) when infants were 8 months- (IBQ-R; Gartstein & Rothbart, 2003). Results revealed significant correlations between 1) infant sleep quality and soothability ( $r=.317$ ,  $p=.004$ ) and 2) infant sleep quality and sleep distress ( $r=-.563$ ,  $p<.001$ ). No significant associations were found with infant soothability and sleep distress. Results suggest that infants who are more soothable have increased sleep quality while infants with increased distress have more difficulty sleeping.

**Batten, Lauren; Landgsdorf, Nadine; Whiting, Jaclynn; "Intra-rater Reliability of Mobil-aider Device for Measuring Anterior Drawer Translation Of Talus During Anterior Drawer Test" (Penny Head)**

The anterior drawer test is commonly used to assess ligamentous laxity following lateral ankle sprain. This test involves creating an anterior translation of the talus relative to the ankle mortise. Inter-rater reliability of the anterior drawer test was found to be poor (ICC 0.059), while intra-rater reliability was found to have a large variance, ranging from 46% to 92% agreement. Use of a joint arthrometer to measure the linear translation may be valuable to improve reliability of the anterior drawer test and allow for a more accurate assessment of ligamentous integrity following ankle sprain injury. The purpose of this study is to establish the intra-rater reliability of the Mobil-Aider device to measure anterior translation of the talus during an anterior drawer test. Twenty-eight participants (18-25 years old) with no history of ankle surgery or ankle injury within the past 3 months will be recruited. An experienced physical therapist will perform 3 anterior drawer trials for each participant, using the Mobil-Aider device to measure anterior



translation. The physical therapist will be blinded to the measurements. Calculation of an intraclass correlation coefficient (ICC 3,3) will be used to determine the intra-rater reliability.

**ben Yosef, Justice; Allamradov, Yaran;** "Synthesis of Gold Nanoparticles via Laser Ablation in a Liquid Medium for use in the Photodynamic Therapy of Bacteria" (Ali Oguz Er)

With the ever-increasing threat of antibiotic resistant bacteria, alternative treatment methods have been developed including Photodynamic Therapy (PDT). Within the PDT process, photosensitizers are used to generate reactive oxygen species (ROS) and facilitate the cell termination process. This work studied the functionalization of the photosensitizer methylene blue (MB) with gold nanoparticles (Au NPs) and the incorporation of the AcrAB efflux pump inhibitor INF-55 to enhance the effectivity of the PDT process. Au NPs were synthesized using laser ablation in an aqueous citrate solution. Both nanosecond and picosecond pulse rates, as well as both 532 nm and 1064 nm wavelengths at various powers and frequencies were tested to determine the effect of laser parameters on particle synthesis. After synthesis, the Au NPs were characterized using Transmission Electron Microscopy imaging, UV-Vis, Fluorescence, and Fourier Transform Infrared (FTIR) spectroscopy. Once characterized, the ROS generated in solution were measured using ABMDMA-UV-Vis analysis. Additionally, the effects of the Au NPs in conjugation with MB were tested on the Gram-negative bacteria Escherichia coli (E. coli) to determine the effect of Au NP size and the effect of efflux pump inhibitors on cell termination.

**Bentley, Alexander; Ko, Jae;** "Partial Displacement Of A Triamine Ligand From Platinum(ii) By Guanine Derivatives" (Kevin Williams)

Platinum triamine complexes often have low anticancer activity compared with cisplatin; however, unique activities have been noted for complexes with sterically hindered nitrogen atoms. We have reacted Chloro[2-(4-Methyl-1,4-diazepan-1-yl)ethanamine]platinum(II) chloride ([Pt(L)Cl]Cl) with guanine derivatives such as guanosine 5'-monophosphate (5'-GMP) and 9-ethylguanine (9-EtG). Because ([Pt(L)Cl]Cl) exists as a pair of enantiomers, reaction with the former leads to diastereomer products; thus, reaction with 9-EtG can lead to simpler NMR spectra. Reaction of the ([Pt(L)Cl]Cl) with 5'-GMP at pH 4 produces both [Pt(L)(5'-GMP)]<sup>+</sup> and [Pt(K2L)(5'-GMP)<sub>2</sub>], the latter having the L ligand binding in a bidentate mode. The latter is not seen when the reaction is conducted at pH 7 or if the original platinum compound has previously been converted to [Pt(L)(D<sub>2</sub>O)]<sup>2+</sup>, suggesting the formation of a [Pt(k2L)(5'-GMP)Cl] intermediate form at pH 4. In addition, 9-ethylguanine has shown the ability to displace the Cl in platinum compounds at pH 3, giving expected values. These results suggest that ([Pt(L)Cl]Cl) could react with DNA in a bidentate binding mode (similar to cisplatin) under the right conditions.

**Berry, Daniel;** "Blazar Variability From The Ground And Space: S5 0716+714 Observed With Wku's WKU's Robotically Controlled Telescope And Nasa's NASA's Transiting Exoplanet Survey Satellite (tessTESS)" (Michael Carini)

The defining characteristics of blazars are a featureless or nearly featureless optical continuum, large amplitude and highly variable polarization, and large amplitude continuum variability at all wavelengths and on timescales ranging from minutes to decades. Blazars are oriented such that we are looking nearly down the throat of the relativistic jet, resulting in the observed emission being dominated by processes at work in the jet and being both amplified and time-compressed in our frame. The blazar class of radio loud Active Galactic Nuclei Blazars represent the most extreme examples of the Active Galactic Nuclei (AGN) phenomenon. The lack of discrete

features in their spectra leaves us with only continuum variability and/or polarization variability as a diagnostic of the emission mechanisms at work in many of these objects. In this presentation, I will compare the ground-based observations of the blazar S5 0716+714 obtained by WKU's Robotically Controlled Telescope (RCT) that I reduced and analyzed with contemporaneous light curves extracted from TESS observations of the source.

**Blackledge, Ava;** "Discovery And Analysis Of Mycobacteriophage Hetestia" (Rodney King) Bacteriophages are viruses that infect and lyse bacteria. They are abundant worldwide with a population estimated to exceed  $10^{31}$  particles. Despite their prevalence, the majority of these phages remain uncharacterized. The objective of the SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) program is to isolate, purify, amplify, analyze, and archive a phage specific to *Mycobacterium smegmatis*, a nonpathogenic bacterial strain related to the *Mycobacterium tuberculosis*. A water sample from a blue hole located in Lost River Caves, KY was confirmed to contain *M. smeg* phages using a spot test assay. A pure population was generated from the sample and the isolated phage was named Hetestia. Hetestia was amplified to generate a high titer lysate suitable for further analysis. Hetestia's genomic DNA was isolated and subjected to two rounds of analysis using different sets of restriction enzymes. Transmission electron microscopy was employed to observe Hetestia's morphology and revealed that Hetestia was a siphoviridae with exceedingly straight tails. Initially believed to be lytic based on plaque phenotype, Hetestia was confirmed to be a temperate phage through lysogeny experiments. The information acquired from this research will contribute to the scientific community's overall knowledge of bacteriophage behavior and diversity.

**Boateng, Ama** "The Influence Of School Policies And Attitudes On Black Students' Mental Health" (Sarah Bonis)

When educators target black students' hair through school policies or attitudes, they inadvertently target their racial identity, causing harm to their mental health (Joseph-Salisbury & Connelly, 2018). A retrospective and current survey will explore the experiences that Black college students currently have and had in high school related to their race and hair. Recommendations for schools and educators will be provided about covert racism, and the steps schools can take to provide a safe, healthy environment for Black students.

**Boike, Abby** "The Gatsby: Apartment In Asheville, Nc" (Shahnaz Aly)

The goal of this project was to design a place for retired-age individuals where they have all of their basic needs and wants met; a place where they can eat, sleep, shop, socialize, relax, and be active, without having to leave the location. The Gatsby is located near downtown Asheville, NC. Asheville was chosen because it is known for its vibrant art scene, great restaurants, breweries, and well-preserved art deco architecture. The city of Asheville offers people the beautiful scenic views that come with living among the Blue Ridge Mountains with great urban amenities, which makes the area a popular place to retire to. The Gatsby extends the feel of downtown Asheville with retail shopping and restaurants, while also providing the area with apartments, as there are limited options in the area. An important aspect of the Gatsby is encouraging community and providing spaces to socialize. At The Gatsby, there are opportunities for social activities and an abundance of spaces for people to gather and socialize throughout the building, including lounges on every residential floor and a green roof that is

accessible to tenants. The Gatsby is a place where, through the efforts being made towards sustainability, individuals feel good about living at.

**Bonifer, Kaylie** "Determining Pre And In-flight Severe Weather Risks And Causes Of The September 27 2023 Ohio County N3097m Plane Crash Using Satellite And Radar Techniques" (Josh Durkee)

A severe thunderstorm, as defined by the National Weather Service, is a thunderstorm that produces hail with a 1-inch diameter and/or has winds that are 58 mph or stronger. They can often be identified using satellite or radar techniques. The purpose of this study is to investigate the affect effect severe weather may have had on the N3097M plane crash on September 27, 2023 through satellite and radar techniques as well as determine the storm mode the pilots experienced. Results from this study show that storm type was initiated through surface convergence as opposed to convective forcing. Additionally, radar analysis indicates that the pilots likely experienced turbulent winds and hail moments before losing contact with Air Traffic Control. Overall, this study shows that severe thunderstorms were present in the area before and during the time of the N3097M plane crash.

**Borges, Hailey; Swift, Alyssa; Rios, Logan;** "Associations Between Parent Mental Health, Stress Responses, And Infant Affect Reactivity" (Diane Lickenbrock)

Parents influence their infants' social and emotional development, with factors like parental mental health (Taipale, 2016) and stress responses (Fuchs et al., 2021) shaping outcomes. Baseline respiratory sinus arrhythmia (RSA), indicating regulatory capacity, serves as a measure of parent stress response (Stifter & Corey, 2001). Although higher RSA is associated with increased emotional reactivity (Richter & Lickenbrock, 2021), research has not examined whether parent stress responses buffer the negative impact of psychopathological symptoms on infant affect reactivity. This study investigated parent mental health and physiological regulation as predictors of infant affect reactivity. At 4 months, parents completed a depression and anxiety questionnaire (Watson et al., 2007) and baseline RSA was assessed. At 8 months, parents individually engaged in a peek-a-boo task with their infants (Lab-TAB; Goldsmith & Rothbart, 1999). Results (n=59 families) revealed a significant Well-Being X Mother RSA interaction predicted infant positive affect reactivity ( $B=.253$ ,  $p=.044$ ), such that infants exhibited decreased positive affect reactivity when mothers had low well-being and high baseline RSA ( $B=-.605$ ,  $p=.002$ ). A significant Social Anxiety X Father RSA interaction predicted infant negative affect reactivity ( $B=.344$ ,  $p=.009$ ). Infants showed decreased negative reactivity when fathers had low social anxiety and high baseline RSA ( $B=-.444$ ,  $p=.031$ ).

**Bowers, Matthew** "Digging Deep: The Role Of Depth Versus Nutrient Additives On Zai Pit Maize Productivity In Southern Kenya" (Bruce Schulte)

In Kenya, the reliance on rainfed agriculture means that crops are frequently jeopardized by droughts, which have become more frequent and intense due to climate change. Zai pits, an Indigenous Climate-Smart Agriculture (CSA) technique, have been shown to improve crop yields in drought-ridden areas. However, this technique is labor intensive, discouraging its adoption on a large scale. This study assessed whether the depths of zai pits or the nutrients added to them were more critical to their success. At an enclosed research camp within Rukinga Wildlife Sanctuary in southern Kenya, maize growth, development, and yields were compared between manure-enriched, 50 cm-deep zai pits and 1) 50 cm deep zai pits without manure, 2) 25 cm zai pits with manure, and 3) non-zai pit surface planting (0 cm) over two growing seasons.

Maize grown in deep and shallow zai pits performed similarly, and maize grown in deep zai pits with manure performed better than maize in deep zai pits without manure and the surface planting controls. Nutrient additives appear to play a more important role than depth in the success of maize. Encouraging smallholder farmers to dig shallower, manure-enriched zai pits could increase their usage and thereby enhance food security.

**Brantley, Robert; Modrall, Max; Pfeil, Sarah;** "Comparison Of Controlled Articular Rotations And Static Stretching For Hip Internal Rotation Range Of Motion" (Penny Head)

Introduction: While adequate research exists regarding static stretching, there is minimal research on the Controlled Articular Rotation Stretching (CARS) protocol. This study aims to compare the effect of the hip CARS protocol and static stretching on hip internal rotation (IR) range of motion (ROM). We hypothesize that there will be no difference between static stretching and the hip CARS protocol on hip IR ROM. Methods: Thirty-six healthy adults, ages 18-26, will be recruited. Participants must have  $<35^\circ$  hip IR ROM. A two-way mixed methods design will be utilized. Participants will be randomized into two groups, with each group completing the assigned stretching protocol for 4 consecutive weeks. Hip IR ROM will be measured using a goniometer at baseline, 2 weeks, and 4 weeks. Results: A 2x3 mixed ANOVA will be used to determine between and within group differences, as well as interaction effects. Post-hoc testing with a modified Bonferroni will be performed if significance is found. Discussion: The clinical significance of the study is to add relevant research on hip CARS protocol, as there is little to no research on the topic readily available.

**Briles, Emma; Traxler, Sidney; Maddox, Emma; Peterson, Caleb;** "Examination Of The Impact Of Gender On Chronic Pain, Binge Drinking, And Cannabis Use." (Jenni Teeters)

This study explores the impact of physical pain on binge drinking and cannabis use in young adults, considering gender as a potential factor. Examining 240 participants from a college campus, predominantly women (80.7%), the research found that the association between physical pain and binge drinking was significantly moderated by gender ( $p < .001$ , 95% CI [-2.59 --.78]). Specifically, the link was notably stronger for men ( $B = 1.54$ ,  $p < .001$ ) compared to women ( $B = -.15$ ,  $p > .05$ ). However, gender did not influence the relationship between physical pain and cannabis use frequency. These findings suggest that young men may engage in heavier drinking in response to physical pain. This underexplored aspect of using alcohol and cannabis to cope with physical pain in this age group could offer valuable insights for educational, preventive, and intervention strategies.

**Brindley, Makayla; Bruce, Sydney; Gore, Cheyenne;** "3D Motion Analysis Of Single Leg Squat With Association To Hip Strength And Ankle Dorsiflexion" (Melissa Tolbert)

When the body is in motion, the transfer of energy and force occurs in a series as a kinetic chain. One impairment along the chain can impact the proximal and distal segments. The single leg squat (SLS) is a functional movement, requiring adequate hip strength, knee and ankle range of motion (ROM). Previous literature has found a correlation between hip strength and ankle ROM deficits. However, limited research is available regarding 3D analysis systems examining these areas during a SLS. The purpose is to assess and correlate SLS depth to hip strength and ankle ROM, as well as to determine if there is a correlation between hip strength and ankle ROM. Seventy-five participants, aged 18-40, in good health, and capable of performing a SLS will be recruited. Participants must have no previous history of lower extremity musculoskeletal surgery or current lower extremity injury. One session will be conducted to examine ankle ROM, hip

strength, and SLS depth. A Oneone-tailed correlation statistical test will be used for data analysis. Anticipated positive correlations include: hip abductor strength and SLS depth; ankle dorsiflexion ROM and SLS depth; and hip abduction strength, hip extension strength, and ankle dorsiflexion ROM.

**Brough, Julianna;** "Property Renewal & History Through Adaptive Reuse at Western Kentucky University" (Margaret Gripshover)

Renewal is the essence of sustainability. It is the longevity of positive practices that will increase the quality of life for current generations and those to come. Adaptive reuse is a prime example of renewal for premises that would have otherwise been torn down and the land resources be cultivated for further development. The buildings that will be presented through this GIS story map presentation have a rich history of those who dwell in them and should be brought to light. Life goes on and so does the continuation of these buildings' stories, thanks to 'second life,' through adaptive reuse. This interdisciplinary study of sustainable practices addresses the problem of limited resources being used for unnecessary development and hopes to shed light on the importance of reusing these buildings by sharing their history. Methods of research include GIS story maps, photography, and historical records of ownership. Results proved positive in using adaptive reuse as a sustainable practice. Implications We hope to see more adaptive reuse and less new development to keep these buildings alive so that generations of students to come may enjoy them as much as we now do.

**Brown, Jamison; Wyatt, Rachel;** "Building Foundations: Introduction to Child Welfare" (Austin Griffiths)

Child welfare is a cornerstone of our community, confronting the challenges of child maltreatment, sexual assault, domestic violence, and the impacts of generational poverty and substance abuse on families. Addressing these critical issues head-on, LCCWEAR is dedicated to pioneering solutions within the child welfare community. One such initiative involves cultivating awareness and proactive engagement among the next generation through our innovative and interdisciplinary course, "Intro to Child Welfare CHHS 100." By equipping emerging professionals with essential knowledge and insights about child welfare and child protection, our goal is to inspire a wave of change-makers committed to fostering a safer and more nurturing environment for all children. The LCCWEAR research team surveyed students who had completed the CHHS 100 course. The survey asked about the knowledge students gained by taking the course and their plans for applying what they learned to their respective professions. Our data analysis provided evidence of students' changed perceptions, motivations, and preparations to make a difference in families and children's lives. It indicated the efficacy of CHHS 100 in its goal to educate future service professionals on child welfare and the crucial role child welfare plays in the health and well-being of our families and our community.

**Brown, Joshua** "Case study of the May 24, 2017, Southwest Ohio severe storm using satellite and radar" (Joshua Durkee)

On May 24, 2017, a severe storm went across southwestern Ohio, creating 6 tornadoes. None of these tornadoes were strong, as they were rated EF-1's and EF-0's. Satellite was used to observe how the storm developed while radar showed how the different radar products align with each other. The satellite ran a day prior up to the hour of the event. Radar then was used from 0000Z to 0040Z on May 25. The study uses used the GOES-16 satellite which has 16 different bands. Out of the 16 bands, 3 of them will be used which includedwere used, including red visible,

water vapor, and clean longwave IR. Radar has three levels of data. In this study, Level 3 data is primarily used. Level 3 products that were used are base reflectivity, radial velocity, specific differential phase, correlation coefficient, differential reflectivity, storm relative velocity, spectrum width, and hydrometeor classification algorithm. The only Level 2 product that was used was NROT. The study found that satellite is good at seeing how the storm formed as well as locating the cold fronts and overshooting tops, while radar is able to locate areas of potential heavy precipitation, hail, and possible tornadoes when compared to other radar products.

**Browning, Clay; Saul, Maddox; Harris, Benjamin; Harris, Kacy; Goodpastor, Jennifer; Scarborough, Heather; "Virtual Simulation Escape Room" (Michael Galloway)**

This project enhances the remote learning experience for medical students at Western Kentucky University through an interactive application. The app, built with Unity Engine, immerses students in virtual hospital rooms, where they face medical scenarios. Working closely with professionals from the university's medical center, the project creates three distinct patient treatment scenarios. Students must navigate these scenarios, making decisions and solving challenges, to earn completion certificates. To integrate this learning experience into the academic framework, the project allows students to submit certificates through platforms like Blackboard. The scenarios mirror real-life patient treatment, providing comprehensive documents and a hint system to guide students. This approach not only reinforces theoretical knowledge but also offers practical insights in a controlled environment. The project's gamified approach breaks the monotony of remote learning, promoting critical thinking, decision-making, and teamwork. It offers a dynamic alternative to traditional coursework, enhancing students' understanding of medical concepts and preparing them for healthcare challenges.

**Brunot, Kara; "Climate Change Vulnerability Assessment Of A Regional Karst Landscape For Hazard Mitigation Planning" (Jason Polk)**

Climate change is a global phenomenon affecting all sectors of society by creating conditions more conducive for the occurrence of extreme events, which are projected to increase in intensity and frequency. Flooding, in particular, is projected to be exacerbated. Karst landscapes are especially vulnerable to climate change impacts, because of their unique hydrology and geology that can create intense flooding from prolonged or intense rain events, which climate change will likely make more feasible. Areas are often disproportionately affected by climate change due to population demographics and environmental conditions. This study uses a modified climate vulnerability assessment and GIS (Geographic Information Systems) to quantify and identify vulnerable areas in the BRADD (Barren River Area Development District) of Kentucky. Each county will be scored using indicators evaluating social, economic, and environmental factors. The scores will be analyzed using GIS by producing spatial distribution maps and compared with demographic and physical landscape attributes to identify patterns of intersection. The resulting maps and scores will help inform the BRADD of the most vulnerable areas, including those that lack data for future planning, and indicators that can inform future mitigation.

**Buhay, Noelle; Justice, Dylan; "Effect Of Covid-19 Pandemic On Distraction-related Motorcycle Crashes In Kentucky" (Kirolos Haleem)**

This study investigates the effect of COVID-19 pandemic on distraction-related motorcycle crashes in Kentucky by comparing pre-pandemic (2015-2022) and post-pandemic (2020-2022) periods. Recent eight years (2015 through 2022) of distraction-related motorcycle crash records

and associated roadway information were retrieved from the Kentucky Transportation Cabinet (KYTC). Statistical tests including the chi-square test of independence, Z-test of proportions, and odds ratio (OR) were used to identify the factors affecting the severity of distraction-related motorcycle crashes pre- and post-pandemic. Results from the Z-test revealed that the percentage of severe distraction-related motorcycle crashes significantly increased post-pandemic. Furthermore, the proportion of severe distraction-related motorcycle crashes for very young at-fault drivers (16 to 20 years old), presence of horizontal curves, speeding, and at intersections significantly increased post-pandemic. The OR results revealed that the odds of severe distraction-related motorcycle crashes involving speeding, with presence of horizontal curves, and for very young drivers increased by 67%, 64%, and 48%, respectively post-pandemic. Based on the study findings, removal of distraction-related road elements (e.g., billboards) at high motorcycle crash risk locations and ensuring installations of rumble strips on edge line could help reduce the severity of distraction-related motorcycle crashes on Kentucky roads.

**Burke, Cecil; Loshinskie, Jonathan; Head, Jason; King, Skylar; Mancini, Anthony;** "The Effects Of Virtual Reality Training And Body Weight Supported Treadmill Training Therapy On Children With Cerebral Palsy: A Single Subject Design Proposal" (Sonia Young)

Introduction: Cerebral Palsy (CP) is the most common childhood disability. The most common impairments include difficulty with gait, standing balance, and postural stability. Physical therapy is often a keystone of intervention to improve function for these individuals. The aim of our study is to examine the effects of virtual reality training (VRT) and body weight supported treadmill training (BWSTT) on the balance and gait parameters in children with cerebral palsy. Methods: 2 participants, aged 4-7 years, with a medical diagnosis of spastic cerebral palsy will be included in this two-standard deviation band method study. Individuals of this study will receive both VRT and BWSTT interventions at separate intervals over 6 weeks with resultant effects on balance and gait parameters observed with both. Results: A two-standard deviation band method will be used to analyze the results. Discussion: The use of VRT treatment using the Bertec Balance Advantage System is a relatively new treatment with few studies existing that observe the effects on children with Cerebral Palsy. BWSTT is a previously used treatment with supporting evidence for its use on improving balance and gait. This study will provide potential evidence confirming VRT as a viable treatment option for children with CP.

**Carden, Mykah** "Geological And Hydrogeological "red Red Flags" That Influence Land-use Hazards In Karst: A Case Study In Warren County, Kentucky" (Patricia Kambesis)

Sinkhole flooding and collapse, and impaired groundwater quality are characteristic land-use hazards in karst landscapes. The karstic Lost River groundwater basin (LRGB), Warren County, Kentucky, is the site of two infamous sinkhole collapses, numerous cover collapses, significant sinkhole flooding, and breaches in groundwater quality. This study documented and analyzed the geological and hydrogeological "red flags" making areas within LRGB more susceptible to such hazards. We assessed the potential for karst hazards in an undeveloped area of LRGB recently re-zoned from agricultural to residential land-use. Speleological mapping revealed an undocumented cave system, established its relationship to surface topography, and quantified thickness of rock/soil overburden above the cave. Geological mapping documented faulting and joint-control that influenced cave extent/footprint, and bedrock characteristics impacting groundwater flow. Field observations identified underground zones where surface sediments and debris accumulated causing impact to groundwater flow. Direction of groundwater flow in the cave system and proximity of significant springs outside of LRGB suggested the area of interest

was not part of LRGB but of an undocumented groundwater basin. Landform analysis using GIS/LIDAR revealed pre-existing sinkholes making the area prone to future collapses and flooding. Evaluation of assessment data showed the undeveloped area to be at high risk for karst land-use hazards and informed recommendations for additional assessments and more detailed risk-analysis.

**Carlton, Landon;** "Exploring The Contributions Of V-type Atpases To Drosophila Melanogaster Wing Development" (Ajay Srivastava)

*Drosophila melanogaster*, commonly known as the fruit fly, has been a crucial model organism in biology due to its amenability to genetic manipulation and short lifespan. A sentence here about V-ATPases in general. This study aimed to explore the role of V-type ATPases in the development of *Drosophila* wings, building upon the history of *Drosophila* research. V-type ATPases are proton pumps involved in various cellular processes, and their specific functions in wing development remain poorly understood. The Gal4/UAS system, a powerful tool in *Drosophila* research, was used to downregulate V-type ATPases through RNA interference (RNAi). Fly stocks were cultured and crossed, and the phenotypes of the progeny were analyzed through dissections and imaging. The results showed that the downregulation of V-type ATPase subunit 16 (VHA-16) led to significant phenotypic abnormalities in the wings of the progeny. Different Gal4 driver stocks resulted in distinct phenotypes, including smaller wings, wing deformities, and larval or pupal stage lethality. These findings suggest that V-type ATPases play a crucial role in normal wing development in *Drosophila melanogaster*. Additional crosses incubated at room temperature and antibody staining using immunohistochemical techniques must be performed for further and more in-depth analysis of the role of V-type ATPases' roles in wing development.

**Carter, Grace** "Teaching Dancers How to Tape and Recover from Common Dance Injuries" (Meghen McKinley)

This study explores common dance injuries among modern dancers, drawing on surveys from working professionals. Ankle sprains and lower extremity pains were reported frequently, while Achilles tendonitis and dancer's fractures were less common than anticipated. Surprisingly, 50-60% of dancers who recognized these injuries admitted to self-diagnosing. A striking 100% of participants acknowledged dancing through injuries, with 60% using medical tape for pain relief. This underscores the necessity for proper education on injury management, as many relied on YouTube for taping methods. The absence of benefits for physical therapy or medical assistance reveals a support gap in the dance industry. The study highlights the challenge in defining "common dance injuries," advocating for a holistic approach to injury prevention, particularly for ankles and knees. The findings contribute to the modern dance community's understanding of injury prevention and management, offering guidance on taping techniques aligned with dancers' athletic need.

**Casey, Daria; Priddy, Cassandra; Putman, Alyssa;** ; Quilligan, Andrew; "Mesonet Ai Quality Assurance/quality Control Analysis" (Michael Galloway)

This project is dedicated to the development of an AI model for enhancing quality assurance and control of weather data from the Kentucky Mesonet. Under the leadership of Andrew Quilligan, the team will improve the current quality control methods by utilizing a PyTorch machine learning model to evaluate the precision of data collected. In partnership with the Kentucky Climate Center, Mesonet gathers weather data from multiple stations across the state, with updates transmitted



every few minutes. Presently, data points receive quality values via either automated or manual assessment. This initiative aims to refine the quality control process by uncovering previously undetectable errors and minimizing the need for manual intervention. Spanning 14 weeks, the project includes data collection, model training, refinement, testing, and system integration. Functional requirements cover data ingestion, quality valuation, and interpretation capabilities, while non-functional requirements focus on scalability, accuracy (targeting over 60%), and compliance with security protocols. Data quality and volume will be rigorously reviewed to validate the model's precision. Once implemented, the AI model will streamline the Mesonet quality assurance framework, ensuring swifter and more accurate data processing and fault detection in equipment.

**Castaneda, Bruno** "A Compact VOC Monitor For Nasa Space Missions" (Vladimir Dobrokhotov)

This study presents the development of a compact analytical instrument designed for monitoring ethylene levels within NASA's compact greenhouses for cultivating fresh vegetables in space. Conventional ethylene monitoring using GC-MS systems is impractical in space due to their large size, weight, and high maintenance needs, including a special carrier gas. We have engineered a more suitable, battery-powered ethylene monitor based on analytical gas chromatography principles, utilizing purified ambient air as a carrier gas and a metal oxide sensor for GC detection. The application of a CarboWax 20 M packed column and a Tenax TA pre-concentrator enabled us to reach a detection limit of 20 ppb for ethylene. The integration of a Raspberry Pi 4 computer and a 7" 720P LED capacitive touchscreen facilitated full automation for measuring and reporting ethylene concentrations. The findings led to the creation of a fully automated, industrial-grade ethylene monitoring and removal system tailored for greenhouse applications.

**Chasmawala, Zahra** "Modeling Neuron Energy Efficiency And Consumption Using Hodgkin-Huxley Equations" (Valentino Sampaio)

The human brain's neural activity is highly energy-intensive, largely due to the generation and firing of action potentials, which rely on ATP-driven ion pumps to maintain ionic gradients. This project utilizes the Hodgkin-Huxley (H-H) model to assess the metabolic energy consumption of an isolated neuron. We developed a MATLAB-based simulation of an H-H neuron's voltage and ionic currents under various stimuli. The simulation calculates ATP supply and total energy consumption, allowing for the optimization of parameters to enhance neuronal energy efficiency. Insights into neuronal energy consumption are vital for understanding diseases linked to compromised brain energetics, such as dementia. The outcomes of this research, particularly the minimized energy consumption findings, are intended for applications in the comprehension and treatment of such neurological disorders

**Childress, Bailey**; Jackson, Wil; Hodes, Kyle; Yocum, Chastity; Thomason, Sara; "Yellow Moths" (Travis Newton)

In this short film, a mother bears the weight of guilt and regret after her husband molests her son. After the guilt manifests into a physical embodiment of her future self, she becomes trapped within the house where the assault happened. She relives witnessing the assault and being told that she is at fault for not protecting her son, therefore failing as a mother. She keeps going back to the moment before the molestation happened, trying to change the situation, but it still keeps happening. Each time she tries to change the past, her future self becomes more threatening. In a

moment of reliving the traumatic experience, she makes a decision not to change the past but instead to accept it and be there for her son after everything happened. This breaks the cycle and allows her to put forth the thought that she hasn't failed as a mother.

**Chukwu, Onu** "Tri-amine Platinum Complex With A Seven-membered Chelate Ring Interactions With N-acetyl-l-methionine, 2-hydroxy-4-(methylthio)butyrate And Dgpg" (Kevin Williams)

Platinum compounds can exhibit cytotoxic activity through their reaction with DNA; however, interaction with proteins, especially at methionine residues, is another common biological reaction. Our lab has synthesized Chloro[2-(4-Methyl-1,4-diazepan-1-yl) ethanamine]platinum(II) chloride ([Pt(L)Cl]Cl), which exhibits a tridentate binding mode with the amine ligand. This study focused on the characterization of its reactivity at pH 4 and 7. Mass spectrometry analysis of N-AcMet interaction with [Pt(L)Cl]<sup>+</sup> showed m/z values of 542 and 579 for reactions at pH 4. The m/z of 542 suggests the displacement of the chloride by N-AcMet to form [Pt(L)(N-AcMet)], while 579 suggests the displacement of one of the ligand's nitrogen atoms to form [Pt(L)(N-AcMet)Cl]. By contrast, reactions at pH 7 showed [Pt(L)(N-AcMet)] as the only product, which could be due to the displacement of Cl by water. Characteristic peaks in the <sup>1</sup>H and <sup>195</sup>Pt NMR spectra were observed for each of the products identified by mass spectrometry. Reactions with 2-hydroxy-4-(methylthio)butyrate, a methionine analog lacking a nitrogen atom, showed similar reactivity patterns to N-AcMet, suggesting that the nitrogen atom of N-AcMet does not coordinate with the platinum atom. Our results indicate that when the chloride is still attached to the platinum, displacement of both the chloride and an amine nitrogen is possible. They also indicate that only one guanine from dGpG coordinates with the platinum.

**Cing, Niang** "Wku School Of Architecture And Design" (Shahnaz Aly)

For my senior research project, I designed a building for the Architecture and Design program at Western Kentucky University. The campus has undergone various changes and expansions to accommodate different programs and uses, which inspired me to create a building that serves the needs of the architecture, construction, and interior design programs. This building is tailored for students majoring in design-related fields, including architecture, interior design, landscape architecture, construction, and more. The primary aim of this building is to foster collaboration among students, provide a space for skill advancement, and stimulate motivation. It is envisioned as a place that fosters creativity without constraints and sparks inspiration. The building includes studios, labs, workshops, study areas, lounges, and classrooms/meeting spaces. While Western Kentucky University already has numerous study areas and commons, some are not suitable for students because the facilities are dispersed across the campus. The proposed building will meet the specific needs of students in the targeted programs and also provide workspaces for the broader university community.

**Clark, Thomas; Gani, Nahid;** "Sinkhole Progression and Public Safety at Mammoth Cave and Surrounding Areas" (Nahid Gani)

The Pennyroyal Plateau, formed during the Mississippian Period, is one of the major geologic regions of Kentucky. This region boasts an extensive karst landscape largely composed of limestone and other porous, easily soluble rocks, stemming from the calcium carbonate remains of ancient sea life. The landscape is prone to the formation of caves and sinkholes. Notably, Mammoth Cave, the world's longest cave system, is located within this area. This study aims to deepen our understanding of sinkhole formation, progression, and evolution over time on the

surface of the Mammoth Cave area by comparing past Digital Elevation Models (DEMs) of the region. Data were collected from the publicly available archives of the Kentucky Geological Survey and the United States Geological Survey from 2014 and 2020, respectively. The data were then compiled and analyzed using geospatial software. A sinkhole extraction tool was employed to delineate areas identified as sinkholes that had not been previously recognized. These results could be used to make predictions about the future formation and progression of sinkholes and to draw conclusions about the processes contributing to the formation and growth of sinkholes. Moreover, these findings could have practical applications in enhancing public safety measures and civil engineering practices.

**Clifton, Tyler** "Characterization of Microglia in a Novel APP-SAA KI Model using the Quiver Technique" (Adam Bachstetter)

Alzheimer's disease (AD) represents a pressing global health concern, with millions diagnosed annually. This necessitates extensive research to understand its neurobiological underpinnings and to develop effective therapies. This study explores the roles of microglia and astrocytes, two key cell types in the central nervous system, in AD pathology using innovative techniques. The use of preclinical models, particularly the novel APP-SAA KI mouse model, offers insights into microglial responses to AD pathology. Additionally, the development of the QUIVER technique facilitates multidimensional analyses of protein expression, aiding in the characterization of cellular interactions within the brain's microenvironment. Experimental findings underscore the efficacy of free-floating immunohistochemistry over Sequenza techniques in staining, providing valuable insights into antibody titers and staining optimization. While Sequenza techniques offer cost-effectiveness, further refinement is required to match the staining efficacy of free-floating methods. Future research endeavors aim to broaden antibody screening using QUIVER and to extend comparative analyses between Sequenza and free-floating techniques using diverse brain tissue samples. These efforts are instrumental in advancing our understanding of microglial dysfunction in AD and hold promise for therapeutic development and biomarker discovery.

**Cline, Kal-El; Nee, Matthew;** "The Adherence Of Photocatalysts To Biodegradable Polymer Beads" (Matthew Nee)

Lack of freshwater access is a significant problem worldwide, and one of the main reasons for this scarcity is pollution. Numerous studies have indicated that toxic chemicals are inadequately treated by most wastewater reuse sites. Although various solutions have been explored, photocatalysts stand out as one of the most cost-effective and efficient. Photocatalysis involves using sunlight to generate free radicals that continue to engage in reactions. Our method employs polymer beads as a substrate to facilitate easy removal, increase surface area, and ensure buoyancy. These beads are coated with commercially available photocatalysts, which accelerate the process. Subsequently, the beads can be collected, reapplied, and reused. However, some beads may not be recoverable, potentially turning them into pollutants themselves. Therefore, we are developing beads that can organically decompose after the photocatalysts have completed their function. Using Poly(methyl methacrylate) beads as a model, we have developed a procedure to utilize Poly(lactic acid), which naturally degrades. Various variables were tested, with the main focus on alcohol-water solutions. We discovered that ethanol-water mixtures increase the porosity of the beads, allowing for a greater amount of photocatalysts to be attached, which enhances the efficiency of the degradation process.

**Crone, Jarred; Cerrato, Brianna; Stafford, Noah; ; Neelly, Kurt; Norris, Elizabeth;** "The Reliability Of Iphone 15 And Goniometer Rom Measurements Of The Hip" (Kurt Neelly)

Introduction: The universal goniometer (UG) has traditionally been used to measure the clinical range of motion (ROM) of joints throughout the body. With the advent of emerging phone technologies and applications, these are increasingly being utilized within clinical settings to assess ROM. This study aims to examine the inter-rater, intra-rater, and inter-instrument reliability of a UG and an iPhone 15 in measuring passive hip ROM.

Methods: Thirty-five individuals aged between 21 and 30 years old, with no acute hip or spine pain and no history of hip or spine pathologies, will be included in this cross-sectional study. Participants will lie on a mat table, and their hip flexion, extension, abduction, adduction, internal rotation, and external rotation ROMs will be measured with both a UG and an iPhone 15.

Data Analysis: Interclass Correlation Coefficients will be calculated using SPSS to determine the inter-rater, intra-rater, and inter-instrument reliability of the UG and iPhone 15 measurements.

Discussion: There are few studies exploring the reliability of using a smartphone to measure hip ROM, and there is no existing research on the efficacy of using the iPhone 15, with its updated components, for this purpose. The results of this study could support the use of a readily available alternative tool for measuring joint ROM in a clinical setting.

**DALE, KRISTIN** "Finding Community Through Music - Summer Shade Pickers" (Kate Hudepohl)

This project presents original ethnographic research from an ongoing project documenting the explicit culture of the Summer Shade Pickers community. Methods such as participant observation, interviews, and material object analysis are employed to identify some of the traditions of picking sessions, which are informal music sessions open to individuals of all musical abilities. The project also documents how a passion for music forges community relationships during these performances. Research reveals that the etiquette and specific structure of picking sessions promote community-valued qualities such as inclusivity, informality, and familiarity. Additionally, the increased use of social media, which began during the pandemic as a survival strategy, has uncovered essential themes such as accessibility and global connection. This project presents a community-specific example of how music can be used to build and strengthen community bonds.

**Daniels, Brycen** "Ground-based Observations of 1ES 1959+650 Coincident With Observations From The Transiting Exoplanet Survey Satellite" (Michael Carini)

Blazars represent the most extreme examples of Active Galactic Nuclei (AGN) phenomena. The blazar class of radio-loud AGNs are oriented such that we are looking almost directly down the throat of the relativistic jet, resulting in the observed emission being dominated by jet processes and being both amplified and time-compressed in our frame of reference. The defining characteristics of blazars include a featureless or nearly featureless optical continuum, significant and highly variable polarization, and substantial amplitude continuum variability at all wavelengths on timescales ranging from minutes to decades. The absence of discrete features in their spectra means we must rely solely on continuum variability and/or polarization variability as a diagnostic of the emission mechanisms at work in many of these objects. In this presentation, I will compare the ground-based observations of the blazar 1ES 1959+650 obtained by Western Kentucky University's Robotically Controlled Telescope (RCT), which I reduced and analyzed, with contemporaneous light curves extracted from TESS observations of the source.

**Daugherty, Jordan** “Counseling Survivors with Military Sexual Trauma” (Rhemma Payne)

Military sexual trauma (MST) is an issue that affects both men and women in the United States Armed Forces. It is estimated that one in three women and one in fifty men report experiencing sexual trauma while serving in the military. The unique culture and circumstances of military service present barriers to reporting sexual assaults, resulting in a wide underreporting of MST incidents. Although strides have been made in recent years to provide care to survivors of military sexual trauma, including free services related to MST through the VA, challenges persist in military members accessing these benefits due to reporting requirements. MST can lead to both mental and physical health conditions such as PTSD, depression, substance abuse, difficulty sleeping, chronic pain, and memory loss. Mental health providers can support survivors of MST by being aware of its prevalence, recognizing the signs and symptoms, understanding the uniqueness of military culture and lifestyle, and acknowledging the barriers to reporting and seeking care.

**Daugherty, Trenton; Wichman, aaron;** “Partisan Identity Matters Most When Politicians’ Corruption Benefits Their Party” (Aaron Wichman)

Political partisans may support extreme acts when the perpetrator is a representative of their own party. We investigated whether the ends justified by politicians’ transgressions act as a constraint on this support. In a study of 292 participants, individuals were randomly assigned to read a vignette describing illegal activity committed by either a Democrat or Republican, which served either the politician’s personal interests or the goals of their party. Participants then indicated their attitudes toward the politician, including the degree to which they viewed the behavior as a threat to democracy, and their desire to punish the politician. Results indicated that participant ideology only mattered when politicians committed crimes to advance their party’s goals. Specifically, these in-group politicians were seen more positively, as less threatening, and less deserving of punishment compared to out-group politicians, with these effects extending across our dependent variables. Conversely, when politicians committed the same crimes for selfish reasons, political ideology did not influence perceptions as a function of the politician’s party affiliation.

**Davenport, Jessica;** Swift, Alyssa; Lickenbrock, Diane; “The Power Of Parenting: Associations Between Maternal Personality And Infant Temperament” (Diane Lickenbrock)

There are various approaches to measuring personality, with some being more useful than others for operationalizing specific behavioral patterns. The Behavioral Activation System (BAS) predicts persistence, novelty seeking, and extraversion, whereas the Behavioral Inhibition System (BIS) is associated with avoidance, neuroticism, and agreeableness (Smits & Boeck, 2006). Maternal behaviors that correlate with these personality components, such as intrusiveness and overprotectiveness, can influence individual differences in a child’s behavioral and emotional responses to their environment, which is referred to as a child’s temperament (Kiel & Buss, 2009). The current study examined the associations between parental personality and infant temperament. Mothers (n=79) reported on their personality (using the BIS/BAS questionnaire; Carver & White, 2013) and their infant’s temperament at 8 months of age (measuring vocal reactivity, approach, fear, and activity level; Infant Behavior Questionnaire-Revised, Gartstein & Rothbart, 2003). Results revealed significant associations between maternal BAS and infant vocal reactivity/approach ( $r=.24$ ,  $p=.03$ ), as well as maternal BIS and infant fear/activity level ( $r=.25$ ,

p=.03). These results suggest that infants may be more approachable when their mothers exhibit similar traits and, conversely, more fearful when their mothers do.

**Davidson, Samuel** “Climatology Of Rain-on-snow Events Within The Connecticut River Watershed” (Zachary Suriano)

Rain-on-snow events, where rain falls on an existing snowpack, can precipitate substantial hydrological and environmental consequences, such as accelerated snowmelt, flooding, landslides, and other natural disasters. This research aims to examine such events within the Connecticut River Watershed from a climatological perspective and to conduct a fine-grained analysis of the hydrological repercussions through case studies, employing Geographic Information Systems (GIS) and MATLAB for data analysis. The investigation will scrutinize previous events and their subsequent hydrological effects, applying GIS spatial analysis to quantify these impacts. While similar phenomena have been studied in other watersheds, this research will elucidate the specific outcomes in the Connecticut River Watershed. The data amassed for this study includes precipitation levels, snow water equivalent, and streamflow measurements. We will identify rain-on-snow occurrences in the region, then dissect their frequency, severity, and chronological trends, supported by spatial visualizations via GIS mapping. The insights from this study will be vital for future risk management and mitigation planning in the watershed. The preliminary phase of this research concentrates on the climatic elements of the study, establishing a solid foundation for subsequent exploration.

**Davies, David; Wallace, Thomas; ; Wallace, Tj;** “Avulsion” (Sara Thomason)

This project will showcase a thesis film production. The narrative revolves around two brothers, the eldest and the youngest of three, who decide to meet up at their estranged middle brother’s isolated cabin. Their aim is to mend the fractures in their relationship and provide assistance to their beleaguered brother. However, upon arrival, they confront the stark reality of just how far their brother has spiraled into madness.

**Dick, Olivia;** Milam, Lily; Forrest, Hanna; Woodward, Kelsey; Woodward, Matthew; “Comparing Associations Between Child Sexual Assault, Adult Sexual Assault, And Negative Network Orientation.” (Matthew Woodward)

Child sexual assault, occurring during formative years, can severely disrupt one’s trust in others, making it challenging to access and establish supportive networks. This contrasts with adult sexual assault survivors who may have pre-established social networks and coping mechanisms. However, risks such as shame and posttraumatic symptoms can lead to decreased social connections following the assault. Consequently, there may be variation between these types of sexual assault (SA) and the resulting network orientation. The purpose of the current study was to examine the relationship between exposure to child/adult SA and negative network orientation (i.e., negative attitudes about utilizing social support). Participants included 1,279 young adults who completed an online survey assessing network orientation, child sexual assault (CSA), and adult sexual assault (ASA) exposure. Independent samples t-tests comparing network orientation scores (NOS) between individuals who have experienced CSA and those who experienced ASA indicated that exposure to any SA resulted in significantly higher NOS than those with no exposure. Similarly, exposure to both CSA and ASA indicated increased negative orientations compared to those exposed to only one type of SA. In contrast, there were no significant differences in network orientation scores between exposure to CSA or ASA, respectively. This

suggests that exposure to SA, regardless of age, negatively impacts one's attitudes towards social support, and these effects can be exacerbated by exposure to both types of SA.

**Duvall, Grayson;** Arnold, Savanna; "Investigating The Dna Damage Repair Pathway At Telomeres" (Jason Stewart)

The CST complex in humans is a telomere-specific complex composed of three unique proteins: CTC1, STN1, and TEN1. Telomeres are repetitive sequences at the ends of chromosomes that protect the ends from being recognized as DNA breaks and prevent unwanted repair mechanisms. The CST complex prevents the overlengthening of telomeres, which can lead to chromosomal defects that result in cancer and disease. When CTC1 is specifically removed from cells, there is an increased localization of the DNA repair factor RPA. RPA binding typically signals for repair, which is undesirable at telomeres. However, despite RPA binding, normal repair signaling is not present at telomeres following the removal of CTC1. This project investigates how telomeres remain protected from repair even when RPA is present. Our hypothesis was that the DNA damage signaling protein 53BP1 blocks this repair. Using immunofluorescence, we examined the localization of 53BP1 at RPA-bound telomeres in cells with deleted CTC1. We observed that in the absence of CTC1, there is an increase in 53BP1-RPA localization, which depends on another signaling protein, ATR. This suggests that 53BP1 is recruited by ATR to prevent unwanted repair at telomeres when CST is absent.

**East, Ashley;** Burch, Katrina; "Social Comparison In Academia Amid Covid-19: Exploring Gender And Rank Dynamics In Perception Of Pressure" (Katrina Burch)

Navigating dynamic job environmental due to COVID-19, understanding how social comparison tendencies, gender, and organizational rank influence perceived levels of telepressure and time pressure is crucial. This proposal investigates the predictive impact social comparison tendencies on perceptions of telepressure and time pressure, considering gender and organizational rank. Theoretical insights are drawn from social comparison theory, self-determination theory, and the selective accessibility model. By examining how social comparison tendencies intersect with gender and organizational rank, the research can shed light on potential disparities in the experience of telepressure and time pressure. With limited existing research on contributing factors and relationships with social comparison tendencies in academia, the study employs a panel design with two time points for the same sample, conducting correlation and regression analyses in SPSS. Hypotheses to be investigated include examining the direct associations of social comparison tendencies on perceived tele- and time- pressure, as well as examining the proposed moderating effects of faculty sex and rank on the aforementioned associations. Implications for research and practice will be discussed.

**East, Rene;** Morris, Lauren; "Residential Segregation And Black Homicide Victimization Rates In 48 Msa's" (James Kanan)

Violent crime, and most notably homicide, continues to plague American urban settings. Although UCR data show a relatively steady decline in homicide rates from the 1990s to the present, recent increases in homicide rates have propelled violent crime into the forefront of political discussions and public consciousness. A notable pattern in homicide data and research is the disproportionate representation of black individuals in homicide arrests (according to UCR data) and black homicide victimization (according to UCR and CDC data). While numerous structural explanations have been explored to better understand the racial dynamics of homicide in the U.S.,

this research focuses on residential segregation. Beginning in the late 1980s and 1990s, researchers highlighted the bleak reality of life—and death by homicide—for black Americans living in highly segregated cities. In this study, we examine the updated empirical relationship or impact of more recent measures of residential segregation (calculated using 2020 Census data) on disaggregated homicide victimization rates by race (black and white). The results provide an illustration of the costs, in terms of lives lost, due to the continued spatial and structural inequality perpetuated by residential segregation.

**Elmore, Molly** “Observations of 1ES 0647+250, an Active Galactic Nucleus classified as a blazar, with WKU’s 1.3m Robotically Controlled Telescope (RCT) and NASA’s Transiting Exoplanet Survey Satellite (TESS) observed 1ES 0647 + 250.” (Michael Carini)

When the black hole at the center of a galaxy actively consumes material from the surrounding galaxy, the object is known as an Active Galactic Nucleus (AGN). These AGNs produce relativistic jets perpendicular to the disk of the galaxy, which provides the matter it consumes. These jets emit energy across the electromagnetic spectrum, and when they are pointed towards Earth, they are called blazars. Due to their orientation and speed, these jets are greatly amplified in power and can pose a challenge to study. Their spectra have no distinct features, so researchers rely on the variability of the continuum and polarization to understand the underlying causes of the observed emission from these objects. I will compare data I have reduced and analyzed from Western Kentucky University’s ground-based 1.3-meter RCT of the blazar 1ES 0647+250 with data from NASA’s TESS mission to understand the light curve of this source.

**Enderle, Boston; McCormick, K. Christian;** “Disciple – A Wku Short Horror Film” (Sara Thomason)

In my film, I aim to delve into the issues of religious extremism and indoctrination and their effects on the youth population. I plan to explore how these issues can distort young people’s perceptions of morality and how religious guilt can persist into adulthood. Additionally, I intend to examine the specific impact these issues have on queer youth.

**Engel, Samuel** "The Myth of Swiss Style" (David Marquez)

Switzerland is renowned as the birthplace of Swiss-style design, a style celebrated for its simplicity, functionality, and clarity, which also laid the groundwork for the International Typographic Style. I had long aspired to visit Switzerland, a place pivotal to my educational journey, to delve deeper into its rich design history and principles. In the summer of 2023, Western Kentucky University made this possible through the FUSE and LTE scholarships, enabling me to attend three courses in Switzerland—Poster Design, Design Research, and Type Design—at the Basel Academy of Art and Design. The Basel Academy has historical ties to the Schule für Gestaltung (School of Design), founded by Armin Hofmann and Emil Ruder, who were notable figures in Swiss design. At the academy, I had the privilege of studying exemplary Swiss designs at the Basel Poster Collection and observed original Swiss posters dating back to 1923. I explored the different roles designers assume in research, including the three forms of research: into art and design, through art and design, and for art and design. In addition to the knowledge I gained abroad, my poster showcases the works I created, which include my process of designing a typeface from scratch.



**Esmaeilzadeh, Nima;** Gani, Nahid; Gani, Royhan; Brotzge, Jerald; "Application Of Remote Sensing And Artificial Intelligence For Critical Raw Material Exploration In The United States" (NAHID GANI)

"Geological mapping is crucial for mineral exploration, analyzing lithological units, alterations, and various mineral types. Traditional methods, which rely on fieldwork and ground surveys, are limited by accessibility and costs. This study focuses on California's Mountain Pass District, aiming to identify potential areas for rare earth element (REE) host rocks using advanced remote sensing and artificial intelligence techniques, incorporating satellite imagery such as ASTER, Landsat-9, and Sentinel-2. Thematic layers, created through band ratios and principal component analysis, were integrated into mineral perspectivity maps using fuzzy logic modeling. The results detail the spatial distribution patterns of various minerals, highlighting zones with a high potential for hydrothermal ore mineralization. Field surveys validated the outcomes, confirming alteration zones and identifying prospective locations. This study represents a paradigm shift by leveraging artificial intelligence technology for efficient perspectivity mapping. The identified spatial patterns enable precise targeting, reducing costs and increasing the likelihood of discovery. The prospective zones identified serve as valuable guides for future exploration, contributing foundational knowledge to the eastern Mojave Desert. Beyond this specific area, the research enhances the understanding of REE deposits in carbonatite-hosted environments, offering an innovative template for mineral exploration strategies in various geological settings.

**Ferguson, Cheyla;** Kalgren, Taylor; Brausch, Amy; "The Eating Disorder Inventory (EDI) Predicting Suicidal Ideation in an Adolescent Sample" (Amy Brausch)

Introduction: Previous research has shown that certain facets of eating disorders can predict suicidal ideation (Joiner et al., 2022). The Eating Disorder Inventory (EDI) includes multiple traits common in eating disorders (e.g., low self-esteem, interpersonal alienation, and perfectionism). This study aims to uncover which subscale of the EDI is the best predictor of suicidal ideation. We hypothesized that a subscale specific to eating disorders would best predict suicidal ideation (Perkins & Brausch, 2019; Rufino et al., 2018).

Procedure: Data were collected from middle/high school students in Kentucky in 2015 (n = 456). 53% identified as female, and 85% identified as White/Caucasian.

Results: A forward stepwise linear regression was run in SPSS and found that emotion dysregulation and body dissatisfaction were significant predictors of suicidal ideation in this sample.

Conclusions and Implications: Emotion dysregulation was the best predictor of suicidal ideation. This is consistent with previous research on youth (Brausch, 2018). Body dissatisfaction is a symptom more specific to those with eating disorders and has also been shown in previous research to predict suicidal ideation in adolescents (Kim, 2009). Therefore, adolescents with eating disorders are at greater risk, especially individuals who score high on these two subscales.

**Ferguson, Robert** "Remote Sensing Analysis Of Virginia And West Virginia June 22nd-24th, 2016 Flooding Event" (Joshua Durkee)

The record-breaking flooding event that occurred from June 22nd to 23rd, 2016, left a profound impact across large portions of West Virginia and Virginia. Several rounds of thunderstorms brought high rainfall amounts and extreme flash flooding and river flooding. A State of Emergency was declared in 44 of 55 West Virginia counties, 12 of which received a Presidential Disaster

Declaration. An estimated half a million people were initially without power, with thousands of buildings damaged or destroyed. The damage total reached an estimated \$1.2 billion.

Remote sensing is a crucial component of nowcasting, numerical modeling, and the spatial distribution analysis of meteorological variables. Satellites and radar provide an abundance of the world's weather information through the creation or utilization of electromagnetic energy from the sun to analyze the atmosphere through different lenses and collect as much data as possible. Different methods of observing the atmosphere will be utilized to analyze the June 22nd to 23rd, 2016, West Virginia flooding event from a remote sensing perspective to identify what caused this event to be so impactful, as well as to identify the issues that occur due to the remote sensing process, such as data loss and contamination

**Fjeld, Katrina** "Taiwanese Belief That The Us Will Aid In Defense Against A Chinese Invasion" (Timothy Rich)

Despite Taiwan's strategic importance to the US and its history of honoring defense commitments and capabilities, Taiwanese people remain skeptical that the US would get involved in a war against China. This skepticism only rose when the Biden Administration hinted at a policy change that would pledge clearer support to Taiwan, only to end up leaving it as ambiguous as it has always been. I suggest that Taiwanese people might be skeptical of the US following through on its verbal commitments due to historical evidence where the US has been hesitant to supply troops to foreign conflicts, even if there was a similar supportive relationship in defensive training. The benefit of an ambiguous policy here is that it does not embolden Taiwan to provoke China or allow China to feel completely comfortable in starting an invasion. I also suggest that part of the reason the US might retain this ambiguity is because there is research that shows that the US could lose a war against China. The uncertainty of when and how a Chinese invasion of Taiwan could occur makes it hard to be confident that the US could successfully support Taiwan against the invasion. If the US were to try and lose, the political reputations of China and the US would change on the global stage.

**Fjeld, Katrina** "Does The Taiwanese Public Believe Us Defense Commitments? Evidence From A National Survey" (Scott Lasley)

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**Florence, Andrea;** Cline, Tabby; Miller, Kelly; Lushpin, Yegor; Gabbard, Kelcee; "SunSketcher" (Michael Galloway)

We understand that the Sun isn't perfectly spherical, but what exactly is its shape? Currently, our measurements are accurate to within a few hundred kilometers. Our project aims to refine this accuracy to just a few kilometers by capturing images of Bailey's Beads during key moments of the April 2024 Solar Eclipse, utilizing the assistance of a NASA-backed mobile app called SunSketcher. This app will be accessible on both iOS and Android platforms. Using a combination of techniques, including OpenCV image cropping, the app will swiftly and securely transmit these photos to a central server located on campus. This data will enable researchers to utilize the moon as a reference point to determine the Sun's precise shape, gain deeper insights into solar convection, and potentially enhance our understanding of certain gravitational theories.

**Fournier, Reagan** "The State Of The Union Address (sotu) And Rhetoric Towards China: Does It Change With The Geopolitical Environment?" (Tim Rich)

The present study investigated the link between Presidential rhetoric and the general direction of U.S.-China relations by coding excerpts from SOTUs that included the phrase "China" or "Chinese" from 1950-2020 using WordStat to determine the positivity or negativity of the words used. The researcher hypothesized that three trends would exist. First, from 1950-1978, rhetoric would be more negative than positive. Second, from 1979-1991, rhetoric would be more positive than negative. Lastly, from 1992-2020, rhetoric would be more negative than in the previous time frame. The research demonstrated a correlation between the geopolitical situation and the rhetoric used in SOTUs about China. Given the complexity of U.S. governmental institutions, further research should be conducted to determine the extent to which the geopolitical environment affects rhetoric, or vice versa.

**Francis, Allison;** Polk, Jason; Taylor, Ritchie; "Impacts Of Land Use And Groundwater Inputs On Biological Stream Health And Habitat Of Jennings Creek, Bowling Green, Kentucky." (Jason Polk)

In Bowling Green, Kentucky, the Jennings Creek watershed encompasses the entire city and surrounding area. Little work has been completed assessing the creek's water quality, habitat, and biological indicators. Jennings Creek is fed by several karst groundwater springs, making it highly vulnerable to contamination due to the rapid connection between the surface and subsurface via sinkholes and underground rivers. An examination of Jennings Creek's water quality, habitat, and biological indicators with land use and karst inputs allows for a clear assessment of the watershed's health. The methodology closely follows the methods for assessing habitat by Kentucky's Energy and Environment Cabinet and approved for the EPA 319 Watershed Plan project underway for Jennings Creek. Three study sites were identified along Jennings Creek for assessment with concurrent water quality sampling. All variables are modeled in ArcGIS Pro software to analyze the data spatially and temporally. Additionally, a comparative analysis of water quality for the three stream sites and a reference stream using the CCME Water Quality Index will be completed. All sites received poor biological and habitat ratings, and through geospatial and comparative analysis, it will be possible to highlight sources of degradation and areas of improvement within the Jennings Creek watershed.

**Galloway, Jack; Claros, Gianna; “Developing A Comprehensive Water Resources Monitoring Dashboard Using Big Data Analytics And Modeling” (Jason Polk)**

An integrated, interactive public-facing data dashboard is being developed to provide a comprehensive tool for understanding and monitoring water resources in areas where caves, springs, and underground rivers make it difficult to address water quality issues, flood impacts, and related ecosystem issues. The inputs include real-time data streaming to create interactive graphs and visuals in partnership with the City of Bowling Green. The real-time network consists of more than 50 monitoring sites collecting 1-minute data for rainfall and water levels and 10-minute data for water quality parameters throughout Bowling Green, Kentucky, which are fed into different online platforms to generate more than 500,000 data points per day. The project will leverage ArcGIS GeoEvent Server and Amazon Web Services (AWS) cloud software to connect and synthesize data from the various online ingest platforms, creating an interactive dashboard that allows users to monitor and analyze live-streaming data. The resulting dashboard will offer a user-friendly web map to assess flood risk, real-time rainfall and water level data, water quality impacts, where the public can obtain current and historical data, thereby advancing both scientific research and community engagement in addressing water resource issues in karst areas.

**Galloway, Jack; Claros, Gianna; "Developing A Comprehensive Water Resources Monitoring Dashboard Using Big Data Analytics And Modeling" (Jason Polk)**

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**Gibbs, Barrett; Gani, Nahid; "Exploring Karst Hazards and Mass Wasting Potential in Pulaski County, Kentucky: Insights from the Appalachian Region" (Nahid Gani)**

In this remote sensing project, we utilized Light Detection and Ranging (LiDAR) Digital Elevation Model (DEM) data to identify karst hazards, specifically focusing on potential mass wasting events. Our aim was to uncover the locations of these hazards. Thus far, we have generated a mosaic of data tiles at the intersection of KY Highway-80 and downtown Somerset in Pulaski County within the Appalachian region of Kentucky. From this mosaic, we produced hillshade and slope maps illustrating varying degrees of elevation levels and steepness of hills and knobs. These maps were also enhanced by using color to accentuate target features. Through this methodology, we identified multiple locations of slope hazards and a plethora of sinkholes. It is crucial to identify these karst and slope features because there are many homes and businesses in this area that could

be damaged due to these hazards. Furthermore, these hazards pose a public safety concern for those working and residing in the area and for those driving along Highway 80. Our next step involves analyzing additional LiDAR DEM tiles to extend these mapping efforts across Pulaski County. Ultimately, the findings of this project will inform strategies to protect critical assets and improve the well-being of rural Appalachian households, promoting local awareness.

**Gieselman, Marlee;** Gregory, Caitlin; Brausch, Amy; Teeters, Jenni; "Adverse Childhood Experiences (ACES) as a moderator in the prospective relationship between defeat, entrapment, and suicide ideation" (Amy Brausch)

**Background:** Defeat and entrapment are risk factors for SI (Stenzel et. al., 2020). Adverse childhood experiences (ACES) have been shown to associate with a greater likelihood of SI in young adults (Bhargav & Swords, 2022). The current study examined total ACES as a moderator in the relationship between defeat and entrapment and SI at baseline and 6-month follow-up. **Methods:** The study included 408 young adults at baseline, and 208 at follow-up. Participants completed the Adverse Childhood Experiences Scale (ACES), the Brief Defeat and Entrapment Scale (BDES), and the Self-Injurious Thoughts and Behaviors Interview-Short Form (SITBI-SF). **Results:** Significant relationships between both baseline defeat ( $b = 0.37, p < .01$ ) and baseline entrapment ( $b = 0.34, p < .01$ ) and SI were found at all levels of ACES but was strongest at low levels. **Conclusion:** The results support the greater likelihood of SI in individuals who have experienced more ACES, as well as feelings of entrapment and defeat being indicators of SI (Bhargav & Swords, 2022; Stenzel et. al., 2020). Stronger relationships between defeat, entrapment, and SI when ACES are low indicates that defeat and entrapment may signal suicide risk more prominently in those with lesser adverse childhood experiences.

**Gillispie, Nathaniel;** Nee, Matthew; "Size Effects of SO<sub>2</sub> in Water Nanoparticles: a Molecular Dynamics Perspective" (Matthew Nee)

Despite being a simple molecule, water exhibits complex behavior. The properties of water have been studied in bulk, but these change at molecular quantities. This fact is particularly important in aerosol chemistry, where the median atmospheric aerosol diameter is under 10 nm. This talk discusses the effect of size on the solvation of sulfur dioxide from the perspective of molecular dynamics simulations and the structure of water. Sulfur dioxide is a compound of unique importance in atmospheric chemistry. Derivatives of sulfur dioxide are associated with a higher production of secondary organic aerosols, which are studied for their climate impacts and potential effects on human health. We accomplish this by simulating the trajectories of water molecules in a water nanoparticle from which useful properties are derived.

**Godby, Janna; Krohman, Kayla; Williams, Mallory; Eastwood, Logan;** ; Neelly, Kurt; "The Influence of A Fall Risk Screening Service-Learning Program On Student Confidence, Anxiety, And Perception In Assessing And Working With Older Adults" (Elizabeth Norris)

**Introduction:** The purposes of this study were: 1) to establish a service-learning community-based fall risk screening program (FR-SLP) and 2) to assess Doctor of Physical Therapy (DPT) students' anxiety, confidence, attitudes, perceptions, and comfort in working with the geriatric population. **Methods:** The FR-SLP was developed by student/faculty investigators for use in the Geriatric Physical Therapy course within the WKU DPT curriculum. The FR-SLP included the CDC STEADI Algorithm and the VSTBalance, an instrumented system that assesses fall risk. Second-year DPT students received training in the FR-SLP and worked in groups of 2-3 to conduct the

FR-SLP locally at Arcadia Senior Living. Students completed a survey pre-post FR-SLP. The Wilcoxon signed-rank test was used to analyze changes in student confidence, anxiety, and attitudes before and after participating in the FR-SLP.

Results: Student confidence increased significantly in 62% (13/21) of related survey items. Student anxiety decreased significantly in 57% of related survey items. Student attitudes, perceptions, and comfort level in working with older adults increased significantly in 12.5% (1/8) of the related survey items.

Conclusion: Participation in a 1-hour FR-SLP reduced student anxiety and increased confidence in the ability to conduct fall assessments, communicate with older adults, and make recommendations to other healthcare providers.

**Godsey, Alex; Dixon, Cy; Johnson, Nicholas; Lynch, Michael; Werner, Kevin; "Alien P.R.O.B.E." (Michael Galloway)**

This project introduces a mobile application that utilizes RFID technology to optimize parking management at WKU Parking and Transportation Services (WKU PTS). The "Alien P.R.O.B.E." mobile application aims to automate parking verification processes, enhancing operational efficiency and user experience for WKU Parking and Transportation workers. Utilizing an Alien F800 RFID reader and ALR-8698 RFID antenna, the mobile app's backend system scans parking permits' RFID tags. Our app will then cross-reference the RFID tags with WKU's servers to check permissions and verify the tags. Our goal for this app is to reduce manual verification time and address unauthorized parking issues that the WKU PTS employees encounter. By automating these processes, the project will streamline operations and improve overall parking experiences for users and Transportation service employees. The primary audience comprises WKU parking management teams, with the Senior Information Technology Consultant at WKU Parking and Transportation Services as the client. This project employs a systematic approach, emphasizing clear documentation, client engagement, and RFID technology application. The development follows distinct phases aligned with a modified waterfall model, ensuring adaptability and continuous improvement. The system offers a scalable, secure, and efficient solution for parking resource management at WKU.

**Gonzalez, Thomas "Effect of Photodynamic Therapy on Legionella Pneumophila" (Simran Banga)**

Legionella pneumophila is a gram-negative aerobic bacteria found in stagnant water sources. These bacteria cause Legionnaires' disease in humans. L. pneumophila infects the macrophage cell and using the Dot/Icm system establishes a way to ensure its survival in host cells. This process, however, is only possible because of Legionella's ability to survive extracellularly in biofilms. In this study, I investigate a way to limit the growth of Legionella in its natural habitat through Photodynamic Treatment (PDT). PDT is a treatment that combines light with a photosensitive compound such as methylene blue to destroy cells. We exposed Legionella to the photosensitizer under a specific time interval in its post-exponential stage of growth to establish a baseline of the treatment's effect. We extended these findings to analyze the response of Legionella under different exposure conditions to test PDT's effects using a time course model. This data will allow us to measure the most effective exposure time for proper treatment. Based on the statistical analysis of standard plate counts using colony-forming units, we will be able to conclude whether photodynamic treatment with Methylene Blue is effective against Legionella growth and can be used to limit its growth in natural environments.

**Gooden, Gabriel; King, Rodney;** "The Discovery and Analysis of the Novel Siphoviridae Mycobacteriophage Bigbubba" (Rodney King)

Bacteriophages are viruses that infect bacteria and are the most numerous biological entities found in nature. With an estimated population exceeding  $10^{31}$  particles, they represent an incredible amount of genetic biodiversity and medical potential that has scarcely been explored. The purpose of this project was to isolate and characterize a bacteriophage capable of infecting *Mycobacterium smegmatis*, a bacterium genetically similar to the pathogens that cause leprosy and tuberculosis. Here we report the isolation and study of a novel lytic bacteriophage called BigBubba. To begin, a soil sample was collected outside Jody Richards Hall on WKU's campus. The sample was enriched for mycobacteriophages by adding the soil to a culture of *Mycobacterium smegmatis* host cells. A pure population of single type of phage was then purified through multiple rounds of serial dilution. BigBubba's morphotype and size were determined using transmission electron microscopy (TEM). The genomic DNA was then purified and analyzed using spectrophotometry, restriction digestion, and gel electrophoresis. This analysis suggested that BigBubba is a unique mycobacteriophage. It is necessary to sequence BigBubba's genome to determine evolutionary relationships with other phages. In addition to advancing the scientific understanding of phages, our results may be useful in combating antibiotic resistance among bacterial pathogens since bacteriophages are highly specialized microbial predators in constant coevolution with their hosts.

**Gregory, Hannah; Simpson, Madison; Festervan, Dalton; Neelly, Kurt;** "Burnout in Newly Licensed Physical Therapists with Less Than Five Years of Experience: A Cross-sectional Survey" (Kurt Neelly)

**Introduction/Background:** Burnout has become a pressing concern in the healthcare field, influencing the well-being of the workers and impacting the delivery of healthcare. Studies have shown that burnout is prevalent in 45-71% of physical therapists (PT) and PT students. However, little research has been conducted on early career PT's with two to five years of experience. The purpose of this study is to determine if burnout is present in early career PT's with two to five years of experience and begin exploring factors that may contribute to burnout. **Methods:** A cross-sectional survey will be distributed to newly licensed PT's (between two to five years of experience) from Kentucky, Tennessee, Ohio, and Indiana. The participants will complete the Maslach Burnout Inventory: Human Services Survey for Medical Personnel [MBI-HSS(MP)] as well as additional demographic and open-ended questions regarding causes of burnout. **Data Analysis:** Descriptive demographic and burnout subscale values will be calculated. ANOVA and t-test comparisons will also be completed to determine burnout differences between subgroups of survey respondents. SPSS will be used to calculate descriptive, subscale, and group comparisons. **Discussion:** This study will explore burnout levels as well as begin exploring factors associated with burnout in early career PT's.

**Guercio, Harmony; Suriano, Zachary;** "Snowfall Processes in the Ohio River Basin" (Zachary Suriano)

Snowfall holds a significant impact on various aspects of our lives. Besides affecting transportation, local businesses, and outdoor activities, snowfall holds a significant impact on the environment in several different ways. When snow melts, it provides a vital source of water for plants, by replenishing soil moisture and supporting their growth. Additionally, snow acts as an

insulating layer to the Earth, which protects many different plants and animals from the extreme colds in the winter. Over the last half-century, many within the Ohio River basin have witnessed a decrease in seasonal snowfall, as well as the amount of snow dropped from a storm. These changes have had a large impact on local communities. This research focuses on examining the relationship between snowfall and its processes in a warming climate. By analyzing daily snowfall records dating back to the 1950s, this study aims to identify the various weather patterns that lead to snowfall, the spatial distribution of snowfall across the region, and an assessment of how this has changed over time.

**Guzman-Rivera, Rozany** "Synthesis Offices: Amalgamation of Nature and Productivity" (Shahnaz Aly)

The city of Owensboro is the fourth-most populous city in the state of Kentucky and the city is seeing a continuous stream of new residents looking to move to the riverfront city. Now, the city is facing exponential growth and new construction is cropping up for the city to adapt to this arrival of new residents. With that growth in population comes a need for new jobs and spaces that encourage growth both personally and professionally in a growing community. Synthesis Offices redefines the modern workplace by fostering a vibrant ecosystem where nature and technology converge to fuel creativity and collaboration. Its biophilic design connects busy office workers with lush greenery decorating an atrium lit by natural sunlight flooding through the skylight. Synthesis Offices breaks the walled cubicle spaces built up between workers and provides the office with an open-plan co-working space that encourages workplace interaction and idea exchanges while individual office spaces are open for remote workers to rent for focused productivity. The large conference rooms come equipped with technology for video conferences, team meetings, and client meetings and the large auditorium becomes a venue for large-scale conferences. Synthesis Offices aims to make a community in the new workplace.

**Hadden, Hunter** "Adairville Baptist Church" (Shahnaz Aly)

Adairville Baptist Church needed to expand to accommodate their growing congregation. As a tight knit church that welcomes everyone, the congregation outgrew the capacities of its classrooms and fellowship hall and on some Sundays, the sanctuary. This project provided relief of overcapacity and added some additional areas to the new building that the previous one did not offer. This project allows adequate space for the existing congregation as well as future congregation size due to the continuous growth of the church. The larger classrooms as well as more classrooms allow for less crowded Sunday morning and Wednesday night classes. A larger fellowship hall was designed to match the growth of the sanctuary to ensure all guests feel comfortable during events not in the sanctuary. A library and gymnasium were not in the original church but while pursuing community outreach and giving people a place to belong and worship these were necessary to help educate and unwind, even on days church is not in session. This project is centered around the core values of community and fellowship. A place of worship should not only be a sanctuary for spiritual growth but also a welcoming and inclusive space where people can come together, connect, and support one another on their journey of faith.

**Haider, Md Zulfiqur; Waltermann, Jacob;** "A Robust Finite Difference Model Reduction for a Fully-Clamped Three-Layer Laminate" (Ahmet Ozkan Ozer)

This research investigates a fully-clamped three-layer laminate, incorporating alternating piezoelectric/elastic layers and a viscoelastic core. Supported by RCAP funding, our goal is to



develop a Finite-Difference-based model reduction for the corresponding partial differential equations (PDE) governing transverse vibrations. The PDE model is confirmed as exactly controllable/observable, as demonstrated in [Ozer-Hansen-IEEE-CDC'10]. A challenge arises with standard Finite Differences or Elements, struggling to maintain uniform observability as the discretization parameter approaches zero. Recent studies on fully-hinged [Aydin-Ozer-IEEE-LCSS-2023] and clamped-free [Aydin-Ozer-ESAIM-COCV'23] scenarios reveal shortcomings in achieving uniform observability. To address this, we employ the commonly used Direct Fourier Filtering Method. The intricate coupling between shear and overall bending dynamics poses a significant challenge. Handling fully-clamped boundary conditions introduces obstacles, such as the inability to analytically construct the system matrix's spectrum. In response, we adopt a discrete multiplier approach to overcome hurdles associated with spectral-based proofs. Our proof extends beyond a single layer Euler-Bernoulli beam [Cindea-Micu-Roventa-SICON'17] to three-layer laminates, providing valuable insights. The proposed model reduction technique not only addresses these challenges but also demonstrates enhanced efficiency in capturing the fundamental dynamics of the fully-clamped three-layer sandwich beam. This research advances the understanding and computational modeling of laminated structures, holding promise for applications in structural engineering and materials science.

**Hardesty, Mallory** "Are You Satisfied?: An Analysis of Democratic Satisfaction Amongst Self-Reported Identity Groups" (Scott Lasley)

Democratic satisfaction has been researched consistently and many studies have concluded that democratic satisfaction is on the decline. This study attempts to identify which groups are experiencing higher levels of dissatisfaction. Understanding why levels of dissatisfaction are rising is critical in understanding how to solve these issues. By having an understanding of who is affected, further research can be done to uncover why these particular groups are dissatisfied. The main research question was: Is democratic satisfaction an issue of representation within the federal government? To gather data, a survey was analyzed using questions that were formulated by Western Kentucky University students and reviewed by Dr. Timothy Rich. These answers were then broken down into key identity groups, including race, party identification, and sexual orientation. Through the research, it was found that respondents did not feel as though they were represented in the federal government, but this did not have a major impact on their satisfaction with democracy. However, the identity groupings did have an impact on whether the groups were satisfied with democracy. Having this information allows for a more detailed understanding of who is dissatisfied with democracy and will allow for more targeted research on the subject matter.

**Harner, Jenson; Marquardt, Joseph;** "Investigating Cell Shape Control by the Polarisome and Septin-Associated Kinases in *Saccharomyces Cerevisiae*" (Joseph Marquardt)

A cell's shape is often indicative of and critical for its function. In the budding yeast *Saccharomyces cerevisiae*, cell growth is a tightly controlled process. Elm1, a key player in this regulation, controls the shape of the growing bud in part by regulating the septin cytoskeleton at the mother-bud interface. Cells missing this kinase are highly elongated. Proteomics data has suggested there may be more downstream effectors for Elm1 than previously thought. One of these potential substrates is Spa2 – a polarisome component which helps direct polarized cell growth. This study analyzes the effects of Spa2 gene deletion in reference to Elm1-related phenotypes through classical yeast genetics and fluorescent microscopy. Preliminary results

indicate that while the codeletion of Spa2 and Elm1 genes results in a bud shape phenotype closer to Spa2 mutants, molecularly, cells resemble Elm1 loss. This indicates that Spa2 might be influencing Elm1 in a previously unknown pathway. These findings prompt investigation into other polarisome components' relation to Elm1 and other Elm1-mediated pathways. While Spa2 may not have a direct human homolog, the human homolog of Elm1 is directly involved with cell polarity in the liver, hinting that this crosstalk in yeast may be functionally relevant during human development.

**Harness, Briana** "Effect of Photodynamic Therapy on Staphylococcus aureus Biofilm Formation" (Simran Banga)

There are several microbial diseases associated with biofilm formation such as ear infections, urinary tract infections, and prosthetic joint infections. Particularly, reoccurring prosthetic joint infections are a serious complication often caused by treatment-resistant bacteria. Photodynamic therapy has become a promising potential treatment for antibiotic-resistant pathogens. In photodynamic therapy, photosensitizers like methylene blue (MB) react with infrared 660nm light to produce antimicrobial species. We have previously shown that methylene blue in association with silver nanoparticles (AgNPs) is more antimicrobial against Staphylococcus aureus than methylene blue and silver nanoparticles alone. However, the effect of photodynamic therapy on biofilm formation was not tested. In this study, Gram-positive Staphylococcus aureus was exposed to methylene blue during photodynamic therapy to test whether photodynamic therapy affects the biofilm formation of Staphylococcus aureus. We hypothesized that photodynamic treatment would delay the biofilm formation in S. aureus. To test this hypothesis, we optimized the growth parameters for biofilm formation in a 24-well plate and then exposed the bacteria to photodynamic treatment. Our observations and data suggest a link between photodynamic therapy treatment and biofilm formation. However, data suggests that there are likely many confounding variables that influence how photodynamic therapy affects future biofilm growth.

**Hartman, Anna; Dant, Jacob; Seadler, Jocelyn; Putnam, Sydney; Morgan, Lesley;** "Herbaceous Plant Diversity" (Martin Stone)

Cloudbridge Nature Preserve in Costa Rica is a large hotspot for biodiversity as a cloud forest, where interactions between vegetation and environmental factors shape the landscape. Herbaceous plants play an important role in maintaining ecosystem dynamics, but often their diversity and ecological significance are overshadowed by the trees and their lush foliage within the forest. This study provides a look at herbaceous plant diversity through varying successional stages within the preserve. Surveys were conducted in five plots ranging from early to late stages of forest development, where the herbaceous plant diversity and abundance was quantified. Additionally, the diameter at breast height and basal area were measured in the surrounding trees to better understand the dynamics between herbaceous plants and succession within the forest. This analysis shows distinct patterns of herbaceous plant diversity across varying successional stages, as well as variations in species composition and abundance. These findings have been displayed in the presentation through multiple graphs, showing the richness and distribution of species. The field data was applied to existing literature on the subject, giving context to the findings to determine how ecological succession affects herbaceous plant diversity within a cloud forest ecosystem.

**Hartman, Sarah** "Dynamic Grey Relational Analysis of Air Pollution in Kentucky" (Ngoc Nguyen)

Air pollution is a crucial factor affecting the environment and public health. With growing communities in Kentucky (KY), it is essential to address these factors as the state has unique economic imports and exports and Air pollution has a significant impact on both morbidity and mortality (Song, Deng, & Ren, 2020). Therefore, monitoring and regulating air quality must mitigate these harmful effects. Various methods are available for assessing air quality and pollution levels, such as regression models, principal component analysis, and factor analysis tools. However, some of these methods present issues in multicollinearity and the nature of collected data. It is essential to recognize that air pollution data is often uncertain, incomplete and contains limited valid data points. In this study, grey relational analysis methodology is used to analyze economic and meteorological factors and their relationship with three criteria pollutants: nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), and ozone (O<sub>3</sub>) pollutant data at three Kentucky Monitoring Sites. Results indicate that economic variables are more influential to pollutant levels than weather variables are, though the weather variables also have consistent rankings. These results also allow us to deeply consider what impact economic variables have on Kentucky's environmental health.

**Hartman, Sarah; Fortune, Nicholas;** "Online Real Analysis Course for In-service Teachers Using Project Ultra Recommendations: Meanings for Continuity and Differentiability" (Zachary Bettersworth)

Calculus, and the related mathematical content, is one of the most important, foundational areas of mathematics for people intending to pursue careers in STEM (Bressoud et al., 2016; Rasmussen et al., 2019). Understanding how in-service teachers develop their mathematical understanding of ideas related to Real Analysis topics will provide important insights to researchers about the development of teachers' mathematical meanings (Thompson, 2016), or mathematical knowledge, for teaching calculus (Ball, 1990; Hill et al., 2008). We will present preliminary results from an initial attempt to implement the instructional recommendations from the Project ULTRA research group in their textbook Understanding Analysis and its Connections to Secondary Mathematics Teaching (Wasserman et al., 2022). This work represents an initial attempt to extend this research group's instructional recommendations in a fully online Real-analysis course for in-service teachers in the Southeastern United States. We borrowed and added tasks from Sellers et al. (2017) to better understand the teachers' attention to mathematical logic in addition to their conceptual understanding of the concepts of continuity and differentiability when interpreting alternative statements for the Intermediate Value Theorem and the Mean Value Theorem. This pilot data will inform our second attempt at implementing the recommendations of the Project ULTRA research group in an online context with in-service teachers in a future academic semester.

**Hasan, Zim Warda** "Effect of Glucocorticoid Blockade on Inflammatory Responses to Acute Sleep Fragmentation in Mice" (Noah Ashley)

Sleep fragmentation induces a pro-inflammatory response in peripheral tissues and brain, but it also activates the hypothalamic-pituitary-adrenal (HPA) axis, releasing glucocorticoids. It is unclear whether this rapid release of glucocorticoids acts to potentiate or dampen the inflammatory response in the short term. The purpose of this study was to determine whether blocking or suppressing glucocorticoid activity will affect the inflammatory response from acute

sleep fragmentation (ASF). Male mice were injected with either 0.9% NaCl (vehicle 1), metyrapone (a glucocorticoid synthesis inhibitor), 2% ethanol in polyethylene glycol (vehicle 2), or mifepristone (a glucocorticoid receptor antagonist) 10 min before the start of ASF or no sleep fragmentation. After 24 h, samples were collected from brain and periphery (liver, spleen, heart, and epididymal white adipose tissue). Proinflammatory gene expression (TNF- $\alpha$  and IL-1 $\beta$ ) was measured, followed by gene expression analysis. Metyrapone enhanced proinflammatory cytokine gene expression in cardiac tissue whereas reduced expression in adipose tissue of mice exposed to ASF. Conversely, mifepristone elevated proinflammatory cytokine gene expression in spleen while decreasing expression in cardiac tissue in mice subjected to ASF. The results provide mixed evidence for pro- and anti-inflammatory functions of corticosterone to regulate inflammatory responses to acute sleep loss.

**Hauschild, Benjamin; Polk, Jason; "Investigating Groundwater Dynamics and Aquifer Recharge Patterns in Barbados Using Forensic Hydrology" (Jason Polk)**

This study investigates water resource management challenges on the small, karstic island nation of Barbados, located in the North Atlantic Ocean bordering the eastern Caribbean Sea. The island's vulnerability to changing climate and storm patterns and sea level rise is compounded by its reliance on karst aquifers for its freshwater supply, which highlights the urgency for sustainable water resource management on the island. Through a multifaceted approach, including water level and precipitation monitoring, forensic hydrologic tracers (stable isotopes and dye tracing), and remote sensing analysis, this study endeavors to enhance the understanding of the groundwater dynamics, recharge patterns, and water resource availability in Barbados' karst environment. Through a collaboration with the Barbados Water Authority, this research seeks to provide valuable insights for improved water resource management approaches, addressing critical questions regarding groundwater-surface water interactions, recharge dynamics, and the influence of human activities on the islands' karst hydrology. Furthermore, through the utilization of the preexisting 3D-PAWS rainfall monitoring network, an investigation into the variations in precipitation both spatially and temporally will be conducted. This research contributes to a broader understanding of coastal karst islands and offers valuable insights for water resource management in similar regions around the world.

**Hauser-DeMeo, Nicholas; Buchheit, Michael; Terrell, Scott; "The Effects of Foam Rolling on Work-Related Musculoskeletal Pain and Motivation to Participate in Healthy Activities" (David Bell)**

Foam rolling has become an increasingly popular tool used in the treatment of various musculoskeletal conditions. Current literature primarily focuses on athletes while other, relevant populations such as linemen, are overlooked. This research is aimed at assessing the effectiveness a foam rolling routine has on work-related pain and how it might affect motivation for participation in healthy post-work activities compared to a dynamic stretching routine. Study participants will be gathered from linemen working for Warren Rural Electrical Cooperative Corporation and divided into two groups: foam rolling and stretching. Two different outcome measures will be used to assess work-related pain and motivation. Work-related pain will be measured by the SF-36 questionnaire and motivation for participation in healthy activities will be measured by the Baecke questionnaire, specifically the habitual physical activity section. Data will be collected over an 8-week period with the intended foam rolling and dynamic warmup routines performed every day the participants work. At the conclusion of the study the data will

be analyzed using a two-way mixed methods analysis of variance (ANOVA). The results of this study may indicate foam rolling as an effective method of managing work-related pain and as a motivator for participation in healthy activities.

**Heelan, Lauren; Savage, Savannah; Wininger, Steven; Savage, Savannah; Roepke, Emily; Drinnon, Randi; Cline, Averi; Bowman, Kayle;** "The Impact of Goals on Attention, Anxiety, and Performance" (Steven Wininger)

The purpose of the study was to examine how goal types impact performance anxiety and performance across two tasks. Hypotheses: H1: Self-referenced performance goals will result in better performance compared to intrinsic goals. H2: Intrinsic goals will result in lower performance anxiety. Task one consisted of utilizing a balance board as the controller for a maze game. Task two was a prone plank task. In session one, participants pursued an intrinsic goal; instructions were "have fun and enjoy the activity." During the second session participants pursued a self-referenced performance goal, with a target performance goal of at least 25% better than baseline. Results: H1 was supported. Participants performed significantly better with a self-referenced performance goal vs an intrinsic goal across both tasks. H2 was not supported. Performance anxiety was higher in the intrinsic goal session compared to the performance goal condition for the plank task. There were no differences in performance anxiety for the balance task. Goal type had a significant impact on overall performance. Performance goals resulted in better performance. Explanations and applications of results are discussed.

**Hendrickson-Brown, Gracie; Brough, Julianna; Forbes, Meghan; Pekara, Brittany; Brunot, Kara; Herrmann, Grace; Petty, Maddie; Brittenham, Evan;** "Jennings Creek Watershed Community Development Through Environmental Restoration and Recovery" (Jason Polk)

In December 2021, Bowling Green was struck by a tornado, causing widespread destruction in the Creekwood community adjacent to Jennings Creek, which was heavily impacted by loss of life, property, and environmental damage. Jennings Creek itself was altered, including sedimentation, streambank erosion, and loss of stabilizing trees. Working together with the Rotary International Bowling Green AM Club, WKU Water Professionals, WKU Engineering, and WKU Center for Human GeoEnvironmental Studies (CHNGES) students are leading a recovery project in partnership with the City of Bowling Green and Warren County BG-WC Metropolitan Planning Organization to help restore the environment and support the community's recovery. The project aims to provide restoration to the stream and floodplain area adjacent to Jennings Creek and provide environmental and hazard mitigation education to Creekwood residents via an outdoor learning area, a water monitoring station, educational signage, hazards kiosk, tree planting in partnership with TVA, and stream access trail. Overall, this project aims to enhance stream bank stability, prevent erosion and sedimentation that can lead to increased flooding, monitor the area's water quality and flood potential from stormwater runoff, and provide a gathering space for environmental education through the use of interactive flood data and educational watershed models.

**Hennessey, Hannah; Wilds, Alexander;** "The Relationship Between Right Wing Authoritarianism and Perceived Feelings of Safety" (Christopher Peters)

Right Wing Authoritarianism refers to an individuals' deference toward authority figures, tendency to act out in said authority figure's name, and tendency toward conformity. The current

research examined how individuals Right Wing Authoritarian orientations are related to individuals' feelings of safety in their local community. Participants completed a Right Wing Authoritarianism, Feelings of Safety, and Police Legitimacy scale. The results indicated that the higher the individual is in Right Wing Authoritarian orientations, the safer they feel; however, that effect is mediated by how legitimate they believe law enforcement to be. Implications for violent criminal behavior and law enforcement are discussed.

**Herrmann, Hannah; Polk, Jason; Lawhon, Nick;** "Perceptions and Visual Awareness of Urban Karst Flooding to Inform Preparedness Planning and Management Actions" (Jason Polk) Awareness and perception of flooding can heavily impact how an individual or community prepares for flooding and the risks posed due to understanding or lack thereof. Flood awareness can be impacted by factors such as flood experiences and type of flooding. Flooding in karst landscapes can vary from other types of flooding, and awareness of karst flooding has not been directly explored. This study will explore karst flood awareness through surveys, interviews, and cognitive mapping activities. This study aims to increase the understanding of flood awareness in karst environments through quantifying flood risk understanding and ways in which people relate impacts to karst environment. Bowling Green, Kentucky is used as a case study given its long history of development and being an urban karst area with frequent flooding issues. Comparisons between the surveys, interviews, and cognitive mapping activities, along with comparisons to factors like the FEMA flood maps to identify any differences between flood management and survey results, will be completed. This research will be used to explore potential policy and management practice changes for flood prevention that can be implemented in urban karst areas through the development of improved practices for stormwater and drainage design in karst areas.

**Hill, Liam** "Meaning in Life and Metacognition" (Aaron Wichman)

This study examines the relationship between our sense of confidence and our perceived Meaning in Life. Previous work in the domain of Meaning in Life indicates there may be metacognition at work. The current study seeks to discover any potential meta-cognitive elements by applying methods and theory from the Self-Validation framework. The current study discovers that Meaning in Life may be more of a function of how confident we are that life is meaningful, less if there is any objective meaning in one's life.

**Hines, Christian** "Cube Brewing Co." (Shahnaz Aly)

I designed a brewery called CUBE Brewing Co. with a restaurant and bar, an outdoor "beer garden" space with seating, recreational areas (volleyball courts, etc.), and an outdoor stage for live music performances. There is one building completely dedicated to brewing beer, with public tours available to get an inside view of the brewing process, a tasting area and bar, and administrative offices on the second story. The other building is a 400-seat restaurant, with a large bar in the center, and outdoor seating. Bowling Green is a large college town lacking bars and hangout spaces targeted toward the 20,000 students occupying the city for a good part of the year. There are also only 2 other local breweries in town, which are not marketed towards college students and do not offer a restaurant or outdoor space either. The goal was to create a commendable brewery that also is a hub for students and residents of Bowling Green to enjoy great food and beer, while in a great social atmosphere.

**Hines, Nick** "Supporting Community Growth in Russellville, Kentucky" (Aly Shahnaz)  
I designed a mixed-use center to support the continued growth of Russellville, Kentucky. As Russellville experienced rapid expansion, some of the city's shortcomings became evident. My project aimed to introduce a building that bridged the gap between Russellville's then-current state and its future. Also, it delivered on a design for a new community center that seamlessly blended with the city's landscape while fulfilling many of its needs. My design focused on pushing the current norm of architecture in Russellville, designing a structure that maintained materials used around Russellville while delivering a more contemporary facade. The other goal was to create an enriching space for the populace of Russellville to gather as a community. I achieved this by creating an attraction for the community, from the Concert Hall to the Basketball Court. There is something to bring everyone together. My design drew inspiration from the "Largo Community Center" in Largo, Florida. Due to Largo's influence, I added sustainable design elements, namely the active strategies of my building. Which included both Solar Panels and Rainwater Collection systems. Solar panels acted as a clean source of energy for my building, and Rainwater Collection was a way to naturally irrigate green elements on-site. Ultimately, I created a Community Center that is contemporary and fulfill the needs of the community.

**Hoagland, Ansley** "How Do Queer Women Leave Behind a Legacy?" (Leigh Johnson)  
The goal of this project was to compare Sapphic (queer women) literature and see how these women are represented. A main question that kept coming up throughout the books and in queer theory was "How do queer women leave behind a legacy?" This paper attacks this question head-on by showcasing all the ways this minority can leave behind their mark on society without having children that are a part of the next generation. I covered three fictional works from 1987 to 2021, poems from Sappho (where the term "Sapphic" came from) and compared the queer theory brought forth in two academic articles as well as an academic article discussing a Sappho poem. I found that queer women are able to leave behind a legacy by guiding people from younger generations whether through literature or going through life together.

**Holland, Grant; Rayno, Kevin; Buller, Andrew; Ballance, Lauren; Norris, Elizabeth;** "The Effects of Percussive Massage Therapy After Fatiguing Eccentric Exercise to the Hamstrings" (Elizabeth Norris)

Introduction: Percussive therapy is widely accepted but under-valued in physical therapy literature. This study aims to examine the effectiveness of percussive therapeutic instruments applied to the hamstring muscles of recreationally active(RA) individuals in improving knee range of motion, increasing hamstring flexibility, decreasing DOMS, and increasing pain pressure threshold (PPT) following an eccentric hamstring exercise program. Methods: Approximately 35 RA individuals, aged 18-28 years within normal functional limits for knee ROM will be included in this prospective within-subjects repeated measures design. Following an eccentric training protocol, all individuals will receive 2 minutes of 40 Hz percussive therapy to the hamstrings applied from origin to insertion on the dominant leg with the non-dominant leg acting as the control. Individuals will be assessed pre-test and post-test. Results: Two-way repeated measures ANCOVA will be performed using SPSS. The dependent variables consist of DOMS, PPT, knee range of motion, and hamstring flexibility. Discussion: The study's findings will contribute to the effectiveness of therapy to mitigating negative effects of DOMS.

**Hoskins, Kaitlyn; Milam, Lily; Milan, Lily; Woodward, Matthew;** "The Relationship Between Alcohol Use and Alcohol-Related Problems is Stronger for College Student Service Members/Veterans" (Matthew Woodward)

College students are at heightened risk of heavy alcohol use. Student service members/veterans are even more susceptible to alcohol-related harms due to extra external responsibilities and potential mental health issues. This study analyzes whether the relationship between alcohol use and alcohol-related problems varies depending on whether individuals are student service members or traditional students. Participants (N = 777, 79% White and female) included traditional students (76%, n = 591) and student service members/veterans (24%, n = 186) who were recruited via an online survey. Participants completed measures assessing military history, alcohol use, alcohol use disorder, and alcohol-related problems. Analyses controlled for ethnicity, gender, and age. Results indicated that student service member status moderated the relationship between drinking quantity and alcohol-related problems (B= .08, p= .03), such that the relationship between drinking quantity and alcohol-related problems were stronger for student service members/veterans than traditional students. No moderation effects were found when analyzing alcohol use disorder symptoms. The results indicate student service members are at risk for negative outcomes related to drinking behavior. Future research is needed to understand what influences drinking in student service members/veterans to tailor prevention and intervention efforts.

**Huffaker, Ethan** "Close Reconstructions of Proofs in the Quantificational Logic of Principia Mathematica" (Landon Elkind)

Principia Mathematica is both famous and infamous for its symbolism. It famously intimidates casual and even scholarly readers by its frequent use of formalization in stating and proving theorems. It is no understatement to say there are more logic symbols than English words in the work. It infamously only provides proof sketches and not complete step-by-step proofs. So despite its reputation for rigor, logicians have long criticized Principia for falling short of modern standards for logic proofs. Here we go some way to rebutting longstanding allegations that Principia lacked rigor. To do this, we reconstructed from the text's proof sketch complete step-by-step proofs of the 105 propositions in the beginning of Principia's quantificational logic (theses that use the logical words "all" and "some"), or Chapters 9-10 of the book. We found that an impressively small raw number of extra steps were omitted from otherwise nearly complete proof sketches. Further, we found that the omitted steps were generally applications of definitions or of the basic rule of inference called modus ponens. So with few exceptions, the proof sketches in Chapters 9-10 of Principia from which we are to construct step-by-step proofs fully meets modern standards of rigor.

**Humphrey, Kelly; Gibson, Steven; Noriega-Crespo, Alberto;** "Constraining Properties of Evolving Cold Interstellar Clouds" (Steven Gibson)

Stars form from the collapse of cold, dense interstellar clouds of mostly hydrogen gas. To better understand such clouds, we examined relations between three properties: the fraction of hydrogen in the cloud that is neutral hydrogen atoms (HI), the empirical scaling factor between the CO emission tracing molecular gas and the amount of H<sub>2</sub> and the scaling factor between the amount of dust and the amount of hydrogen. Clouds with HI self-absorption (HISA) are cold, thus good prospects for H<sub>2</sub> formation and subsequent collapse. We analyzed gas properties in a HISA cloud complex in the Perseus spiral arm for different neutral atomic fraction values, using



21 cm HI and CO radio spectral line survey data, and dust images from the Planck satellite. Combining these results with a common dust scaling factor, we mapped neutral atomic fraction and CO scaling factor values and the amount of total hydrogen, HISA, H<sub>2</sub>, and dark H<sub>2</sub> across the HISA complex. Our findings confirm that the Perseus HISA Complex is quite cold and mostly molecular, with significant dark gas likely. Future analyses will use higher angular resolution data and then consider other cold clouds. This research was supported by NASA KY EPSCoR RID award 3200004560-23-206.

**Hurley, Henry; McCorkle, Kelsie; Lienesch, Philip;** "Distribution of an Invasive Zooplankton Species, *Daphnia Lumholtzi*, in South-Central Kentucky" (Philip Lienesch)

Invasive species are becoming more abundant and widespread due to our global economy. Exotic species such as Kudzu and Silver Carp have invaded the U.S. and caused damage throughout the southeast. *Daphnia lumholtzi* is an invasive water flea native to Africa, India, and Australia. It invaded the U.S. in the mid 1990's and is now found in Kentucky. The presence of *D. lumholtzi* is of concern due to its long helmet and tail spines, which make it difficult for young fish to eat them. We performed a zooplankton survey of four large reservoirs (Barren River Lake, Green River Lake, Nolin River Lake, and Rough River Lake) to determine the distribution of *D. lumholtzi* and native zooplankton in southcentral KY. We also have repeatedly sampled zooplankton from multiple sites in Barren River Lake during different years and seasons to assess its spatial and seasonal distribution. *Daphnia lumholtzi* occurred in all four of the sampled reservoirs although its presence and abundance were not predictable. The presence of *D. lumholtzi* in Kentucky may pose a threat to fish abundance and overall biodiversity.

**Hurt, Cora; Burch, Katrina;** "A Process Model of Workplace Cyber Incivility Spillover" (Katrina Burch)

Integrating affective events theory and the theoretical model of selective cyber incivility, we examine work-related affective rumination as a mechanism in the relationship between daily cyber incivility at work and aggressive and withdrawn behaviors at home. Results from a 10-day daily diary study from 63 participants indicate that on days when employees experience cyber incivility at work, they are more likely to engage in affective rumination, which is associated with at-home aggressive/withdrawn behavior. Implications for research and practice discussed.

**Hyman, Emma; Srivastava, Ajay;** "An Analysis of the Nuclear Pore Complex in *Drosophila Melanogaster*" (Ajay Srivastava)

The Nuclear Pore Complex (NPC) is a staple of eukaryotic life, acting as a gate keeper for the nucleus. Formed by a variety of nucleoporins (Nup's), the NPC is a complex of proteins that monitor the comings & goings of substances in & out of the nucleus. The NPC is not constant within cells, with amounts & sizes of NPC's varying in cells with differing functions. This variation is also seen during stages of development for eukaryotic organisms. Due to their short generation time and relative simplicity in comparison to humans, *Drosophila melanogaster* has been used as a model organism to study the variations in amount and size of NPCs. Qualifying NPC's during vital stages of development can lead to greater understanding of function and structure, in addition to medical application. Deviations in NPC quantity and size are seen in mutated cells, such as metastatic cells. This paper aims to apply information gained from studies of NPC qualities in *D. melanogaster* to present a different perspective on the advancement of treatments for metastasizing diseases.

**Irizarry, Matthew; Vance, Zach; Kerney, Trevor; "WKU Filmatrix" (Michael Galloway)**

The WKU Filmatrix project addresses the need for a management system for the WKU Film and Journalism Department. They create about sixty short films each year and for each one of these is a variety of data associated with each film. For example, essential data about the films including cast and crew details, project landmarks and tasks, and legal documents such as location and vendor contracts. Currently, this data is currently stored in Google Drive, which is not only inefficient, but also is burdened by scaling issues. To combat this problem, our solution is the development of a secure, user-friendly platform designed with the department's faculty and students in mind from the beginning. Our system boasts secure authentication by implementing the existing Outlook logins via OAuth. Further, the user experience is extended by providing a user interface that not only adheres to WKU's style guidelines but is also effective in completing processes in an efficient manner. Another feature is a project checklist outlining major milestones in the film creation process. In summary, this app will aid the WKU film and journalism department to more securely and efficiently manage their data and processes related to film creation.

**Isaacs, Katie "Application of Gaussian Tools for the Study of Molecular Symmetry" (Jeremy Maddox)**

The geometric symmetry of a given molecular structure is often important in determining the physical and spectroscopic properties of a substance. For small molecules in particular, molecular symmetry is described mathematically in terms of a point group that consists of one or more symmetry operations, such as rotations, inversion centers, improper rotations, and mirror planes. These symmetry elements can be hard to understand at first because they are difficult to visualize by just reading about them in a textbook. In this poster, we present our work on a tool that we have designed, using Mathematica, that creates an interactive user interface for visualizing symmetry elements and animating their operations. Our code reads molecular structure data from the output produced by the Gaussian electronic structure software package. The user can turn on and off each symmetry element and each animation. We believe that this tool will aid in both visualization and comprehension of molecular symmetry elements.

**Jewell, Andrew "Atlas" (Aly Shahnaz)**

The purpose of this gym is to create a space using neo-classical architecture where the community feels invited to participate and enjoy, while also being known for a place where physical and mental well-being can be achieved. Roman and Greek temples invited people to come and attend as a way of rejuvenating their spirits and pursuing a high-quality physical state and lifestyle. Through the use of features like columns, arches, and symmetry this can inspire a feeling of motivation, balance, and euphoria. This project introduces a neo-classical gym that has a blend of modern architecture.

**Johnson, Fletcher; Marquardt, Joseph; "Novel Techniques for Imaging Septins in Yeast That Do Not Require Hydrofluoric Acid" (Joseph Marquardt)**

Studying septins is very crucial for our understanding of how eukaryotic cells work. However, studies involving human septins are complicated due to there being multiple isoforms. Baker's yeast provides an alternative since many critical genes controlling cellular processes are highly conserved with genes in human cells and there are only 5 mitotic septins. The goal of this study

was to develop a technique for viewing septins in yeast under a TEM without having to use hydrofluoric acid to dissolve the glass coverslips used to process the yeast. We chose to replace the glass with cellulose acetate which could be dissolved using a safer solvent, acetone. Yeast are adhered to poly-L-lysine/carbon coated cellulose acetate, mechanically unroofed, fixed and dehydrated with HMDS. The cellular remains were rotary shadowed with platinum and then the cellulose acetate was placed on a TEM grid, soaked with acetone, and the cellulose acetate dissolved so that the shadowed septins floated onto the TEM grid. Using the process above, and imaging with the SEM, we found that yeast cells successfully bound to cellulose acetate and unroofed, exposing septins. We are still optimizing the cellulose acetate removal process for transferring the septins to a TEM grid.

**Jones, Caleb** "William Natcher Public Library" (Shahnaz Aly)

One of the most pressing issues public libraries face today is resource constraints. To help with this issue, I included a café space with the intent of increasing foot traffic within this library as well as distinguishing it from others in the area. The main goal for this project was to create a space where people could visit with friends and enjoy all the benefits of a typical library while still being able to experience the building's natural surroundings. One of the methods I used to help accomplish this is the use of floor to ceiling windows throughout the building to make sure there was a view of the natural environment in as many rooms as possible. Another method used was the use of a central courtyard within the building that featured exposed balconies on the second floor. The reasoning behind this was to create areas where visitors could enjoy the natural weather without having to ever exit the library. One other goal of this project was to create a building that acted as a cornerstone for the surrounding community. To create a space that supported the local community I included an art gallery to display local art as well.

**Joung, Juwon** "Integration of Zinc Finger Protein Arrays into a Microfluidic Device for Detecting Specific Pathogens" (Moon-Soo Kim)

Zinc Finger domains possess the ability to detect double-stranded DNA. When Zinc Finger domains are engineered into Zinc Finger Proteins (ZFPs), the Zinc Finger domains allow for increased specificity and affinity to target dsDNA. Further incorporating the assembly of TEM-1 beta-lactamase enzyme via SEquence-Enabled Reassembly (SEER-LAC) system alongside the use of ZFPs allows us to demonstrate the detection of DNA sequences present in *E. coli* O157:H7 on a microfluidic device. The ZFPs engineered to detect Shiga toxin 2 strands present in *E. coli* O157:H7 are immobilized on the surface of an epoxy-coated microfluidic device via conjugation. Pathogen-specific dsDNA can then be detected via the engineered ZFPs. The results can be measured using a colorimetric assay that occurs from the hydrolysis of nitrocefin by beta-lactamase. This study demonstrates the simple and rapid detection of pathogen-specific DNA without laborious processes such as polymerase chain reaction (PCR) or fluorescence in situ hybridization (FISH).

**Kane, Bruce** "Athletes: While We Should be Making Them Stronger, Society is Encouraging Them to be Smaller" (Andrea Kirk-Jenkins)

Intense dieting, rigorous workouts, and frequent weigh-ins are often typical demands for athletes. Athletes are pressured by coaches, peers, spectators, and themselves to maintain strict body requirements. These requirements affect athletes of all performance levels, both mentally and physically. According to NFHS (2023), 7,851,833 adolescents participated in high school sports

in the United States from 2022 to 2023 (p.55). This statistic does not represent athletes worldwide, nor does it consider youth leagues, collegiate-level sports, or professional-level sports. Yet, this representation of athletes is still a large portion of the general population that is regularly pressured to make quick changes to their body, such as losing weight or building muscle quickly to meet the demands of their sport. These weight requirements for their sport may force individuals to find faster methods of losing weight, which may lead to eating disorders or potentially a culture that promotes disordered eating. In this research presentation, we will explore the hidden world of eating disorders among athletes.

**Kane, Bruce** "Veterans and Suicide: 6,392 Too Many!" (Andrea Kirk-Jenkins)

War and suicide have been thought to go hand in hand, just like milk and cookies. For thousands of decades, warriors of all sorts have been known to commit suicide due to shame or dishonor they may have brought upon themselves or others. Another factor in suicide is the truly terrifying and traumatic acts of war that they were exposed to without anyone to process the experience with. It has taken over 110 years to entirely accept the true horrors that war can do to a person. There is no definite reason why people complete or attempt suicide. In World War 1, it was called Shell Shock; in World War 2, it was called Combat Stress Reaction; during the Korean War, it was called Gross Stress Reaction; during the Vietnam War, it was referred to as Vietnam Stress or Syndrome. It took more than 3 significant wars to recognize PTSD after countless lives lost to suicide. Veterans Affairs have taken on this immense responsibility to try and combat suicide among service members. With the help of President Obama, the Suicide Prevention for American Veterans Act of 2015 has created an interest in protecting the individuals who gave their all to protect us.

**Kellogg, Brian; Sy, Simon; Gruchala, Eden; Hutchinson, Natalie; Kotagiri, Varshith; Li, Lei;** "Developing Phenanthroimidazole-based Fluorescent Sensors for Efficient Analyte Detection" (Lei Li)

The highly efficient design and synthesis of organic fluorophores with an excellent quantum yield have received extensive attention. Compared with instrumental techniques, fluorescent sensors derived from organic small molecules offer many impressive benefits. Various detection mechanisms (such as colorimetric, ratiometric, and fluorescence turn on/off) have been reported for single analyte detection. Nowadays, developing molecular probes that are capable of detecting two or more different analytes (cations, anions, and/or biomolecules) have emerged as a new research area and attracted considerable attention in the field of chemo- and biosensors. Phenanthroimidazole (PhImH) represents a new class of novel organic molecules that features a plane structure, strong  $\pi$ - $\pi$  interaction, and electron-donating properties. However, fluorescent sensors built on the electron-rich phenanthroimidazole, paired with electron-deficient pyridine or diketopyrrolopyrrole, have not been extensively studied, especially their potential applications in detecting two or more different analytes. In this project, we designed a series of novel fluorescent sensors based on phenanthroimidazole and diketopyrrolopyrrole or pyridine to constitute a donor-acceptor-donor alternate structure with advanced photophysical properties, and aim to explore their applications in detecting multiple analytes, like proton, fluoride, and copper (II) ion, with a single sensor. Structure modification was also done to explore the potential of increasing its hydrophilicity to enable its application in an aqueous medium.

**Kelly, Ethan** "Quantitative Analysis of an Analytical Hodgkin-Huxley Model Solution" (Tony Simpao)

Using a modern re-investigation of an often omitted term of the Hodgkin-Huxley (H-H) model (the second order time-derivative) combined with an interpretation of the neuron as a coaxial transmission line, an analytical solution for the H-H model voltage (by Simpao) was implemented and investigated using Mathematica. Other H-H terms in the Mathematica code are compared to their experimental counterparts in order to assess validity of the comprehensive Mathematica implementation. All portions of the implementation match well-known neuron behavior and suggest this Mathematica model is not only capable of reproducing experimental work with qualitative and quantitative accuracy, but can be used to carry out further investigations of previously difficult to identify properties of the neuron (axon self-inductance, electromagnetic field around the neuron, neuron network interactions, etc.).

**Khalilullah, Sk Md Ibrahim; Ozer, Ahmet Ozkan; Rasaq, Uthman;** "Uniformly Exponentially Stable Finite-Difference Model Reduction of a Heat and Piezoelectric Beam Interaction with Static or Hybrid Feedback Controllers" (Ahmet Ozkan Ozer)

The RCAP-funded study explores the dynamics of a copper rod undergoing heat transfer, coupled with a magnetizable piezoelectric beam in a transmission line setting. Integrating longitudinal vibrations and total charge accumulation, the piezoelectric beam creates a complex interplay between electromagnetic and mechanical waves with notable differences in propagation speeds. In an open-loop scenario, our investigation reveals a lack of exponential stability when considering only thermal effects in the amalgamation of heat and beam dynamics. To address this, we propose two boundary-type state feedback controllers: (i) Static feedback controllers exclusively and (ii) a hybrid approach where an electrical controller dynamically enhances system dynamics. Recent findings [Khalilullah-Uthman-Ozer-IEEE-ACC'24] highlight solutions to the PDE system exhibiting exponential stability through a carefully designed Lyapunov function with varied multipliers. The primary goal of the poster presentation is to achieve a robust model reduction ensuring exponential stability. To accomplish this, we introduce a novel order-reduction-based Finite-Difference discretization of the PDE model, effectively eliminating Fourier Filtrations. Importantly, the demonstrated exponential decay rate remains independent of the discretization parameter, aligning seamlessly with that of the original PDE. This research significantly contributes to the literature in intelligent materials by advancing the understanding of complex interactions within magnetizable piezoelectric beams.

**Khuzhakulov, Zikrulloh;** Kylychbekov, Salizhan; Allamyradov, Yaran; Majidov, Inomjon; ben Yosef, Justice; Banga, Simran; Er, Ali Oguz; "Bioactivity and Mechanical Properties of Hydroxyapatite on Ti6Al4v and Si(100) Surfaces by Pulsed Laser Deposition" (Ali Oguz Er)

This study explores how adjusting substrate temperature and laser ablation wavelength influences the properties of hydroxyapatite (HAP) coatings. Using pulsed laser deposition on Ti6Al4V and Si(100) substrates, coatings were produced at temperatures ranging from 25°C to 800°C, and three Nd:YAG pulsed laser wavelengths (1064 nm, 532 nm, and 355 nm) were employed. Surface morphology was examined using SEM with EDX Analysis and AFM, revealing that coatings produced with 355 nm and 532 nm lasers exhibited smoother surfaces. XRD analysis indicated a shift from amorphous to crystalline HAP above 500°C. Adhesion strength was evaluated through pull-out tests, showing increased adhesion with rising substrate temperature up to 800°C, but a decrease thereafter. Additionally, the bioactivity of coatings was

assessed through protein adsorption, dissolution in simulated body fluid, and cell proliferation assays.

**Kotagiri, Varshith; Li, Lei; "Developing a Novel Fluorescent Sensor for Detecting Analytes in an Aqueous Medium" (Lei Li)**

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

**Krent, Abigail "The Influence of Gravity on Germination and Early Growth of Beets and Radishes" (Martin Stone)**

Gravitropism is the physiological mechanism by which the vertical position of the axial plant organs is maintained with respect to the gravity vector. However, gravitational magnitude on Earth varies from that on other planets. While NASA is making strides to define the principle of gravitropism as it relates to microgravity, an application of this concept remains undefined in hypergravity. Here we report the discovery and characterization of crop response to hypergravity in phenotypic terms. We cultivated *Beta vulgaris* and *Raphanus sativus* in 25 cm-deep tubes and subjected them to one of three treatments using a centrifugal gravity apparatus. We find that there is no significant evidence to suggest a relationship between hypergravity and germination rate in *B. vulgaris* or *R. sativus*, but there is significant evidence to suggest an inverse relationship between hypergravity and average weight across all organs. Our findings challenge the scope of gravitropism, suggesting that the concept is inherently related to Earthly conditions by yielding morphologically deformed specimens with lower average weights. These preliminary results can serve as the foundation for future studies to discern whether plants can grow in hypergravity, possess the ability to adapt to grow in hypergravity, or fail to grow adequately in hypergravity entirely.

**Kuegel, Johnna "Grow Up, June!" (Alysia Fae Klein)**

My project is done in conjunction with the requirements for the Film Production BFA program. I chose to do my thesis project in directing, so I wrote and directed a short film, entitled "Grow Up, June!", which is a coming-of-age comedy. When June, a thirty-something, headstrong dreamer, returns home to her family's farm after years away in the city, she finds it all but empty. Her younger brother, Skip, a stoic, lonely farmer, has cleared the farm and insists on

moving on from the past. When their last cow, Reba, keeps coming back to the farm, June and Skip must set aside their differences and band together to put Reba in her place and, in rediscovering a lifelong bond stronger than any other, find where they belong, too.

**Kumar, Aishwarya; Rumage, Abby; ; Burch, Katrina; "Influences of Race and Personal Tolerance on Resource Depletion from Daily Work Incivility" (Katrina Burch)**

While conditions have improved for workers due to the advances of labor and civil rights, we still encounter stressors in the workplace, such as work incivility. Work incivility is a low-intensity behavior, conducted in an ambiguous manner. A possible outcome of work incivility is an individual's depletion of resources. Conservation of resources theory (COR) theorizes that the loss of resources holds more impact for employees than gain. With this framework, we can broaden our understanding of work incivility's impacts, as moderated by other factors, not yet covered by the literature. We hypothesize that daily experienced workplace incivility will be significantly, positively associated with daily resource depletion. We also hypothesize that employees with a higher personal tolerance for mistreatment will experience a weakened association between daily workplace incivility and daily resource depletion. Finally, we hypothesize that non-white employees will experience a stronger association between daily workplace incivility and daily resource depletion. Seventy-eight couples took a baseline survey, followed by ten daily surveys. To analyze data, a multilevel regression model with two moderators will be used. Implications for research and practice will be discussed.

**Kumar, Nikhil; Marquardt, Joseph; "Shedding Light on Cancer by Exploring the Influence of Bem1, Boi1, and Boi2 Proteins on the Elm1 Protein Kinase – Mediated Cell Shape Control in *Saccharomyces Cerevisiae*" (Joseph Marquardt)**

Elm1, a protein kinase in *Saccharomyces cerevisiae*, regulates fundamental cellular processes such as the cell cycle, cell polarity, and cell morphogenesis. Furthermore, it inhibits pseudohyphal growth, characterized by an irregular elongated shape. The downstream factors controlling Elm1's influence on cell shape remain largely unknown. This study investigates the phenotypic results of deleting the three potential Elm1 downstream proteins – Bem1, Boi1, and Boi2. Additionally, previous studies suggest Boi1 and Boi2 are functionally redundant. By examining their differences, we can shed light on evolutionary relationships, differences in protein function - ultimately implicating disease via protein dysfunction - and the differences in the shared pathways. Studying these specific proteins is significant for their possession of human orthologs, enabling the translation of our findings to human systems. Through classical yeast genetics, the protein-coding genes were deleted or tagged with an Enhanced Green Fluorescent Protein (EGFP). Moreover, we created double-deletion strains of the three proteins with Elm1. We imaged and analyzed these, enhancing our understanding of the intricate relationship between Elm1 and its downstream regulators. By examining the phenotypic outcomes of Bem1, Boi1, and Boi2 deletions, we shed light on their distinct roles and potential for human disease control using a microbiological model.

**Kumar, Nikhil; Schugart, Richard; "Celestium: Optimized and Accurate Planetary and Interplanetary Satellite Modeling Via Utilization of Advanced Differential Equations" (Richard Schugart)**

In 2022, the Satellite Industry Association reported a staggering 45% increase in the number of operational satellites, resulting in an orbital population exceeding 7,000 around Earth. With the growing reliance on satellite technology, there is a lack of open-source, accurate, robust satellite

simulation tools that accompany a wide variety of missions (including interplanetary trajectories). This project aims to help aid this problem through the creation of Celestium, a sophisticated software solution engineered to compute satellite orbits while accommodating a spectrum of perturbations, including J2 effects, atmospheric drag, etc. Celestium enables users to define satellite orbits through the Keplerian Orbital Elements (KOE) which comprise the semimajor axis (a), eccentricity (e), inclination (i), true anomaly (theta), argument of periapsis (omega), and the right ascension of the ascending node (Omega). The transformation between the perifocal frame of reference (PQ) and the Earth-Centered Inertial frame (ECI) is accomplished using Euler's Angles to create a translation matrix. This allows for a position and velocity vector to be generated from the KOEs. Furthermore, we propose a novel algorithm to solve Lambert's problem through a combination of the Universal Variable method and Battin's solution. From this Celestium can accommodate attitude maneuvers, Hohmann transfers, and interplanetary transfers.

**Lahman, Alexandria** "Jim Robert's Park Community Center" (Shahnaz Aly)

The goal of the project was to create a community center for Jim Roberts Community Park in Franklin, KY. The community center would fit into the 20-year plan that was created for the park by Lose Design. The city of Franklin is rapidly expanding and is in need of a community center that will accommodate people of all ages. The building was comprised of two sections, a community center and an aquatic center. The community center would be built first and contain the majority of the amenities. The aquatic center would be added on later. The community center featured two multi-use courts, a workout gym, classrooms, yoga and dance studios, and offices for the parks service to use. The aquatic center houses a zero-entry pool and 25-yard competition pool. The design philosophy for the Jim Roberts Park Community Center was to create a space that benefits the occupant's mental health and allows them to feel connected to the community. The building was designed so that it can be enjoyed by people of all ages in the community.

**Lane, Katelyn** "Assessing Mammoth Cave National Park's Access for the Deaf and Hard of Hearing" (Chris Groves)

This project assesses the accessibility of cave tours in Mammoth Cave National Park for the Deaf and Hard of Hearing community (DHHC). The study was advertised to the DHHC using the Kentucky Commission on the Deaf and Hard of Hearing, First Baptist Church Bowling Green's Deaf Ministry, WKU social media, and directly to visitors that contacted the park seeking services. Willing participants either joined a group tour or reserved their own cave tour and requested necessary accommodations. Following these tours, a survey was given inquiring about participants' experiences with Mammoth Cave, whether all their needs were met, and any ideas they may have to improve this process. Survey answers were then analyzed looking for overall impressions of Mammoth Cave's accessibility and ideas for improvement. Though analysis is still underway, some possible improvements include the creation of printed scripts for guided tours and increased training for staff. While there is available information on what access Mammoth Cave currently offers for DHHC, this new line of research evaluates its effectiveness and acceptance among the community as well as how these perceptions may be applied to Mammoth Cave National Park's accessibility services.

**Lang, Lily** "Lumina: Illuminating the World of Holistic Beverage Branding with Switchel" (Natalie Tyree)



This Capstone Experience project establishes a compelling brand identity for the beverage switchel, under the name Lumina. Through a comprehensive branding blueprint, a strategic framework is crafted to guide brand development. This framework encompasses industry, competitor, and strategic analyses alongside consumer insights, a communication strategy, and cost of implementing ideas. With these insights, the project extends beyond theoretical constructs to practical applications, including label design, website prototyping, and advertisements (print and digital). By integrating elements of advertising and design, this project aims to not only reimagine switchel, but also to establish Lumina as a distinctive and resonant presence in the beverage industry. Through strategic planning and creative execution, this project aspires to demonstrate a synthesis of academic learning and practical skills, culminating in the creation of a compelling brand narrative for Lumina.

**Lantz, Evy; Gross, Thomas; "Preliminary Evaluation of a Group-Based Teacher Training of Trial-Based Functional Analysis" (Thomas Gross)**

The purpose of this study is to assess whether a group training for teachers on Trial-Based Functional Analysis (TBFA) was effective. There were two trainings. Training 1 was used to estimate knowledge gained and training needs for teachers. Training 2 was to gauge how well educators understood TBFA procedures from a modified version of the first training. The research question was: Does group training increase teacher knowledge of TBFA procedures? Training 1 participants include pre-service teachers and school psychology graduate students and took place at WKU. Training 2 participants included in-service teachers at a regional educator conference. Participants in both trainings completed a series of assessments related to TBFA procedures. Participants in Training 1 had a high accuracy on assessment across six units (M= 96%; range= 88% to 100%). Participants in Training 2 had a high accuracy on assessment across three units (M= 85%; range= 80% to 92%). There were differences in trainings due to unexpected in-service teacher needs and limitations in prior knowledge. Implications will include generalizing and adjusting TBFA trainings across pre-service and in-service teachers.

**Lett, Jenna "Investigating the Manipulation of Movement and Shape in Ballet Choreography" (Amanda Clark)**

The focus of my research is to expand my choreographic voice in creating contemporary ballet movement. Contemporary ballet comes from the blending of classical ballet dance and modern dance. By attending the Visceral Dance Intensive, I was able to have a hands-on experience of different choreographers' choreographic processes, which enhanced my technical abilities and artistic skills. Through research on contemporary ballet choreography, I have explored how to manipulate body lines and positions in space and challenge the movement boundaries of traditional dance. Uncovering new choreographic tools has allowed me to not only broaden my movement vocabulary, but it has also aided in understanding the interconnectivity of classical ballet and modern dance. The end product of my FUSE project was the creation of a contemporary ballet piece. This performance presentation features my original contemporary ballet choreography under the guidance of WKU Dance Faculty.

**Lindsay, Cassandra; Brausch, Amy; "Screen Use and Physical Activity as Predictors of Suicidal Ideation and Nonsuicidal Self-Injury in Adolescents" (Amy Brausch)**

Introduction: Prior studies noted that a high level of screen use in early adolescence is a strong factor for suicide risk in emerging adulthood (Coyne et al., 2021). Our study examined hours per

day on screens and days per week of exercise at baseline, and their association with suicide ideation, severity of suicide ideation, and nonsuicidal self-injury (NSSI). It was predicted that screen time would positively associate, and exercise would negatively associate with suicide ideation, severity of suicide ideation, and NSSI. Procedure: Data were from a longitudinal study of 456 U.S. high school students who were assessed at baseline and a 6-month follow-up. Majority of the sample identified as heterosexual (82.7%), and white (71.7%). Adolescents were asked about suicide ideation severity, experience of suicide ideation and NSSI, screen time, and exercise. Results: Linear regression results showed that screen use ( $\beta=.12$ , p

**Lopez Llorens, Daniela; Linet, Ashlynn; ; King, Rodney;** "Identification of Proteins that Prevent Bacterial Cell Growth: A Possible Alternative to Antibiotics." (Rodney King)

This research project involved a collaborative effort to construct a comprehensive gene expression library for mycobacteriophage NearlyHeadless. The primary objective was to investigate the effect of individual bacteriophage gene products on bacterial growth. Individual bacteriophage genes were amplified by Polymerase Chain Reaction from the NearlyHeadless bacteriophage particles and cloned into a gene expression plasmid (pExTra). After confirming the plasmid constructs contained the desired gene insert, they were moved into Mycobacterium smegmatis cells through electroporation. The expression of the cloned gene was induced, and cell growth was monitored. Out of ten genes tested, two genes were found to be cytotoxic. The toxic gene products will be characterized further and have the potential to be developed as an alternative to antibiotic use. Our results contribute to a greater understanding of the intricate relationships between bacteriophages and their hosts and how these interactions can disrupt critical cellular processes.

**Loveless, Colin; Reed, Steven;** "Role of CST in Genome Stability" (Jason Stewart)

Mammalian CST (CTC1-STN1-TEN1) is a highly conserved, heterotrimeric protein complex that plays essential roles in telomere maintenance and DNA replication. CST dysfunction, from mutation or altered expression, is associated with cancer and genetic disease. Previous research has shown a significant increase in common phenotypic markers of genome instability, namely micronuclei and anaphase bridges, in CST knockout (KO) cells. Such findings suggest CST plays an integral role in maintaining gene stability. CST was previously shown to play a role in DNA damage response pathways (DDR), which recognize and recruit DNA repair factors to damaged DNA. Our previous work suggests that CTC1 KO cells may become reliant on ATR, a kinase that activates the DDR, to prevent further increases in genome instability. In order to better understand the DDR pathway in the absence of CST, we investigated the role of ATR in protecting genome stability in CTC1 KO cells by measuring anaphase bridges and micronuclei after treatment with an ATR inhibitor. These findings will help determine how CST promotes genome stability and prevents disease progression.

**Lunday, John; Gani, Nahid; Yan, Jun; Towoju, Victor;** "Remote Sensing for Geologic Mapping in Karst-Rich Woodlands and Farmlands of the Olmstead Quadrangle, Todd And Logan Counties, Kentucky" (Nahid Gani)

This research investigates the Olmstead Quadrangle, a crucial yet inadequately mapped region in southwestern Kentucky's Todd and Logan counties since 1966. The study addresses the critical issue of amalgamated stratigraphic units, utilizing remote sensing techniques and identify and catalog sinkholes in karst-rich woodlands and farmlands. By utilizing ASTER and LiDAR data,

spectral analysis, and image processing, we aim to produce an updated geologic map. ASTER data was preprocessed using atmospheric correction and radiometric calibration that was used for Principal Component Analyses (PCA) and Band Math. Spectral signatures of mineral groups of stratigraphic units found were analyzed using USGS and NASA spectral libraries as references, which served as the basis for generating PCA and Band Math images. LiDAR was used to create a hillshade facilitating sinkhole identification and extraction, further enhanced through image fusion and sharpening techniques. Our initial results show that the distinctive signature of calcite played a crucial role in accurately delineating the boundaries of stratigraphic units in Olmstead Quadrangle. This study not only enhances our understanding of the region's geological composition for mapping but also tests the applicability of remote sensing in karst-rich woodlands and farmlands for future societal benefits and resource management strategies.

**Maddox, Emma;** Traxler, Sidney; Briles, Emma; Teeters, Jenni; "Examining the Relationship between Sexual Orientation, Substance Use, and Mental Health Outcomes in Women" (Jenni Teeters)

Queer women are known to be at increased risk for negative mental health outcomes including depression, suicidal ideation, and increased rates of harmful substance use. While these topics have been explored separately, less research examines the relationship of sexual orientation, substance use, and mental health outcomes together. A sample of 7,576 women (72% straight, 4% lesbian, 22% bisexual; 53% White) answered questions assessing past year depression, suicidal ideation, and past month substance use. The results showed that compared to straight women, queer women exhibited significantly greater odds of having a major depressive episode and seriously thinking about suicide in the past year. One way ANOVA analyses showed that bisexual women reported significantly more past month binge drinking episodes ( $p = .04$ ) and significantly greater days of past month cannabis use compared to straight women ( $p$

**Maddox, Evelyn;** Dixon, Allison; "A Lab-Built Photometric Titrator" (Eric Conte)

We are using a lab-built photometric setup to eventually measure calcium and magnesium ions using EDTA and calamite indicator. The photometric titration setup includes a beaker, modified to have a pump and two tubes for liquid flow. The tubing is connected from the beaker to a flow cell PVC pipe fitted with windows on each end to hold the sample liquid and allow light to pass through. Laser light shines through this tunnel to a sensor on the other end. Changes in detector voltage are measured, which are used to calculate transmittance. We use an Arduino-controlled system to dispense titrant into the beaker, keep track of the exact amounts of titrant added, and record detector voltage. Once we modified the flow cell to prevent leaks, we compared straight and offset windows angle flow cells. We think the straight ends make the light multiply the b length of  $A = Ebc$ , thus not giving us theoretical b values. We believe that the offset angle flow cell should eliminate this.

**Majidov, Inomjon;** Allamyradov, Yaran; Khuzhakulov, Zikrulloh; Kylychbekov, Salizhan; "Surface Patterning on Zirconia Dental Implants by Laser Imprinting" (Ali Er)

Zirconia is known to be a hard-to-machine in the sintered state. In this study, the zirconia samples were patterned and then sintered. A nanosecond Nd:YAG laser operating at 1064 and was used to pattern the zirconia surface. A confined plasma was formed through the interaction between the laser beam and a copper grid template. The template was covered by a sacrificial aluminum layer, and the plasma was confined using a glass slide. The size and depth of the

pattern were shown to be dependent on the shape of the grid, fluence, exposure time, confinement medium, wavelength, and beam spot size. We successfully achieved patterns ranging in size from 7  $\mu\text{m}$  to 40  $\mu\text{m}$  with depths of up to 3  $\mu\text{m}$ . The resulting patterned surfaces were characterized using Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM). The findings on the nature of the patterning will help in controlling the functionality of zirconia, such as hardness, biofilm formation, and osteointegration.

**Maloney, Shannon** "How Mentorship Enhances the Technical and Artistic Development of the Tap Dancer" (Amanda Clark)

The origins of tap dance lie in African American culture, an important component of which is mentorship. Mentorship in the field of tap dance creates a community that nurtures young dancers by placing them under the tutelage of experienced performers striving for continuous innovation. This practice allows the field to continue progressing while remaining true to its origins and honoring its historical figures. Mentorship is disappearing from tap dance pedagogy as it is modified to fit studio dance education, a departure from the art form's African American roots. By attending the Woodshed Experience and conducting historiographic research on tap dance mentorship, I was able to augment my artistic voice by learning from teachers other than the single tap dance instructor here at WKU. My Woodshed mentor's voice has become a fragment of my artistic voice, joining characteristics of other teachers to create a signature unique to me that will further my choreographic intent. I will present a choreographic work inspired by my tap dance mentors at the Last Chance to Dance student choreography showcase this Spring. When I teach tap dance in the future, my artistic voice will become part of my students, ensuring the continuation of my mentors' legacies.

**Marcum, Ryan** "A Detailed Forecast Analysis of Severe Weather Across Kentucky on March 2nd, 2012" (Joshua Durkee)

This forecast analysis case study is centered around the March 2nd, 2012 severe weather event/tornado outbreak across the state of Kentucky. This analysis was composed of analyzing numerous online sources to acquire information surrounding this specific event. These included local news and National Weather Service articles, Storm Prediction Center and National Weather Service forecasts and images, and radar/surface map images, among many other related text forecasts, articles, and images. Depictions of reports during and following the event were also considered. The entire event spanned from March 2nd to March 3rd across the Southern United States and into the Ohio Valley. This severe weather/tornado outbreak was extremely impactful across the state with 18 total tornadoes along with 26 fatalities. In-depth forecast analysis can help provide valuable information surrounding the atmospheric ingredients leading up to an event along with the forecasting before and during the event to better prepare us for predicting possible impactful or significant events in the future, and this is one of the main goals of this study.

**Marsh, Eliza** "The Hsape of Your Words: An Exploration of Innovative Communication in Ted Talks on Creativity" (Hasan Akdeniz)

This research investigates the communication shapes prevalent in TED Talks on creativity, focusing on the applicability of Nancy Duarte's model. By analyzing the five most-viewed and five least-viewed TED Talk videos in the creativity category, the study aims to provide empirical evidence on how speakers structure their communication to convey innovative ideas effectively.

Anticipating valuable insights, this research not only aims to uncover prevalent communication shapes but also seeks to formulate practical suggestions for ordering, demonstrating, and communicating new ideas. The objective is to guide seasoned and emerging speakers on capturing audience attention and persuasively presenting creative concepts. With a mixed-methods approach, this project contributes to the communication of the innovation field by delivering evidence-based insights into effective idea sharing. By understanding and articulating communication shapes that resonate with audiences in the realm of creativity, this research aspires to provide communicators with a practical toolkit for engaging presentations and facilitating the widespread dissemination of groundbreaking ideas.

**Martin, Thomas;** Egan, Hettie; Mancini, Anthony; "The Use of High Intensity Laser Therapy Paired with Active Forms of Treatment for the Management of Soft Tissue Injuries: A Systematic Review" (Anthony Mancini)

High intensity laser therapy (HILT) is used in a variety of clinical applications, but high-quality research corresponding with physical therapy (PT) intent is lacking. The purpose of this study is to compile current evidence regarding the use of HILT in conjunction with standard PT practice. We hypothesize that adding HILT to standard PT care will not demonstrate significant change to patient outcomes when compared to standard PT care alone. **METHODS:** The following databases will be searched through March 2025: PubMed, EMBASE, Cochrane, Google Scholar, and CINAHL. The keywords of HILT, high intensity laser therapy, photobiomodulation, and exercise will be searched. Studies using other biophysical agents will be included, provided they were used in isolation. The primary measures will be pain & functional outcomes (DASH, LEFS, VAS) reported in the studies. **RESULTS:** Studies included will go through a quality appraisal process. Dependent variables of pain and function will be extracted from all studies and presented in tabular format. **DISCUSSION:** Compiling the current evidence regarding HILT in standard PT practice may help clinicians make decisions about using HILT with patients. When finished this research will provide recommendations for therapists considering HILT for musculoskeletal conditions for best practice.

**Massey, Samantha;** Flinchum, Rachel; Khouryieh, John; Silva, Luiz; "Physicochemical and Sensory Characteristics of Low Fat Sausage Formulated with Xanthan - Locust Bean Gum Mixtures" (John Khouryieh)

This study investigated the effect of partial fat replacement with varying levels of xanthan/locust bean gum (XLB) mixture on the quality properties of low-fat sausages. Six treatment formulations were created: high fat control (HF, 20% fat), low fat control (LF, 10% fat), and LF with four levels of XLB mixture (LF+0.5%XLB, LF+1%XLB, LF+1.5%XLB, and LF+2%XLB). Quality parameters like proximate analysis, pH, emulsion stability, water activity, color, texture profile analysis (TPA), sensory, and proximal analyses were evaluated. The TPA and color were evaluated on both day 1 and 28. The L (lightness) and a\* (redness) color values were not significantly ( $p > 0.05$ ) affected among treatments or days, while b\* (redness) values on day 28 were significantly ( $p < 0.05$ ) lower in HF, LF, LF+0.5XLB, and LF+1XLB compared to LF+1.5XLB and LF+2XLB. The results from the TPA revealed no significant differences in hardness on day 28 among all treatments. Sensory analysis revealed that no significant ( $p > 0.05$ ) differences were observed in flavor intensity between HF, LF, LF+0.5%XLB, and LF+1%XLB. Incorporating 1% XLB resulted in acceptable sensory scores for the sausage formulation, indicating its potential as a fat replacer in low-fat sausages.

**Matthews, Tres** "Hidden Hills Country Club" (Shahnaz Aly)

This project involved the design of a new country club for Hidden Hills Golf Course in Monroe County, Kentucky, replacing the existing building. This location is a large public golf course next to an artificial lake and the county's large park. Unfortunately, the actual clubhouse building itself languished over the years with little to no effort put in place for a remodel or expanded amenities, and served mostly as a bathroom for the golfers, with no venue spaces, and a pool that remained drained from lack of users. My goal with the redesign of the new clubhouse was to revitalize interest in the area and make it a more desirable location. Once, it served as an option for families to be active together and socialize, but a lack of effort and investment has resulted in a space that stands for a major improvement. Development of the design focused on sustainability with an interest in water recycling, clean energy production, and native plant landscaping. Additionally, expanding seating options, kitchen area, and adding other amenities were a focus, while creating an exterior design that is respectful to the local area with its aesthetics.

**May, Lillian;** Peden, Travis; Sawant, Shikha; Ferguson, Tameka; ; Arbuckle, Greg; Hudson, Hugh; Emslie, Gordon; "Sketching the Shape of the Sun with Citizen Science" (Michael Galloway)

We know that the Sun is not a perfect sphere, but what is the actual shape of the Sun? Currently, we have a measurement accurate to a few hundred kilometers. Our project seeks to refine this to within only a few kilometers by photographing Baily's Beads during key points of the April 2024 Solar Eclipse, with the help of a NASA backed mobile app called SunSketcher. The app will be available for both iOS and Android. The app uses a combination of techniques including OpenCV image cropping, to quickly and securely send these photos to a central server on campus. This data would allow researchers to use the moon as a reference to determine the Sun's shape, more completely understand solar convection, and potentially refine our understanding of certain theories of gravity.

**Mbanfu, Albert-Presley** "c-JUN Protein Expression in the Regenerating Lamprey Spinal Cord" (Hilary Katz)

In most mammals, a spinal cord injury often results in permanent motor and sensory deficits due to their inability to regenerate their central nervous system. However, some vertebrates, like the sea lamprey (*Petromyzon marinus*), regenerate their spinal cord and recover motor function. The lamprey spinal cord is ideal for investigating molecular mechanisms of vertebrate regeneration due to its relatively simple neural circuit and large, identifiable neurons. The c-JUN protein has been widely studied for its critical roles in various cellular processes, including regeneration. In this study, we examine c-JUN protein expression during lamprey spinal cord regeneration using immunofluorescence staining. We measured expression at one- and three weeks post-injury in addition to uninjured control cords. c-JUN expression was observed throughout the spinal cord and around the injury site at all three-time points. The three-week cords showed the highest protein expression. Control cords had the next most intensity, followed by the one-week cords. These results are consistent with expression patterns in other regenerating species, suggesting that c-JUN may play a similar pro-regenerative role in the lamprey. Moving forward, we plan to knockdown c-JUN to limit its expression in the lamprey to examine its functional role in spinal cord regeneration.

**McClain, Kyle;** Wilson, Hannah; Conley, William; Raseta, Taylor; Condo, Matthew; "The Collection Of Normative Data Using The Gaitbetter Device: A Descriptive Study" (Matthew Condo)

Introduction: The GaitBetter is a Virtual Reality (VR) treadmill-based device that utilizes motorcognitive interventions for gait rehabilitation and fall prevention. The device has been proven to help the neurologic population, however, there is virtually no baseline or normative data. The purpose of our study is to establish criterion-reference normative values. Methods: First-year Doctor of Physical Therapy (DPT) students will complete a PARQ+ to determine medical clearance for physical activity and must be able to ambulate on a treadmill. After a short trial run, each participant will complete two twelve-minute sessions, in which levels of difficulty will be established based on their ability. Researchers will review and report data collected by the GaitBetter device. Results: Parametric measures of central tendency will be reported from performance data. Discussion: The significance is to fill a gap in the literature due to the lack of normative data for the GaitBetter VR walking platform. The study will serve as a baseline to reference for other studies.

**McCormick, Kendall;** David, Ella; "Lifeblood" (Travis Newton)

Lifeblood is a senior thesis film, written and directed by K. Christian McCormick and 1st Assistant Directed by Ella David. It follows a reserved and unassuming new kid who joins the baseball team, keeping his transgender identity a secret. But, when that secret is exposed by the team captain, he must learn to defend himself and fight back in order to gain the respect he deserves. This story was borne out of the anxieties and fears McCormick faced growing up as a transgender child. Those feelings grounded many of our decisions throughout making this film. At its core, this film is about safety. We put our protagonist in situations where he feels he has to choose between safety and a happy, thriving life. This is a reality for many transgender students who drop out of sports or choir simply because doing what they love is so dangerous. But at what point does choosing safety become choosing suppression?

**McGee Jr., Donte;** Arnett, Scott; Toluoso, Danilo; Stone, Whitley; Pacheco, Guillermo; Barksdale, Manly; "The Effect of Mindfulness Training on Muscular Endurance Performance, mindfulness, And Mental Toughness" (Scott Arnett)

BACKGROUND: Mindfulness training is a method of mental training becoming increasingly popular in performance-based populations, like athletes. Increased mindfulness is also positively associated with mental toughness, and both mindfulness and mental toughness may be valuable during activities that are highly fatiguing and stressful. Although mindfulness training has resulted in increased aerobic endurance performance, it has not been investigated in a similarly challenging exercise modality, muscular endurance performance. The purpose of this study is to examine the effect of mindfulness meditation on muscular endurance performance, mindfulness, and mental toughness. METHODS: A total of 48 male and female participants between the ages of 18-30 will be recruited. All participants will complete two sessions, a week apart, of three repeated planks until fatigue with one minute of rest between trials. Immediately following each trial, RPE will be assessed. The first session will include baseline assessments of mindfulness and mental toughness, then three repeated planks. The second session will divide participants into a mindfulness meditation group and an audiobook group, with each condition lasting 6.5 minutes. Then, the repeated planks will be completed following each respective condition.

ANTICIPATED RESULTS: It is hypothesized that mindfulness meditation will positively impact muscular endurance, mindfulness, and mental toughness.

**McGettrick, Caitlin;** Dick, Olivia; Teeters, Jenni; Woodward, Matthew; "Relationships between Substance Use Motives, PTSD, and Alcohol-Related Problems Across Two Samples" (Matthew Woodward)

Studies reveal that PTSD heightens the likelihood of heavy alcohol consumption and related problems. One route connecting PTSD and alcohol use involves using alcohol to manage traumarelated symptoms. However, various motives for alcohol use may also impact the connection between trauma distress and substance use. Few studies have explored whether these motives'

indirect effects differ among groups. This study aimed to investigate these indirect effects in the relationship between PTSD and alcohol problems and compare findings across college and crowdsourced samples. The study involved 313 adults from a crowdsourcing platform and 343 college students from a midwestern university. Results showed that in college students, social, boredom-coping, and performance motives indirectly influenced the PTSD-alcohol problems link. In the crowdsourced sample, only depression-coping motives had an indirect effect. These findings suggest that the influence of alcohol use motives on alcohol problems varies between samples. Social motives may play a more significant role in college students, while attempts to alleviate low mood may drive alcohol problems in crowdsourced samples.

**Meier, Joel** "Elevating Wellness: A Modern Fitness Center Concept for Bowling Green, Kentucky" (Shahnaz Aly)

The purpose of this project was to create a fitness center in Bowling Green, KY that would be able to accommodate a variety of different fitness goals. This facility will include areas for weights, cardio equipment, group fitness, swimming pool, basketball court, among others. It was also important for this type of facility to have a central location within the population, which was a major focus in choosing the site. The site was also chosen because of its proximity to schools, neighborhoods, and a major interstate system. A gym's location is important for it to be conveniently integrated into someone's daily routine. I conducted research on many different successful gyms, and they were all centrally located in the community. During the design phase, a crucial aspect was to figure out how all the different spaces relate to each other. I conducted research on how to organize the different spaces for the most efficient layout possible. This was an important challenge to overcome because people constantly move between spaces in a gym. I believe the result of this project is a successful relationship between spaces in a fitness center to yield a positive experience.

**Mejia Perez, Misael** "Bowling Green Recreational Center" (Shahnaz Aly)

The Bowling Green Recreational Center, envisioned as a beacon of health, wellness, and community engagement, stands at the forefront of sustainable and inclusive design. Spanning 37,000 square feet, this state-of-the-art facility not only promises to offer an extensive array of fitness and recreational services but also emphasizes a deep commitment to environmental stewardship and social responsibility. At its core, the center integrates cutting-edge, energyefficient technologies and green building practices, aiming for LEED certification to minimize its ecological footprint while maximizing functionality and user comfort. Designed to serve a diverse community, the center features adaptable spaces for a wide range of activities—



from rigorous athletic training in the gym and serene yoga sessions in the aerobic studio to educational workshops in the community meeting rooms. Special attention is given to accessibility, ensuring that all members of the community, regardless of ability, can fully participate in and benefit from the center's offerings. Central to the center's mission is the inclusion of a comprehensive wellness suite, staffed by licensed healthcare professionals, underscoring a holistic approach to health that bridges physical fitness with preventive care. By fostering a vibrant, supportive environment, the Bowling Green Recreational Center is poised to become a cornerstone of community life, setting a new standard for recreational facilities that prioritize health, sustainability, and inclusiveness.

**Merola-Lapson, Jack** "A Spatial and Temporal Analysis of Stonefly (insecta, Plecoptera) Biodiversity of Pennsylvania" (Scott Grubbs)

Insects are in decline globally, in abundance and diversity across both aquatic and terrestrial orders. Stoneflies (order Plecoptera), the most environmentally sensitive group of aquatic insects, have experienced declines in abundance and diversity across North America, Europe, and Australia. To address this issue, focused documentation efforts are important for better understanding biodiversity patterns and ensuring appropriate conservation efforts. Only three U.S. states (Indiana, Maryland, and Ohio) have been assessed for state-level stonefly richness and diversity patterns. The Pennsylvania fauna has yet to be studied, but much data exists in institutional collections, personal collections, and peer-reviewed literature. In total, 147 species, 43 genera, and nine families have been reported from Pennsylvania. Yet, the genera *Alloperla*, *Isoperla*, and *Leuctra* total 36% of species found in the state. Pennsylvania provides critical habitat for both common and rare species. Notably, the 2015 PA Wildlife Action Plan listed 21 species as Species of Greatest Conservation Need (SGCN), including the only state-endemic *Soyedina merritti*. Fieldwork during spring and summer 2024 will focus on three SGCNs (*Alloperla biserrata*, *S. merritti*, and *Sweltsa palearata*) that will result in Distributional Models to assist in future collection efforts and the first formal Conservation Status Assessments for these species.

**Milam, Lily;** Traxler, Sidney; Teeters, Jenni; Woodward, Matthew; "The Role of Coping Motives in the Link between Recent Cannabis Consumption and Suicidal Ideation" (Matthew Woodward)

Previous investigations have found significant associations between cannabis use and suicide ideation among adolescents and young adults. It is still unclear what factors influence the association. One potential factor to consider is a cannabis user's motivations for using cannabis. The study sought to examine the moderating effect of cannabis coping motives on past month cannabis use and a) lifetime suicidal ideation (yes/no) and b) frequency of past month suicidal ideation. Participants (n=223) included young adults with a history of cannabis use recruited via an online study (78% White; 78% female). Results showed significant associations between cannabis use frequency and history of suicidal ideation ( $r = .23, p < .001$ ). Although using cannabis to cope was not found to influence the relationship between past month cannabis use and lifetime suicidal ideation, using cannabis to cope moderated the association between past month cannabis use and past month suicidal ideation ( $B = .02, 95\% \text{ C.I.} = .009 \text{ to } .03, p < .01$ ). Namely, greater cannabis coping had a positive strengthening influence on the relationship between past month cannabis use and suicide ideation. These findings implicate the importance of imparting healthy coping strategies and mental health resources to cannabis users with suicide ideation.

**Miles, Adam** "The Evolution of Arthropod Reaction to the Presence of Smoke" (Albert Meier)  
Many animals have a survival instinct to flee in response to fire, but do they respond to smoke? The response behavior has been observed in some terrestrial arthropods, but currently, this behavior is unknown for marine, aquatic, or cave arthropods, which are atypically exposed to smoke or fire. My research proposes to investigate the behavioral response to smoke of arthropods by comparing responses by aquatic, terrestrial and marine arthropods. I put the individuals into a testing arena and recorded the individual's movement using software and time to quantify the effect. Independent t-tests were used to analyze individual differences for control and experimental observations. Additionally, PCA will be used to compare the movements of organisms found in different environments. There were 22 different arthropod orders used in this study. The results of a pairwise t-test, conducted on control and experimental data on the same individuals in each order, showed that six different orders had a significant difference between the mean time of movement in the control trial compared to the experimental trial with a Bonferroni correction test. Three arthropod orders had a significant difference in the mean time of movement.

**Miya, Mahamad** "Seasonal Variation of Butterfly Community in a Fragmented Habitat: A Case Study from the Institute of Forestry Complex, Hetauda, Nepal" (Dr. Keith Philips)  
Fragmented habitats provide a unique place for biodiversity research, such as butterfly diversity. This study investigated the seasonal variation of butterfly communities in a fragmented habitat: Institute of Forestry Complex, Hetauda, Nepal. Data was collected through the Pollard walk and the Checklist methods and hill diversity was calculated to compare the diversity between the seasons and butterfly families. A total of 115 butterfly species were documented, with Nymphalidae dominating (48 species), followed by Lycaenidae, Pieridae, Hesperidae, Papilionidae, and Riodinidae. The Pollard walk and Checklist methods revealed 54 common species, with distinct species recorded in each. Family-wise analysis highlighted Nymphalidae's highest species richness and diversity. Seasonal variations showed consistent butterfly activity throughout the year, with spring and autumn exhibiting higher species richness and diversity. Butterfly community structure significantly differed between seasons, with partial similarity observed between spring and autumn. The combined species data indicated peak richness in spring and identified 18 species in all four seasons. Family-specific seasonal variations revealed diverse patterns, emphasizing the importance of understanding temporal and familial dynamics in butterfly communities in fragmented habitats. These findings contribute valuable insights into the ecology of butterflies in the studied region, which is crucial for conservation and habitat management efforts.

**Morris, Lauren** "Differences in Mental Health for Adolescents in Gifted and Talented and Traditional High School Settings" (Amy Brausch)  
Gifted children and adolescents experience anxiety at nearly twice the rate of the average population (Karpinski et al., 2018). Previous research has shown conflicting results on the influence of giftedness on adolescents' psychological well-being. Current research will investigate whether gifted adolescents, especially those on a college campus, have higher rates of mental disorders, including depression, anxiety, and self-harm, than their counterparts in typical high schools. The current study will use data from 1) Qualtrics collected from a gifted STEM high school program for juniors and seniors in a residential on-campus setting and 2) in-person

data collection at local traditional high schools through an on-going study in our research lab. The mental health of three different groups will be analyzed: gifted high school students enrolled in college courses and staying on campus (Group 1), high school students enrolled in honors classes at traditional high schools (Group 2), and high school students in traditional high school courses (Group 3). Due to previous research, researchers expect the results to partially align with findings in from Karpinski's intelligence and mental health study, but the current/prospective study compares three different groups of intelligence rather than comparing highly intelligent people's answers to the answers of the general population.

**Muse, Matt** "Injection Molded Strength Testing" (Benjamin Dinan)

Injection molding, a manufacturing technique, involves the production of parts by injecting molten plastic into a mold where it then cools and solidifies into the mold shape. One such application of this method is the production of disc golf discs, where varying material characteristics are achieved using different polymer and elastomer plastic mixtures. These varied mixtures result in plastics with diverse physical and mechanical properties. This study investigates these properties for several commercially available discs through tensile testing per the ASTM D638 standard. Tensile samples were prepared by both laser cutting and die cutting purchased discs. To better understand the influence of plastic composition on mechanical properties, samples from each disc were analyzed by FTIR, CHN, ICP-OES, and TGA to elucidate their chemical make-up. Tensile test results showed discs with those with lower carbon/nitrogen content are much more brittle than plastics made with higher carbon/nitrogen mixtures. The brittle plastic also had little to no oxygen content and had more filler polyurethane material. This comprehensive study illustrates that injection molding plastics can be used to manufacture a broad spectrum of polymers, each exhibiting distinct material characteristics.

**Neace, Mara; Polk, Jason;** "Assessing Water Quality Trends in the Jennings Creek & Lost River Watershed to Develop a Watershed Based Plan in Bowling Green, Kentucky" (Jason Polk) Karst regions have unique hydrogeological properties that make pollution a larger threat than in non-karstic areas. The Jennings Creek/Lost River watershed in Bowling Green, Kentucky is a karst topographic region threatened by pollution from stormwater runoff, agricultural pesticides, industrial wastes, and other factors. The Lost River karst system, which includes the Lost River, Lost River Cave Valley, and Lost River Rise, connects with Jennings Creek and the Barren River. Lost River Rise has struggled with E. coli contamination in the past. To address problems like this, eleven sites spanning the Jennings Creek/Lost River watershed were chosen for sampling as part of an EPA 319 Watershed Plan grant. Grab samples were collected at weekly intervals from each site and used to identify potential sources of pollution, characterize water quality status, obtain bacterial, macroinvertebrate, hydrochemical makeup, and habitat survey data. The samples were analyzed at Western Kentucky University's HydroAnalytical Lab for E. coli, total suspended and dissolved solids, turbidity, and other parameters. Collected data was compiled with historical data and examined using Excel and OriginPro. These data will be utilized to develop a comprehensive, collaborative Watershed Plan for the Jennings Creek/Lost River watershed.

**Neagle, Presley; Marquardt; Joseph;** "Cell Shape is Mediated by a Joint Effort Between a Septin-associated Kinase and Endocytic Protein" (Joseph Marquardt)

Cell shape is often a concerted effort between cell growth and cell division timing. In the

budding yeast *Saccharomyces cerevisiae*, this is exemplified by the kinase Elm1, which has been shown to regulate the shape of the growing bud by linking cell cycle progression to bud growth. In cells that lack the Elm1 gene the bud exhibits a dramatic elongated shape. Downstream effectors responsible for Elm1's effect on cell shape are mostly unknown. This study investigates one of these possible downstream effectors: Ede1—an endocytosis scaffold that was recently linked to Elm1 through proteomics data. Previous research has shown that endocytosis recycles cell membrane machinery, potentially linking the process to shape regulation. This study examines the differences in cell shape due to both Ede1 and Elm1 using classical yeast genetics in conjunction with detailed analysis of fluorescent microscopy images. Initial results indicate that codeletion of both genes results in a more dramatic elongated phenotype. By analyzing phenotypic differences between cells both with and lacking Ede1 and Elm1, we can begin to explain the connection between these two proteins. Also, these two proteins have human homologs, enabling us to translate these results to human systems.

**Nguyen, George; Patel, Om;** "Comparison Of LDA And BERTopic On Commercial Airline Pilot Job Analysis" (Xiaowen Chen)

Topic modeling is a statistical and machine learning technique that explores the latent topics with a given textual corpus. Various topic models have been used to analyze large-scale text datasets; however, few studies have been conducted to evaluate the performance of these models. In this research project, we evaluated the performance of the Latent Dirichlet Allocation (LDA) model and the BERTopic model in extracting the essential qualifications of commercial airline pilots from a large dataset of job descriptions. Experimentation involved comparing models with a different number of topics using a coherence metric to measure the accuracy of the topics. The BERTopic model demonstrated better performance by generating more coherent topics. Our research also identified a range of competencies required to be a commercial pilot.

**Norman, Katie; Groves, Chris; Bledsoe, Lee Anne; Singer, Autumn;** "Comparison of Microplastic Contamination between Urban and Protected Karst Groundwater Basins of South-Central Kentucky" (Chris Groves)

Groundwater in karst areas is susceptible to contamination from various sources of pollution. In this study, we examine karst groundwater in three areas of interest including an area that is relatively impacted by urban activities, the Lost River Groundwater Basin, which includes water drainage from the City of Bowling Green, Kentucky. Great Onyx Groundwater basin is relatively pristine with a remote location in Mammoth Cave National Park, Kentucky, containing two areas of interest: Great Onyx Spring and Bizz Falls (in-cave). Water grab sampling was conducted at all three locations, along with discharge and water quality measurements. Samples were filtered and treated for any biological materials, before being visually analyzed to determine, if any, microplastic concentration. Preliminary observations indicate Lost River is likely to have relatively larger amounts of microplastics. These results indicate that karst areas are vulnerable to microplastic pollution, as well as relatively pristine, remote locations. As hypothesized, microplastics can be transported to a wide variety of land use areas establishing a need for monitoring, especially in National Parks and communities relying on karst sources for drinking water.

**Norman, Lola; King, Rodney;** "'Discovery and Analysis Of Mycobacteriophage Forman'" (Rodney King)

Bacteriophages are viruses that infect bacteria. The bacteriophage population represents the largest reservoir of undiscovered genetic information in the biosphere. This project through the SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) program was undertaken to isolate and analyze a novel bacteriophage, aiming to enhance our understanding of phages and their potential to drive advancements in biotechnology and medicine. The newly discovered phage, Forman, infects the host *Mycobacterium Smegmatis*, a nonpathogenic soil microbe related to *Mycobacterium tuberculosis*. Forman was collected from a water sample in Alvaton, Kentucky. After the presence of bacteriophage was verified, a homogenous population was generated through several rounds of serial dilutions. The phage particles were then examined under an electron microscope. This analysis revealed that Forman is a member of the Siphoviridae family of phages. Forman's genomic DNA was isolated and analyzed by a restriction enzyme digest and gel electrophoresis. The genomic DNA was only cut by a subset of enzymes that were tested. Our results suggest Forman is a novel mycobacteriophage. To determine how Forman relates to other characterized phages, it will be necessary to determine the sequence of its genome. Our results have added to the growing database of characterized phages.

**Nowaskie, Gabriel** "The Non-euclidean Nature of Quantum Phase Space and its relation to Riemannian Manifolds" (Tony Simpao)

Operator Space Manifold Theory (OSMT) is a proposed framework to model Quantum Phase Space by considering a Riemannian Manifold based off intertwining parameters that satisfy Heisenberg's Uncertainty Principle. Using this notion, we define a Riemannian Manifold that embeds these intertwining parameters into the metric such that the quantum operators can be written in vector form. This generalization of quantum phase space takes the form of a non-Euclidean space, in which the configuration space is a special case that converges to  $R^3$ . We exhaust such theory by considering the hydrogen atom and solving the Schrodinger Equation for exact analytical solutions. We then analyze these new eigenfunctions to explore how the perception of position and momentum on a system changes its quantum states.

**Ochoa, Galilea** "Exploring Near-earth Objects with The Largest Telescope In Kentucky" (Ting-Hui Lee)

Near-Earth Objects (NEOs) are a group of celestial bodies, including asteroids and comets, whose orbits bring them into proximity to Earth's orbit. My research focuses on utilizing WKU's newly installed 0.7-m telescope to track and collect images of Near-Earth Objects. The images are then analyzed to plot the light curve of the asteroid, which shows the variation in the asteroid's brightness over a period of time to determine how long it takes for the asteroid to complete one full rotation. Other properties that can be inferred by the light curves are the asteroid's shape, size, and color. Students and faculty across various states have embraced the opportunity to operate this new telescope. In fact, this telescope has opened its doors for many students since the summer of 2023 to actively engage in astronomy research. Here we present preliminary results of our first images and light curve of asteroids taken by this telescope. This project is supported by the department of Physics and Astronomy at WKU.

**Ofoka, Emmanuella** "Ceg10 Legionella Pneumophila Effector Protein Modulate Host Lipid Metabolism" (Simran Banga)

*Legionella pneumophila* is a gram-negative bacterium responsible for severe respiratory illnesses

known as Legionnaire disease and Pontiac fever. *L. pneumophila* has about 300 effector proteins, many of which have yet to be characterized. Ceg10 is one of them. Previous research from our lab has shown that this effector protein gets to the nucleus of the host cell. Our bioinformatics and transcriptome analysis suggested that Ceg10 modulates host lipid and has a potential interaction with peroxisome proliferator-activated receptor (PPAR), a nuclear receptor protein that functions as a transcription factor, involved in regulating lipid metabolism in host macrophage. In this study, we utilized the structural and functional characteristics of the Ceg10 protein to understand its role in host bacterial interactions during *Legionella* infection by applying transcriptomics gene profiling and a series of sever to analyze the structure and function of this protein. We utilized UniproKB and other bioinformatics to predicate the function of this protein. However, the transcriptomic analysis of Ceg10 expressed in HEK 293T cells shows that Ceg10 significantly expresses Cas scaffold protein family member 4 and affects the PPAR pathway signaling pathway upon comparison with a cell expressing GFP tag.

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**Oguntoyinbo, Oluwatobiloba; Srivastava, Ajay; "The Role Of A Cathepsin L And Mmp During Drosophila Development" (Ajay Srivastava)**

Basement membrane (BM)—a specialized form of extracellular matrix, plays a central role in invasive cellular behavior and branching morphogenesis. Proteolytic enzymes such as MMPs and Cathepsins degrade the BM during tumor metastasis and normal development across various organisms including *Drosophila melanogaster*. Previous studies in the lab have implicated both MMPs and a Cathepsin-L (CP1) in the remodeling of BM and suggested the possibility of these two proteases working together. Utilizing genetic and biochemical techniques, the link between MMP and CP1 was explored. While MMPs have been extensively studied for their essential role in tumor metastasis, the role of CP1 remains largely unexplored. Employing genetic and immunohistochemical techniques we assess the involvement of CP1 in tumor metastasis. Data from our experiments provide greater insights into the cooperative role MMP and CP1 play in cellular invasive behavior.

**Oliver, Joshua; Justice, Dylan; Pemberton, Will;** "Analyzing the Safety of Roundabouts in the State of Kentucky" (Kirolos Haleem)

Traffic crashes at intersections are a prevailing public safety concern within the transportation system due to the increased likelihood of severe crashes. One alternative that has gained much popularity recently is replacing intersections with roundabouts. Roundabouts are believed to be one of the safest types of intersections, where drivers are required to reduce their speed and slowly merge with circulating traffic, which in turn reduces the injury severity of the crash. Roundabouts also have fewer conflicting points compared to traditional signalized and unsignalized intersections. This study analyzes the safety of roundabouts in the state of Kentucky by exploring the effect of different explanatory variables on crash occurrence. These variables include speed limit nearby the roundabout, number of lanes at the roundabout (single-lane vs. multilane), area type (urban vs. rural), inscribed circle diameter, center island diameter, presence of markings, presence of crosswalks, and presence of mountable truck apron. The study results will be useful for the transportation agencies, e.g., the Kentucky Transportation Cabinet, to provide some input and guidelines on the safest way of planning and designing future roundabouts in the Commonwealth.

**Owens, Dawson** "Creating Community Through Baseball" (Shahnaz Aly)

You might ask yourself, what does baseball have anything to do with community? There are many ways baseball creates a community, one being my research project. This research project takes a piece of downtown Bowling Green and expands, while not destroying, the area's rich history of industrial architecture. Taking a neglected piece of land in a rundown area that is being developed around, I pridefully designed a mix-use building centered around baseball. The building holds a baseball themed restaurant and a baseball memorabilia and gear store. The main part of the structure is occupied by a baseball diamond shaped hotel, accommodations of the hotel include a bar, state of art video screen and speakers for a tailgate style courtyard, and comfortable and spacious rooms offered in many styles. Located between three streets Adams St, E 8th Ave, Kentucky St., this facility is meant to give friends and family a unique place to come and stay for a short weekend or for a week or two discovering and exploring historic Bowling Green Kentucky. This building incorporates sustainability elements/ strategies. One sustainability strategy is greywater recycling is a great way to save and reuse water creating less waste.

**Pacheco, Andres; Stone, Whitley; Tolusso, Danilo; Arnett, Scott; McGee, Donte; Barksdale, Manly;** "Cannabidiol (cbd) And Resistance Training: Does CBD Attenuate Acute Pain?" (Whitley Stone)

**BACKGROUND:** Strenuous RT can induce acute inflammatory pain which can lead to delayed-onset muscle soreness (DOMS). Cannabidiol (CBD) is a non-psychoactive cannabinoid with purported anti-inflammatory and analgesic properties. One of the main reasons for the use of CBD in exercise is pain alleviation; however, research in humans is limited. Therefore, the purpose of this study is to evaluate two doses of CBD on acute pain after a single bout of strenuous RT. **METHODS:** Participants (n=15) will participate in a double-blind, crossover study for three weeks with a one-week washout between conditions. At the beginning of each condition, they will ingest either a placebo, low dose (2mg/kg), or high dose (10mg/kg) two hours before RT protocol and then again eight hours later. CBD supplementation will continue for 48 hours with two doses each day. Starting each week, participants will complete a strenuous

RT protocol. Pain will be assessed with a Visual Analog Scale (VAS) and algometer at baseline, immediately after RT, and then again at 24h, 48h, and 72h for each condition. ANTICIPATED RESULTS: It is hypothesized based on animal models and limited research on humans, that CBD will attenuate acute pain after strenuous back squat protocol.

**Pan, Amy; Tran, Truth; White, Alan;** "Iequity: An Augmented Reality Theatre Production" (Kristina Arnold)

Augmented reality is commonly seen in game development and design through a mobile device such as a phone. However, it has rarely been tested in other settings. The main focus of this project was trying to deploy augmented reality in settings that are seen as more traditional. This will be done by taking a play, pre-written and performed by a professor at Western Kentucky University, and building an augmented reality set for the play in the background. The main software that will be used is Unity and Blender. Unity will be used to help deploy the set to augmented reality during the beginning stages, and then instead of using the app feature provided on Unity, the focus will turn to Web AR. This is so that it is easier to be deployed and seen by the audience. The image tracking tools in Unity and an image maker will be used so that the set can be detected and the performer can perform within the set. Blender, which is a 3D modeling tool, is used to build the elements of the set. This research presents a way to pair augmented reality elements into a traditional theater space.

**Pandey, Shreya; Polk, Jason;** "Contaminant Transport Mechanisms and Source Tracking In Karst Groundwater Systems Under Agricultural Land Use" (Jason Polk)

Karst areas face severe groundwater contamination that degrades the quality of water because these landscapes are susceptible to pollution. When agriculture is practiced, contaminants are released into the groundwater, which impacts the water quality. This study focuses on how agricultural contaminants, specifically nitrates and E. coli. (*Escherichia coli*), are transported through the karst system by identifying the contaminant transport mechanisms and using source tracking analysis. The study areas for this research are Crumps Cave in Smiths Grove and Church Karst Window in Bowling Green, Kentucky. Grab samples will be collected weekly and during storm events at high-resolution to capture contamination weekly and during storms throughout the growing season. Geochemistry will be recorded using Oakton handheld probes and samples will be analyzed at the HydroAnalytical and USDA labs for nitrate, bacteria, and source tracking (DNA). The data will be compiled in OriginPro spreadsheet software to statistically analyze time-series occurrences of each parameter, which will be regressed to determine relationships between them and environmental drivers. ArcGIS Pro will be used to create maps that visually represent the agricultural land use areas in the karst regions to identify and quantify contamination impacts.

**Pansuria, Kareena; Williams, Langley;** "Novel Application Of Graphene Oxide In Conjunction With Dna-binding Dcas9 For Detecting Antibiotic Resistance Genes" (Moon-Soo Kim)

Antibiotic resistance genes delay the prompt treatment of pathogen-originating diseases resulting in a need for simple, rapid diagnostic tools that are more time and cost-effective than traditional methods. Proposed is a method for detecting pathogenic DNA utilizing the binding properties of deactivated CRISPR-associated protein9 (dCas9) complexed with fluorescein-labeled single-guide RNA (sgRNA) and fluorescence quenching properties of graphene oxide (GO). In this



assay, covalently modified sgRNAs were designed to specifically target 20 nucleotides extracted from the tetracycline resistance (*tetM*) gene sequence. It was predicted that the dCas9 and sgRNA ribonucleoprotein complexes would interact with GO surface groups resulting in fluorophore GO quenching. Upon DNA binding, dCas9 would undergo a conformational change, allowing the ribonucleoprotein and DNA complex to dissociate out of GO quenching proximity, restoring a fluorescence signal output. Our assay demonstrated the fluorescent signal was DNA-dose dependent. Sensitivity and specificity optimizations have been performed to ensure the assay can be implemented as a simple, rapid diagnostic tool.

**Parker, Elizabeth** "S4 0954+658 From the Ground and Space: Ground-based Observations Coincident with Observations from the Transiting Exoplanet Survey Satellite (tess)" (Michael Carini)

The blazar class of radio-loud Active Galactic Nuclei (AGN) Blazars represent the most extreme examples of the AGN phenomenon. The defining characteristics of blazars are a featureless or nearly featureless optical continuum, large amplitude and highly variable polarization, and large amplitude continuum variability at all wavelengths and on timescales ranging from minutes to decades. Blazars are oriented such that we are looking nearly down the throat of the relativistic jet, resulting in the observed emission being dominated by processes at work in the jet and being both amplified and time-compressed in our frame. The lack of discrete features in their spectra leaves us with only continuum variability and/or polarization variability as a diagnostic of the emission mechanisms at work in many of these objects. In this presentation, I will compare the ground-based observations of the blazar S4 0954+658 obtained by WKU's Robotically Controlled Telescope (RCT) I reduced and analyzed with contemporaneous light curves extracted from TESS observations of the source.

**Parris, Steven; Annesly, Netthisinghe; Woosely, Paul; Strunk, William;** "Evaluation of Biochar as a Remediation Tool for Aminopyralid Contaminated Compost" (William Strunk) Composting is the process of decomposing organic material in order to repurpose for various uses. Commonly, compost is used as a soil amendment to enhance nutrient and water holding capacity for improved plant growth. One major problem with compost is aminopyralid contamination from incorporation of manures and grass clippings from treated pastures that negatively impacts growth of garden crops. Research has demonstrated that biochar can effectively absorb or bind various pollutants such as herbicides, which means there is potential for biochar incorporated in compost to counteract phenoxy herbicides like aminopyralid. To test the ability of biochar to alter herbicide contamination in compost, biochar was added at 2%, 4%, and 10% by weight to compost tumblers artificially contaminated with aminopyralid. The compost mixture consisted of dairy manure and mixed wood chips resulting in a carbon to nitrogen ratio of 30:1. Aminopyralid concentrations were undetectable in compost containing 4% and 10% according to chromatographic analysis. However, bioassays of the compost using tomato (*Solanum lycopersicum*) indicated that aminopyralid was present in compost at levels sufficient to induce herbicide symptomology. Results demonstrated that biochar was effective in binding aminopyralid to prevent analytical testing, but plants were still able to extract the herbicide.

**Patel, Hemali; Ali, Mawsoof; Traxler, Sidney; Briles, Emma Jo; Teeters, Jenni;** "Polysubstance Use, Depression, and Suicidal Ideation Among Young Adults" (Jenni Teeters) Previous research has shown associations between cannabis use, binge drinking, polysubstance use, and negative mental health outcomes. However, it remains unclear whether certain substance use patterns are associated with greater risk for depression and suicidal ideation. The present study examined whether polysubstance using young adults demonstrated significantly greater odds of past year depression and suicidal ideation compared to young adult binge drinkers and cannabis users. A subsample of 5,517 young adult substance users who completed the 2021 National Survey on Drug Use and Health were included in the analyses. Individuals were asked questions about substance use, depression, and suicidal ideation and were grouped into categories (binge drinkers, cannabis users, and polysubstance users). Logistic regression analyses indicated that compared to young adult binge drinkers, young adult cannabis users and polysubstance users had significantly greater odds of past year major depression (OR = 1.71 and 2.92) and suicidal ideation (OR = 2.0 and 3.12). Results suggest that young adults that are engaging in past month cannabis use and polysubstance use may be at a greater risk for major depressive episodes and suicidal ideation. This suggests that young adults endorsing heavy cannabis or polysubstance use may need mental health interventions and treatment.

**Patterson, Addie; Hahn, Lance;** "Computationally Investigating Eye-Blink Events in EEG Data" (Lance Hahn)

EEG (electroencephalogram) data is a common type of data gathered in neuroscience experiments. This data indicates the electrical activity of the brain detected by a geodesic sensor net with 128 electrodes across the head. Various undesirable artifacts can reduce the accuracy of EEG data. An event such as an eye blink is a significant anomaly in EEG data. Eye muscles generate large electrophysiological signals that obscure the small signals produced by neurons. We are working to model EEG data and detect when eye-blinks occur. This process involves isolating electrodes around the eyes, identifying times when an eye-movement signal has been generated, and visualizing the physiological signal. Our ultimate goal in this project is to filter the data to remove eye-blink events so the data used for neuroscience research can reflect the neural signal without the eye muscle signal. We are developing the software in Python due to its machine learning capabilities and utilizing existing EEG libraries such as MNE-Python, an open-source "toolbox" for EEG data.

**Patterson, Kellen; Williams, Julian; Veith, Gracie; Nee, Matthew;** "Polystyrene Beads With Incorporated Photocatalysts" (Matthew Nee)

Oil pollution in aquatic environments is an issue that has become more relevant in recent years especially since many ecosystems are now cornered by climate change, habitat loss, and other human activity. Harnessing photocatalysis by using polymer beads as a substrate is crucial in solving this decades old problem. The photocatalytic beads float over a body of water and use the light of the sun to speed up the degradation of organic pollutants. Beads comprised of polystyrene were synthesized with a goal of high surface-area-to-volume ratio to maximize photocatalyst incorporation. Energy dispersive X-ray spectroscopy confirmed titanium dioxide had been successfully incorporated into the beads' surface structure and ultraviolet-visible spectroscopy trials were done to assess the polystyrene beads' effectiveness in degrading organic material. Data showed that methylene blue degraded faster in the presence of the photocatalytic

beads than it did alone. Further experiments have been conducted with the polymer polymethylmethacrylate (PMMA) which is more biocompatible than polystyrene. PMMA beads were also successfully incorporated with titanium dioxide and UV/vis trials have been conducted to assess their effectiveness.

**Payette, Thomas** "A research-to-operational weather monitoring and measuring method for improving health and safety during marathon endurance events" (Joshua Durkee)  
Marathons and other similar endurance events continue to gain popularity and growth around the globe each year. Meanwhile, athletes and event directors have noticed athletes and operational personnel also face a variety of environmental conditions. This research focuses on developing methods for improving weather monitoring measurements used in marathon endurance events, which is rapidly becoming an important aid for assisting in event planning and medical aid assistance. The study aims to deepen our understanding of the optimal race environment and how different weather conditions, such as temperature, humidity, wind, and overall heat stress can affect marathon performance and safety. Specifically, this project utilizes the WKU Disaster Science Operations Center and the Chicago Marathon as a case-study template.

**Peak, Francis** "RGB 0521+211: A blazar observed from the ground with WKU's Robotically Controlled Telescope (RCT) and space with NASA's Transiting Exoplanet Survey Satellite (TESS)" (Michael Carini)  
Blazars are a subtype of Active Galactic Nuclei (AGN) which are oriented such that we are looking nearly down the throat of the relativistic jet, resulting in the observed emission being dominated by processes at work in the jet and being both amplified and time-compressed in our frame. They represent the most extreme examples of the AGN phenomenon. Their defining characteristics include a featureless or nearly featureless optical continuum, large amplitude and highly variable polarization, and large amplitude continuum variability at all wavelengths and on timescales ranging from minutes to decades. The lack of discrete features in their spectra leaves us with only continuum variability and/or polarization variability as a diagnostic of the emission mechanisms at work in many of these objects. In this presentation, I will compare the ground-based observations of the blazar RGB 0521+211 obtained by WKU's Robotically Controlled Telescope (RCT) I reduced and analyzed with contemporaneous light curves extracted from TESS observations of the source.

**Pekara, Brittany; Polk, Jason;** "Stormwater Management Advances Using Smart Sensor Network Precipitation Monitoring" (Jason Polk)  
Advancing stormwater management tools is crucial as runoff from impermeable surfaces increases with urbanization and development. Stormwater runoff is highly susceptible to contamination from non-point source pollution and causing flood impacts following rain events, which varies spatially and temporally in an urban landscape. The unpredictable nature of storm events can make methods for effectively monitoring impacts difficult in trying to capture first flush inputs, flood threats, and sedimentation sources. This research uses a real-time, high-resolution rainfall monitoring network of nearly 50 rain gauges spaced ~1.5 km apart for stormwater monitoring. Utilizing smart sensors allows for real-time monitoring for contaminant detection and identification from anywhere via an integrated GIS dashboard. Stormwater managers can implement scalable networks of precipitation monitoring at construction sites for MS4 programs, industrial and commercial NPDES-permitted facilities, and water quality and

flood monitoring sites to improve the accuracy of tracking contamination sources and transport pathways, as well as improve illicit discharge monitoring and reporting from storm event triggers. Through the integration of 3D printing, smart sensing, and GIS, stormwater monitoring can be accessible for entities differing in size, scale, and experience to address stormwater-related issues, while providing data-driven solutions for improved management of development and stormwater policies.

**Pemberton, Will; Czarnecki, Meaghan; Brittenham, Evan;** "Investigating Impact Of Retroreflective Backplates And Flashing Yellow Arrows on Distraction-related Crashes In Kentucky" (Kirolos Haleem)

This study investigates the safety effectiveness of retroreflective backplate (RRB) and left-turn flashing yellow arrow (LFY) on distraction-related crashes in Kentucky through a before-and-after analysis. A sample of 35 and 72 signalized intersections (mostly 4-legged) in Kentucky installed with each of the RRB and LFY countermeasures, respectively, were used. Typical three years in each of the before and after periods across all the studied intersections were obtained from the Kentucky Transportation Cabinet (KYTC). In addition, average daily traffic (ADT) on both major and minor intersecting approaches were collected manually and integrated with the crash database. To quantify the safety effectiveness of the installed countermeasures in terms of crash reduction factors (CRFs) and due to the relatively limited sample size of intersections used, the naïve method was used. The CRFs were estimated for total (KABCO) distraction-related crashes, and fatal and injury (KABC) distraction-related crashes. Overall, the before-and-after analyses suggested that RRBs were more effective than LFYs in reducing distraction-related crashes at signalized intersections. For example, RRB had ~17% CRF for fatal and injury (KABC) distraction-related crashes (i.e., decreasing KABC distraction-related crashes by ~17%), whereas LFY was associated with ~12.5% increase in KABC distraction-related crashes (i.e., -12.5% CRF).

**Perez Vazquez, David; Lindsey, Gabe; Le, Michael; Goldie, Jacob; Booker, Eli; Nash, Noah; Khalfan, Ali; Mishloney, Sam; Middleton, Caleb;** "Development of Robot For 2024 IEEE SOUTHEASTCON Competition" (Mark Cambron)

Robotics has become an important learning aspect for many institutions to advance the skills of students in STEM. For the senior design students of WKU, the opportunity was given to participate in the IEEE SOUTHEASTCON 2024 hardware competition. SOUTHEASTCON is an annual conference that brings engineering students together to complete technical objectives based on what they learned through their previous years of engineering classes. In addition, SOUTHEASTCON also furthers the students' engineering skills while working with an integrated team of electrical and mechanical engineering students. This year, the team was challenged to design and construct a robot that is fully autonomous to complete a series of tasks while traveling through the course.

**Peterson, Caleb; Ali, Mawsoof; Teeters, Jenni;** "Relations Between Daily Social Media Use, Binge Drinking, And Cannabis Use" (Jenni Teeters)

Social media usage and its potential consequences is a relatively hot topic in modern literature. However, current research primarily focuses on mental health outcomes and largely neglects to study the relationship between social media use and substance use. The purpose of this research is to address this lack of information about social media use and substance use. We investigated

the potential for daily hours of social media use and its effects on alcohol and/or marijuana use in emerging adults for the following platforms: Facebook, Instagram, Reddit, Twitter, TikTok, Snapchat, and YouTube. 244 emerging adults (80.7% female, 76.6% Caucasian, mean age = 19.8) completed an online survey with measures including social media usage, anxiety, stress, coping, life satisfaction, and substance use through WKU's Studyboard system. Daily TikTok use was significantly negatively associated with past month cannabis use,  $r = -.23$ . Daily Snapchat use was significantly positively associated with binge drinking episodes,  $r = .14$ . Daily TikTok use significantly predicted past month cannabis use,  $F(1,90) = 5.01$ ,  $p < .05$ , which indicates that daily TikTok use is associated with past month cannabis use ( $b = -.23$ ,  $p < .05$ ). Daily Snapchat use significantly predicted binge drinking episodes,  $F(1,238) = 4.40$ ,  $p < .05$ , which indicates that daily Snapchat use is associated with binge drinking episodes ( $b = .14$ ,  $p < .05$ ).

**Peterson, Roseanna; Norman, Farley; Lewis, Jessica; Ramirez, Alejandro; Bryant, Emily; Adcock, Payton; "The visual perception of long outdoor distances" (Farley Norman)**

Many previous studies have investigated visual distance perception, especially for small to moderate distances. Few experiments, however, have evaluated the perception of large distances (e.g., 100 m or more). The studies that have been conducted have found conflicting results (diametrically opposite conclusions). In the current experiment, the functions relating actual and perceived distance were obtained for sixteen adult observers using the method of equal appearing intervals. These functions relating perceived and actual distance were obtained for outdoor viewing in a typical university environment—the experiment was conducted along a sidewalk adjacent to a typical street where campus buildings, trees, street signs, etc., were visible. The overall results indicated perceptual compression of distances in depth so that the stimulus distance intervals appeared significantly shorter than the actual (physical) distance intervals. It is important to note, however, that there were sizeable individual differences—the judgments of half of the observers were relatively accurate, whereas the judgments of the remaining half were inaccurate to varying degrees. The results of the experiment demonstrate that there is no single function that describes how human observers visually perceive large distance intervals in outdoor environments.

**Petitt, Hannah; Largen, Grant; Cline, Anthony; "Integration Of Smartphone Apps in Physical Therapy Practice" (Elizabeth Norris)**

Previous research has assessed the reliability and validity of smartphone apps for physical therapy tests and measures, but there is limited research regarding app clinical utility. The purpose of this project is to provide an overview of app use in physical therapy (PT) clinical practice in the US. Methods: A survey will be constructed consisting of items related to demographics, app use, barriers to app use, and prescription of apps to patients. Content validity will be assessed prior to distribution via Qualtrics software. The desired sample size is 390 based on a population of 225,000 employed physical therapists in the US and a 5% margin of error. State PT associations will be solicited to distribute the survey through social media platforms. Results: SPSS software will be used to compile descriptive statistics and to analyze patterns in app use according to clinician years of practice and practice setting. An abstract will be submitted for peer review dissemination at the 2026 national PT conference. Discussion: This study will enhance the understanding of the use of apps by PTs. Information gathered from the study will be used to develop a directory of preferred apps and clinical utility characteristics.

**Petty, Madeline** "Renewable Energy Perception and Policy Implementation in Rural Communities: Case Studies in Southeastern and Midwestern America" (Leslie North)

Utility scale renewable energy (RE) development provides an opportunity for clean energy production to fulfill energy demand and mitigate climate change. Development of utility scale RE such as wind and solar energy requires expansive tracts of land, typically found in rural areas. Rural center communities in America possess unique characteristics and ideologies that influence individuals' perceptions of RE in relation to climate change. This research aimed to gain understanding of rural residents' perception of RE by surveying six rural center communities with varying levels of developed RE. The communities chosen included one RE and one non-RE community each in Kentucky, Tennessee, and Indiana. Surveys were distributed electronically to residents in these communities via multiple methods. Since public perception of RE may influence local policy implementation regarding RE development, this research also aimed to analyze and compare RE policy in rural communities to consider how policy may affect RE development. Policies that influence development of RE enacted by each local government and utility company of the six study sites were analyzed and coded for themes to determine common themes of policy implemented and compare to both existing development in each community and to community perceptions of RE.

**Pfeifer, Harrison; Douglas, Avery; Sandfoss, Jessica; Detre, Emily; Bell, David;** "Surf or Turf? Observing Differences in Achieving a Target Heart Rate, Rate of Perceived Exertion, and Pain Pressure Threshold in Water-based vs. Land-based Walking" (David Bell)

INTRODUCTION: Aerobic exercise is amongst the best physical treatments for overall well-being. Increased load and pain are often obstacles that prevent aerobic exercise in individuals with persistent pain. The goal is to establish whether aquatic-based exercise can help in achieving a similar type of aerobic exercise as that on land while also reducing the load/pain for those in persistent pain. The purpose of this study is to explore the differences in time and perceived effort required to reach a target heart rate during land and aquatic exercise.

METHODS: Approximately 55 healthy adults, ages 18-65 years, will be included in this prospective, cross-sectional, exploratory, correlational/predictive research design. Dependent variables will be measured in land- and water-walking for all participants. RESULTS: Paired t-tests will be performed for HR, time, and PPT; and Wilcoxon signed-ranks tests will be performed for RPE. DISCUSSION: While there have been many studies that examine aquatic therapy, achieving a target HR, and RPE on an individual basis, no present research has incorporated all these factors into a single design. In addition, in studies that are most like our topic of interest, they have been limited to those in persistent pain and not with healthy individuals.

**Pham, Tuan** "Refining The Goals of Public Education in the United States: An Exploratory Single-case Embedded Study of Student-centered Path-goals Setting" (Aaron Hughey)

US public higher education has many goals and missions to achieve social and educational goals. Uncertain aims plague many higher education institutions. Institution X's strategies and programs are examined using the Student-Goal Setting technique to match them with leadership processes. The researcher used an exploratory single-case embedded design at a regional comprehensive college to examine variations, problems, and issues experienced by students, administrators, and the institution in achieving specified goals. Collection methods included

interviews and archival data. A convenient sample of undergraduate students (n = 6) and administrators (n = 10) were interviewed. Archival data examined the strategy plan. With limited institutional resources and confusing policies, the researcher established a clear and data-driven way to reorganize student assistance programs and initiatives using an adjustment model of Path-Goal leadership theory and a psychological Goal-Setting theory. The findings underline the need of open communication, inclusive activities, and effective goal-setting in student route goal leadership. Institutional challenges include poor coordination, strategic planning, program implementation, and communication. Transparent, data-driven policies that balance student demands and institutional goals and the use of artificial intelligence in higher education are suggested. Implications include enhancing complex system educational leadership research.

**Polak, Matthew; Suresh, Harsha; Harris, Jeremiah; Harris, Kacy; Moore, Lora; Flanigan, Teresa; "Nursing Documentation Management Application" (Michael Galloway)**

Western Kentucky University's Associate Nursing program currently has a physical system in place to manage and organize documents that are submitted by potential students who are applying for the program. The program receives over 360 applications annually, which equates to the submission of thousands of documents throughout the year. Our client has requested a software system that will simplify this process for administrators and people facilitating the application process. Our team will follow the software engineering process to devise a solution for this problem and create appropriate documentation that will aid future work towards this system. We chose to develop our project using Next.js because it's a well-documented and modern tool for web development that will allow us to more easily integrate our solution to the issue. Several of the requirements that we'll be fulfilling through the website involve allowing applicants to upload or fill out documents online, connecting them to Western Kentucky University's secure drive, sorting them, parsing them for information, and notifying applicants of mistakes they've made in the submission process. Overall, our application will help administrators more easily view documents submitted for WKU's Associate Nursing Program.

**Pooler, Jacob; Samer, Mina; Warren, Ethan; "Assessment of Smartphone Goniometer Application" (Beth Norris)**

The purpose of this study is to examine the reliability and validity of knee ROM measurements made by asymptomatic adults (layperson) using a smartphone application. The research questions this project will attempt to answer are: 1) What is the reliability of knee active ROM (AROM) measurements made with a smartphone app by laypersons; 2) What is the agreement between laypersons and physical therapist for knee AROM measurements made with a smartphone app; and 3) What is the accuracy of knee AROM measurements made with a smartphone app as compared to a goniometer? A single cohort methodological research design will be used. Repeated measurements of knee flexion and extension made by laypersons and by a physical therapist using the app will be obtained to examine intra and inter-rater reliability. Concurrent validity of knee AROM obtained from the app will be established against goniometric measurements, the current standard in clinical practice. Findings from this study will contribute to establishing the efficacy of app use by a layperson to measure their knee AROM. If found to be reliable and accurate, smartphone measurements made by a patient may enhance a physical therapist's ability to objectively document remote physical therapy sessions such as telehealth.

**Potts, Lincoln; Novikov, Ivan;** "The Mechanical Design of a Near  $4\pi$  Array Support for BaF2 Gamma Detectors" (Ivan Novikov)

Time reversal symmetry implies that reversing the final conditions would return the system to its initial state, a concept assumed to apply universally to all microscopic processes. The direct discovery of a time reversal symmetry violation in 1964 was a profound revelation. Since there is no fundamental explanation for this violation, the quest for new sources of time reversal symmetry violation (T-violation) stands as a top priority in physics. The Neutron Optical Parity and Time-Reversal Experiment (NOPTREX) collaboration aims to explore T-violation in the elastic forward scattering of polarized neutrons on polarized targets. Neutrons passing through the target form compound nuclei that decay, emitting gamma rays. The angular distribution of these gamma rays provides crucial information about the relative orientation of neutron and target polarization. The ongoing development of a  $4\pi$ -detector array by the WKU and Indiana University research teams is essential for analyzing the angular distribution of emitted gamma rays. The arrays contain a number of fast timing BaF2 scintillation crystals along with associated electronic modules. We present the status of the array mechanical design to support 12 BaF2 gamma detectors and discuss how the proposed design can be expanded to greater number of detectors (up to 1000).

**Powers, Jackson** "Tornado and Severe Weather Modeling" (Xingang Fan)

This study examines the Bowling Green Tornado of December 10-11, 2021 as a case study of out-of-season and nocturnal tornado outbreaks, using the Weather Research and Forecasting (WRF) model to simulate the event and to visualize the atmospheric conditions and evolution of the thunderstorm system. The particular danger of these types of tornadoes put people at a higher risk. This tornado occurred during one of the most prolific winter tornado outbreaks of all time, covering the greater Southern-Illinois, Kentucky, and Tennessee area, which will be included in the modeling domain for analysis and visualization. This study shows the unique and explosive environment that led up to this extreme event, as well as the magnitude of the environment in the context of the winter season.

**Puente, Meghan** "Sinkhole Hazard Assessment Index and Risk Analysis To Inform Karst Policy And Mitigation Planning" (Jason Polk)

Sinkholes are geologic hazards that occur in karst landscapes that can be highly destructive and costly. It is unknown how much sinkholes cost per year and sinkhole-related policies are nonexistent on a federal level and nearly nonexistent at the state level. A lack of awareness has led to the continuation of the development and urbanization of sinkhole-risk areas, which put lives and property at risk. This study characterizes sinkhole vulnerability to aid in quantifying sinkhole potential cost and risk, including the scale and threat of bedrock collapse sinkholes, which are less common but highly destructive. In addition, comparison and contrast of existing sinkhole policies and regulations to assess how well they measure the characteristics of sinkhole hazards will occur; however, karst landscapes are inhomogeneous, and it is unlikely that a "one size fits all" policy approach will be effective. A policy analysis across the U.S. suggests that few areas prone to sinkholes have regulations, policies, or development plans that address sinkhole risk. The results herein provide a sinkhole hazard index tool that can be used by developers, environmental managers, and policymakers to inform urban karst development decisions based on environmental, economic, and social factors



**Putman, Alyssa; Priddy, Cassandra; Casey, Daria; Quilligan, Andrew;** "Mesonet: Ai Assisted Quality Assurance/quality Control Analysis" (Michael Galloway)

This project aims to develop an AI model for quality assurance in validating weather data collected by the Kentucky Mesonet. Led by Andrew Quilligan, the team intends to enhance the existing quality control process by training a PyTorch machine learning model to assess data accuracy. Collaborating with the Kentucky Climate Center, Mesonet collects weather data from numerous stations statewide, with each station transmitting data every few minutes. Currently, data points are assigned quality values through automated or manual analysis. Our project seeks to refine this process by identifying errors that may otherwise go undetected and reduce the human effort required. The project's scope spans 14 weeks and encompasses tasks such as data acquisition, model selection, training, refinement, testing, and integration into the Mesonet's system. Functional requirements include data ingestion, quality value assignment, and interpretation features, while non-functional requirements emphasize scalability, accuracy (>60%), and adherence to security measures. The quality and quantity of data will be closely monitored to ensure the accuracy of the model. Upon completion, the AI model will significantly streamline Mesonet's quality assurance system, enabling faster, more accurate data processing and equipment fault detection.

**Quire, Michael** "Exploring the Connection Between Weather and World-record Times During Major Marathon Endurance Events Around The Globe" (Joshua Durkee)

Marathons are hosted year-round around the world. The competition and level of athleticism of runners in each of these races varies greatly. Although marathons are run often each year, the world record has been broken only 15 times since 1984 and 1982 for men and women, respectively. Over this period, world record margins have been reduced considerably. There are many dependent factors to consider for faster timers, including course design, runner fitness, training, genetics, shoe technology, and weather, among others. The purpose of this study is to examine meteorological conditions and determine its role in world records and elite performances. Specifically, the goal is to determine if ideal weather conditions exist during world record events and what role ambient variables play in these performances. Statistical analysis of hourly weather variables was compared to finishing times during major marathons since 2000. While the focus of this study is world record performances, marathon winners, top 3, top 25, and top 100 finisher's times for both genders were also explored. By comparing world record performances with other elite performances, the research provides a broader view of how weather impacts marathon results for top athletes.

**Ramsey, Stephanie** "Art Therapy as a Discipline and Potential Profession." (Lisa Duffin)

The purpose of this presentation is to inform the audience about Art Therapy as a discipline and potential profession or career path. The presentation will provide the following information: 1) defining the nature of Art Therapy, 2) describing the role of an Art Therapist in counseling, 3) explaining the process of becoming an Art Therapist in southcentral Kentucky, and 4) highlighting the research-based cross-cultural benefits of Art Therapy on human well-being.

**Rasaq, Uthman; Khalilullah, Ibrahim;** "Uniform Exponential Stability in Finite-Difference Model Reduction for Magnetizable Piezoelectric Beams with Non-Collocated Observers" (Ozer Ozkan)

In examining a magnetizable piezoelectric beam model with free ends, governed by partial

differential equations (PDE) illustrating the interaction between longitudinal vibrations and charge accumulation at the electrodes, a novel non-located controller and observer design have been recently introduced [Rasaq-Khalilullah-Ozer-IEEE-CDC'24]. This departure from conventional collocated control allows for the retrieval of all states, enabling the use of boundary output feedback controllers at one end to replace states with estimates from observers at the opposite end. Recent research, guided by a meticulously constructed Lyapunov function, indicates exponential stability in the PDE model solutions. To achieve model reduction while preserving this stability, we propose a unique order-reduction-based Finite Differences tailored for this model. This approach utilizes midpoints in uniform discretization with average operators. Demonstrating success, a discrete Lyapunov function shows both the observer and observer error dynamics with uniformly exponentially stable solutions as the discretization parameter tends to zero. Crucially, the decay rate remains independent of the discretization parameter, mirroring that of the original PDE system. This research enhances understanding of robust model reductions for piezoelectric systems, offering valuable insights to the field.

**Ray, Livi;** Lasley, Scott; Turner, Joel; "Dual Partisanship In America: Dead Or Alive?" (Scott Lasley)

Dual partisanship is one theory that is used to explain why local, state, and federal partisan results differ from each other. It offers one explanation of why some voters split votes between parties in local, state, and federal races. The concept of dual partisanship implies that voters look for different qualities and characteristics from candidates at these different levels of government. Using recently collected survey data that presents respondents with several electoral scenarios, we explore whether voters across the United States utilize different criteria in identifying preferred candidates at different levels (local, state, federal) of elections.

**Reyes, Adriana** "Visualizing Communication Disorders Through Art" (Leigh Anne Roden)

This art series visualizes the signs, symptoms, and intervention strategies of various speech and language disorders. The illustrations were lightly sketched onto the canvas and oil-based paint was used as the medium. In the art series, the disorders covered are childhood apraxia of speech (CAS), dysarthria, articulation disorder, and aphasia. The public and parents may be uninformed or have misconceptions about communication disorders. Therefore, it is important to educate the public and parents about communication disorders in order to construct a network of support, respect, and learning different ways to communicate since speech and language disorders make a profound impact on a person's life.

**Rhodes, Tommy** "St. Anselm Monastery" (Shahnaz Aly)

This project involved the construction of a Catholic Monastery (a place in which religious monks reside) that included a church for public liturgical events and prayer, collegiate educational and pastoral facilities, a communal dining space, and dormitories. This religious institution will offer a place of worship as well as a place for higher education and pastoral care. This project aimed to: Create a welcoming environment using space, form, and structural elements that will nurture and encourage liturgical celebrations and the active participation of the faithful. This project followed traditional Catholic design practices in form and facade while employing contemporary materials. These elements are meant to complement one another to apply traditional forms in the context of the modern world expressing that the Catholic faith is traditional and historical while still being present and active in the modern world. This project is named after Saint Anselm of

Canterbury who was a 10th-century Benedictine monk well known for his works *Monologion* (1075–76), the *Proslogion* (1077–78) in which he details his Theistic Proofs following the motto “faith seeking understanding”. St. Anselm’s works and lifestyle influenced the aim and design of this project through his focus on understanding the world through education within context and through the lens of faith.

**Rios, Logan;** Lickenbrock, Diane; Swift, Alyssa; Borges, Hailey; "Associations Between Parental Involvement, Psychopathology, And Infant Negative Reactivity" (Diane Lickenbrock) Parental involvement is crucial for infant socioemotional development (Kotila et al., 2014). Measurement of involvement can be inaccurate due to biased reports (Yavorsky et al., 2015), which has been associated with increased conflict between parents (Charles et al., 2018). Infants with parents with increased conflict and stress/depressive symptoms display increased negative reactivity (Frankel et al., 2015; Spry et al., 2020). The current study aims to examine associations between involvement report discrepancies, parental psychopathology, and infant negative reactivity. At 4-months, parents rated their own/partners’ involvement in childcare (Cronenwett et al., 1988) and anxiety/depression symptoms (Locke & Wallace, 1959). At 8-months, infants participated in a frustration task (Lab-TAB, Goldsmith & Rothbart, 1999). Negative reactivity was calculated via a composite score of infant affect (Braungart-Rieker et al., 1998) and activity level (Brooker et al., 2014). Results ( $n = 67$ ) revealed several predictors of infant negative reactivity. Increased discrepancies in father indirect care ( $\beta=.273$ ;  $SE=.011$ ;  $p=.034$ ) and father play ( $\beta=.318$ ;  $SE=.012$ ;  $p=.016$ ) were associated with increased infant negative reactivity. Significant Mother Direct Care X Anxiety ( $\beta=-.376$ ,  $SE=.002$ ,  $p=.005$ ) and Mother Indirect Care X Anxiety ( $\beta=-.289$ ,  $SE=.002$ ,  $p=.049$ ) interactions were observed. Findings suggest that discrepancies in mother and father involvement differentially predict infant negative reactivity.

**Rivera, Vivian;** Marquardt, Joseph; Sharma, Nilesh; "Effect of Dietary Flavonoids on Growth in *Saccharomyces cerevisiae*" (Joseph Marquardt)

Plant foods contain a diversity of biologically active compounds called phytochemicals, produced by plant species as secondary metabolites. A phytochemical group known as flavonoids has received much scientific attention in recent times with respect to their antioxidative and anti-inflammatory roles. In this study, we are examining how quercetin and naringenin, the most common dietary flavonoids, affect growth potential of yeast. Using *Saccharomyces cerevisiae* as a model, a dose dependency effect of Quercetin and Naringenin was observed when treating liquid cultures at three different concentrations. These assays have shown that these phytochemicals have significant effect on yeast growth, with Quercetin showing the more dramatic slow growth phenotype. When the concentration of phytochemical was decreased so did the difference in slopes revealing a dose dependency of the effect of each phytochemical on yeast growth. Since these phytochemicals are part of natural diets and they resulted in slower growth potential in the eukaryotic yeast system, these findings could illustrate potential for natural therapeutics in growth related disease such as cancer.

**Roberson, Jacob** "Galaxy Ultra" (Aly Shahnaz)  
Galaxy Ultra Entertainment Building

**Roberts, Jonathan** "Harmonizing Bounded Rationality And Ai: A New Paradigm For Organizational Decision-making In Uncertain Times" (Lily Zhuhadar)

In the age of uncertainty, the intersection of human cognition and the rapidly advancing realm of Artificial Intelligence (AI) presents novel opportunities and challenges in organizational decision-making. As the principles of bounded rationality elucidate constraints related to cognition, time, and information during decision processes, contemporary developments in AI are paving the way to attenuate these very constraints. Particularly, Automated Machine Learning (AutoML) heralds a transformative shift in healthcare, emphasizing its application in the diagnosis of chronic diseases such as diabetes. By adeptly combining human expertise with AI capabilities, AutoML's approach in predictive modeling not only underscores the significance of key variables but also prioritizes efficiency and sustainability. Such AI-augmented processes promise a reduction in decision-making times, and potentially transcend human cognitive limits, particularly in data-intensive fields. In advocating for a harmonized approach, we posit that while AI can provide unparalleled analytical prowess, the essence of human judgment, molded by bounded rationality, remains invaluable, making it crucial to evaluate and integrate supplementary factors rigorously. The overarching aim is to architect a model that melds the precision of AI with the depth of human insight, ultimately enhancing both efficiency and sustainability in organizational decision-making processes.

**Robison, Brooke** "Terra - Soar" (Shahnaz Aly)

Terra Soar has been designed with fun in mind. Located in Saratoga springs Utah, the property offers many natural outdoor attractions. The structure boasts a 45,000 square foot floor plan. The amenities include but are not limited to indoor skydiving, outdoor skydiving, ribbon acrobatics, hoop acrobatics, and rock climbing. The building design was inspired by hang gliders. The large windows are angled in a way to assist with resistance to solar gain. The walls are constructed with stone veneer to act as an additional barrier to heat, similar to a thermal mass wall. The site includes motorized solar flowers to maximize capture of sun energy. Terra – Soar is meant to be a place that allows people to get in touch with nature and themselves. It is a place where individuals can go to escape the daily routines and enjoy a fun experience.

**Rodriguez, Alexis; Harry, Trevor; Davidson, Samuel;** "The Red River Of The North: Trends In Snowmelt Flooding Meteorological Data From 2000-2009" (Zachary Suriano)

The Red River of the North is an important waterway in the Midwestern United States forming a border between Minnesota and North Dakota, continuing into Lake Winnipeg in Canada. In late winter and early spring, the river is prone to flooding due to rapid snowmelt as well as ice dams that form downstream. In 2009, an intense flood occurred because of antecedent conditions in the winter prior, freezing of saturated soils, and multiple ice dams. Data was gathered from the National Snow and Ice Data Center (NSIDC), containing daily information on snow depth, snowfall, temperature, and precipitation at 1° latitude by 1° longitude grids for the conterminous US. USGS historical gauge depth data was also collected for five stations at different locations, including Wahpeton, Fargo, Grand Forks, Drayton, and Pembina, North Dakota. The months relevant to the Red River's snow season (October-May) from 1999-2009 were used to analyze the 2009 flood in relation to previous years. Descriptive statistics were performed for understanding of other meteorological conditions that may be positively correlated with higher

stream values. Results show that snow variables were highest in 2009, emphasizing its effectiveness on the intensity of future spring snowmelt flooding in the Red River.

**Rone, Regan; Thurman, Tanner; Mata, Jessica ; Dumancic, Marko; Mountjoy, Natlalie;** "Course-aid" (Michael Galloway)

This project aims to address the need for accessible and comprehensive course information and support at WKU by developing a chatbot application called "WKU Course Aid." The objective is to provide students with 24/7 access to course material, policies, schedules, and academic support resources, thereby reducing workload for instructors, and allowing students to seek assistance and clarification at their convenience. The project involves the creation and coding of the "WKU Course Aid" application. The team will develop a user-friendly interface (UI) and integrate it with the chatbot functionality to ensure seamless operation. Once implemented, the chatbot will be able to answer student inquiries on various topics, including syllabi, rubrics, course material, schedules, and academic support resources. The chat bot will also be tailored towards specific courses that the instructor uploads. The application's capabilities are expected to enhance overall student and instructor course satisfaction.

**Ross, Geoffrey** "Developing and Evaluating a Prediction Model for Diabetes Diagnosis: A Data Analytics Approach" (Lily Popova Zhuhadar)

Diabetes is a prevalent disease affecting millions, including the author's sister. The project's aim is to identify the causes of diabetes to improve prevention strategies. The study utilizes data from 100,000 patient medical records, including demographics from Kaggle, focusing on continuous, discrete, and binary variables such as gender, smoking history, hypertension, and heart disease, with diabetes as the target variable. The absence of significant correlations negated the need for attribute omission, and nominal values were converted to numerical for analysis. Supervised learning techniques, specifically logistic regression, and decision trees, were employed to predict diabetes; the latter achieved a 97.15% accuracy rate, surpassing logistic regression's 96.04%. The data was divided, allocating 70% for training and 30% for testing, with ROC comparison and lift charts providing further evaluation of model performance. The decision tree model, generated by RapidMiner, offers visual clarity, making it a practical tool for both medical and educational purposes, and suggests its implementation into live databases. Additionally, Tableau is used to create accessible dashboards that could be used to educate the public about diabetes prevention.

**Rutherford, Angela** "An Investigation of Cosmetic Threshold Fragrance Smell Detection" (Eric Conte)

Surfactants can hold back the ability of a fragrance to have a notable scent. Therefore, this research aims to investigate how the threshold smell detection of a fragrance depends on concentration and polarity. The three fragrances studied had different polarities. Limonene is a polar compound, ethyl acetate is a moderately polar compound, and alpha-pinene is a nonpolar compound. We simultaneously collected data through gas chromatography-mass spectrometry (GCMS) and olfactory (human nose) sensing. Using GCMS results, calibrations were generated by integrated signal peaks plotted versus fragrance concentration. Given that surfactants are polar, we can hypothesize that a polar fragrance would be more likely to dissolve in a cosmetic surfactant-containing solution, lessening the smell detection. Thus, the solution would need a greater polar fragrance concentration for it to reach threshold detection compared to a non-polar fragrance. The more nonpolar a fragrance is, the less soluble it becomes in a cosmetic surfactant

solution. Therefore, the surfactant would not retain a nonpolar fragrance as readily as a polar fragrance, allowing the nonpolar fragrance to reach the smell threshold more easily.

**Rzayeva, Manzar; Ding, Xiuhua;** "Effects Of Covid-19 Pandemic On Maternal Health And Cesarean Section Rates Amongst Women In Bowling Green, Kentucky" (Susan Eagle)

The COVID-19 pandemic has dramatically reshaped and impacted many healthcare services globally, including maternal healthcare, leading to unprecedented challenges and disruptions in care. Maternal healthcare is consequential to the health of mothers, children and society, and high C-section rates are persistently increasing in Kentucky, which can be detrimental to the overall health of mother and child. Therefore, the evaluation of implications of the pandemic on maternal health and C-section rates in Bowling Green, Kentucky from quantitative perspective, this retrospective case-control study serves as a critical step in understanding the pandemic's effects on maternal health, and further providing future strategies to be implemented in order to mitigate adverse outcomes. By analyzing data from Med Center Health Bowling Green that encompasses births given in Bowling Green, Kentucky between the years 2017 and 2021, the study aims to compare and analyze maternal health outcomes, C-section rates and risk factors prior to and after the COVID-19 pandemic. The study determines changes in cesarean section and vaginal births, risk factors associated with cesarean rates through analysis of ICD-10 diagnosis codes indicated on patient charts in order to better understand the impact of the pandemic on maternal health in Bowling Green and provide resources for mitigation of adverse outcomes pertaining to maternal healthcare.

**Scannell, Piper** "Pre-service Elementary Teachers Math Autobiographies: Past Experiences And Future Hopes." (Janet Tassell)

The mathematics education experience of an individual's past can dictate how they perceive the future of education. Using mathematics autobiographical reflections written by 325 PSETs enrolled in an elementary mathematics methods course at Western Kentucky University, transcending before, during, and after COVID-19, we generated themes using qualitative analysis. Related to research question one, the findings presented examined how the future educators of this country use their own experiences with mathematics to shape how they teach the incoming generations. Related to research question two, following the experiences of early education through higher education, the mathematics autobiography illustrates the impact on the Pre-service Elementary Teacher's (PSET's) mindset toward mathematics.

**Schueler, Anne; Forrest, Hanna;** McGettrick, Caitlin; Dick, Olivia; Milam, Lily; Teeters, Jenni; "Development and Results of a Novel Digital Intervention for Heavy Drinkers with Interpersonal Trauma" (Matthew Woodward)

Digital brief interventions are an efficient approach for reducing alcohol-related harms, but suffer from less engagement, and have limited effectiveness for trauma survivors. The purpose of this submission is to describe the development of a mobile trauma-informed and peer-supported brief intervention for young adult heavy drinkers with interpersonal trauma and the preliminary results of the intervention. Participants included 34 young adults (85% female, 85% white) heavy drinkers with a history of interpersonal trauma recruited as part of an ongoing study. At baseline, participants received personalized feedback about their drinking, psychoeducation about trauma, and strategies for managing stress. Participants were contacted monthly via text message for peer coaching sessions to review goals and encourage the use of coping strategies. Participants largely

rated the intervention as helpful. Additionally, significant reductions from baseline to 3-month follow-up were found in alcohol use (Hedges'  $g = .68$ ,  $p < .001$ ), alcohol-related problems ( $g = .75$ ,  $p < .001$ ), anxiety ( $g = .39$ ,  $p = .03$ ), depression ( $g = .37$ ,  $p = .04$ ), and PTSD ( $g = .41$ ,  $p = .03$ ). Results provide preliminary support for the intervention and point to useful ways to adapt digital brief interventions to assist at-risk populations such as interpersonal trauma survivors.

**Scott, Aimee** "The Impact Of Unrelated Filler Task Type On Performance" (Jenni Redifer)

When studying long-term memory, researchers often have participants study materials and then complete a filler task to disrupt rehearsal of information before completing a memory test. Prior research indicates filler task difficulty and modality impact participant performance (e.g., Rose et al., 2014). Therefore, choosing appropriate filler tasks is vital to avoid impacting research findings. Math problem filler tasks are commonly used, but the prevalence of math-related anxiety indicates this is not a "neutral" task and may impact other measures. For example, Jamieson and Harkins (2011) found that participants experiencing math stereotype threat performed poorly on a non-math task (after being told that it was unrelated to mathematical ability). Consequently, we hypothesize math filler tasks could negatively impact participants' subsequent memory performance, particularly for participants with low math efficacy. In this study (with data collection ongoing), participants studied a passage, engaged in a filler task (math problems or a non-math related task), then completed a memory test over the passage, before completing a second block with the other filler task. Participants' memory performance will be compared after engaging in the math versus non-math task, and self-efficacy in math, English, and science will also be measured.

**Scott, Jada;** "Investigation Of The Function And Purpose Of The Surf4 Gene In Drosophila Melanogaster" (Ajay Srivastava)

Surf-4 was identified in the Srivastava lab in a biochemical screen for proteins that associate with the basement membrane: a structure needed and required for normal development and its degradation is a hallmark of tumor metastasis. Surf-4 has been predicted to function within intracellular compartments. Surf-4 is also expressed in many parts of the developing fly so the experiments proposed will determine why it is important in development and what role it could play during tumorigenesis. Using *D. melanogaster* for research will allow me to see the role of Surf-4 in its development. Surf-4 is predicted to be a cargo receptor protein, involved in recruitment of coat proteins in the early secretory pathway. This pathway is responsible for the transport of soluble proteins between the Endoplasmic Reticulum and the Golgi apparatus, (Kapadia and Srivastava, unpublished, 2016). It is our prediction that surf4 subcellular localization will place it in either the ER or the Golgi or both. This information will be crucial in determining further surf-4 function. These experiments will benefit from our characterization of the Surf-4 antibody – a crucial reagent for further study of this protein. By characterizing Surf-4, we can determine what factors affect basement membrane development and how that can further be applied to cancer research.

**Seymour, William; Garrett, Chad; Whiticker, Matthew; Riley, Adam;** "Development of Wireless Sensor Glove for Real-Time, Gesture-Based Robotic Arm Control" (Farhad Ashrafzadeh)

Robotic manipulation systems have recently seen a major increase in usage and versatility throughout a wide range of industries. These systems are typically programmed or trained to

perform tasks of varying complexity, but there are often unexpected situations where human intervention is necessary for problem-solving and fault recovery. Because of this, jobs where problems can be very costly are generally still performed by humans, even if there are significant safety concerns (such as with extreme-temperature-areas in the metals industry). Robotic systems that are remotely controlled by humans (acting as "telepresence" systems) may mitigate many of the safety risks of these jobs while still allowing for the use of human problem-solving skills in unexpected situations. The WKU Center for Energy Systems (CES) is developing a gesture-based controller glove for intuitive operation of the Kinova Gen3 Robotic Arm. The intent is for the glove to allow for intuitive remote operation of the robot to allow a user to perform tasks safely without controller training. The glove will wirelessly transmit gesture, position, and orientation data to a computer for processing and controlling the arm and gripper, such that the robot will follow the spatial path of the user's hand as accurately as possible.

**Shiple, Lilly** "Analyzing Graduation Rates In American Universities" (Lily Zhuhadar)

In the initial phase, we delve into the pivotal metric of graduation rates in educational institutions, which reflects the proportion of students completing their degree programs within a specified timeframe. Understanding the multifaceted factors influencing these rates is crucial for the institution's future success and aids prospective students in making informed choices. The dataset comprises 777 observations with 18 variables, rich in information like cost, faculty composition, and alumni engagement. Clean and normally distributed, it requires no preprocessing. Utilizing secondary structured data, we select variables including faculty doctoral percentages, out-of-state tuition, alumni donation rates, and top decile high school student proportions. Employing Linear Regression and data partitioning, the model is trained and tested to predict graduation rates with 14.002% precision. Significant variables include out-of-state tuition, alumni engagement, and top decile high school admissions, indicating their impact on graduation rates. The model, validated and visualized using Tableau, highlights correlations between selected attributes and graduation rates, aiding decision-making. The model's scalability and potential to provide actionable insights make it valuable for educational institutions seeking to enhance graduation rates through strategic interventions.

**Sileo, Sofia** "Characterization of A Bacteriophage Protein That Is Toxic to Mycobacterium Smegmatis" (Rodney King)

Antibiotic resistance is one of the most pressing public health concerns of our time. Currently, antibiotic resistance causes nearly 3 million infections and over 35,000 deaths in the U.S annually. Bacteriophages (phages) are viruses with a natural ability to infect and destroy bacteria. Due to this natural ability, they are being investigated as an alternative approach to battle antibiotic resistant bacteria. The goal of this project was to identify bacteriophage genes whose protein products are toxic to the host cell. This approach bypasses the need to use whole phage for therapeutic treatment. The cytotoxicity of bacteriophage gene products was determined by expressing cloned phage genes in Mycobacterium smegmatis and monitoring cell growth. Our analysis revealed that the expression of the bacteriophage MooMoo gene 86 protein product prevents cell growth. We then employed a 2-hybrid assay to identify the host protein(s) that interact with the MooMoo gene 86 protein product. Sequence analysis of host gene clones revealed multiple interacting partners. This pattern was also observed with our controls, suggesting that the conditions we employed lack sufficient specificity to identify true/known interactions. We are currently troubleshooting the 2-hybrid assay to improve its specificity.



**Simmons, Molly; Barnes, Makenzie;** "Investigating The Leaky Pipeline: Gendered Effects Of Caregiving Policies On Stem Faculty" (Katrina Burch)

Despite implementation of caregiving policies in universities, women remain underrepresented in high faculty ranks in academia, particularly in STEM (Science, Technology, Engineering, and Math) fields. Integrating the Work-Home Resources (W-HR) Model and feminist economics, I will investigate the gendered effects of caregiving policies for STEM faculty at regional comprehensive universities using a mixed-method approach including the use of surveys and structured interviews. Specifically, I will examine how caregiving responsibilities relate to work-life conflict and work productivity among faculty members to understand the nuanced ways in which caregiving influences career trajectories. Data will be analyzed via correlation and multiple regression to evaluate the influence of caregiving on work-based activities (e.g., research, teaching, service). Additionally, a deductive thematic analysis approach will be employed to scrutinize the qualitative interview data. Implications for research and practice will be discussed.

**Sitz, Gregory** "Modeling Urban Karst Flooding at Fairview Plaza in Bowling Green, Kentucky" (Jason Polk)

The city of Bowling Green, KY is established on karst topography, a landscape notable for caves and sinkholes providing direct drainage into underground aquifers. Fairview Plaza, a highly urbanized area within the city, is prone to flooding as stormwater has become directed from the surrounding commercial and parking developments into a centralized sinkhole. Alteration of the terrain has disrupted the natural draining leading to inundation of the sinkhole and pooling of water during intervals of intense precipitation. The purpose of this study is to model the effects of precipitation events on the Fairview Plaza water level. Data will be collected at a one-minute resolution using real-time water level data loggers and precipitation gauges. Collected data will be compared to the precipitation and water level data from previous weeks to establish a flooding threshold for prediction of future flood conditions following storm events. Results of this study will provide a better understanding of apparent flooding dynamics which can be utilized for future stormwater management practices. These practices may improve safety and prevent damage to property at the studied site or other similar locations across the city.

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**Smith, Alexis; Heckerman, Gabe; ; Hopkins, Annah; Mountjoy, Natalie; "Prevalence and Implications of Late Stage Colorectal Cancer Diagnosis in Rural Kentucky"** (Douglas McElroy) Kentucky has the fourth highest colon cancer mortality rate in the nation and ranks highest for incidence of colon cancer. Kentucky is a rural, medically underserved state, which may correlate with late-stage diagnosis and poor outcomes for those diagnosed with colorectal cancer. We investigated if those within rural communities of the state are diagnosed with colorectal cancer at later stages and are at higher risk for poorer outcomes than those within urban communities. We utilized rural-urban continuum codes, demographic factors, and cancer statistics available in the Surveillance, Epidemiology, and End Results cancer incidence and outcome databases. Data were collected and analyzed using an analysis of variance, Chi-Squared tests, and linear regression to determine statistically significant relationships within the data set. Upon analysis, patients from more rural areas were shown to have higher risk of death due to cancer.

**Smith, Hunter "Modifying Myocardial Mitochondrial Energetics Using Empagliflozin"** (Samuel Earls)

Hypertrophic cardiomyopathy (HCM), characterized by abnormal thickening of cardiac muscle tissue, elevates the risk of severe cardiovascular issues and sudden cardiac death due to genetic factors. Empagliflozin (EMPA), an SGLT2 inhibitor for type 2 diabetes, unexpectedly demonstrated cardiovascular benefits, prompting an exploration of its impact on myocardial mitochondrial energetics in HCM-afflicted mice. The study involved two key experiments: The first examined four groups of mice, under parameters of Volume of Oxygen consumed (VO<sub>2</sub>), Respiratory Exchange Ratio (RER), and Activity (XAMB count) during sleep. Data analysis via Tukey's Two-Way ANOVA revealed significant distinctions between the Wild-Type Control Diet group and two treatment groups. The second experiment, using electron microscopy and ImageJ, measured intermyofibrillar mitochondria in Wild-Type and R403Q Mutant Control Diet mice. Results from the initial phase suggested EMPA's impact on myocardial energetics, presenting therapeutic potential for HCM, though definitive cardiovascular drug approval demands further investigation. The second branch highlighted the potential contribution of smaller mitochondria in HCM to dysfunction and heart failure. These findings, while providing insights into biochemical disparities induced by mitochondrial dysfunction, underscore the necessity for larger sample sizes to comprehensively unveil physiological and pathological implications.

**Soliman, Nesma; Soliman, Nesma; "Middle Eastern And North African Students' Identification And Commitment To Predominantly U.s White Institutions1"** (Trini Stickle)

The purpose of this study is to contribute a better understanding of the identification and commitment of Middle Eastern and North African international students in predominantly white US institutions. This topic is important because A better understanding of the experiences of international students enables educational practitioners and scholars to better meet the needs of the international students from the MENA (Middle East and North Africa) area and help them to integrate academically and socially at their universities. In addition, this study is important because it fills a gap in the literature that has not been discussed before at the college level. Additionally, it will help international recruiters accommodate international students and meet their needs and expectations, and as a result, enrollment will increase. International students serve an important role in the social and academic development of their peers, both international

and domestic. Hence, developing a better understanding of the academic and social integration of international students improves student retention and satisfaction with degree programs. Twenty students who were identified as international students from countries in the MENA area were interviewed in semi-structured interviews. The findings suggest that social factors such as professors, staff, and campus activities increase identification and commitment among international students from the MENA area or lack thereof.

**Spalding, Brannon; Coburn, Mason; Filkins, Adam; Thang, Tha; "Noise And Vibration Mitigation In Washing Machines"** (Morteza Nurcheshmeh)

To maintain consistent engagement with a company's products, user satisfaction plays a significant role in the design of household appliances. In this study, a Top-Loading Commercial Washing Machine was analyzed and tested with various subsystems with the goal of mitigating z-axis, or vertical, vibration in the system, along with noise output. Previous data has been collected by teams of years past analyzing various sub-systems and methods to mitigate vibration. In the current iteration of the washing machine, our team is utilizing an accelerometer connected to MATLAB and dSPACE software to analyze four design modifications and their effect on the z-axis vibration and noise output. These four suggested modifications include spring replacements to increase/decrease the spring constant, damping grease to drastically increase the damping coefficient, a pulley system to artificially weigh down the inner drum, and acoustic foam to mitigate noise output. The base system was tested with no load, an unbalanced 1kg load and an unbalanced 2kg load on various voltage inputs to obtain baseline data that simulates uneven laundry loads. Our design modifications are tested under the same loading and input conditions to compare the resulting z-axis acceleration and noise output.

**Stansell, Morgan "Impact of Community Engagement on Teacher Candidate Self Efficacy and Ability to Provide Book Access"** (Nancy Hulan)

Literacy rates are historically low in areas with limited access to books. In addition, teachers often feel unprepared to teach students from underserved populations. Because of this, teacher candidates need to be confident in their abilities to provide access to books and to provide quality literacy instruction for students who live in poverty (Bedford & Brenner, 2010). This study aims to learn more about the impact of literacy-related community engagement on teacher candidates' self-efficacy, their understanding of book access, and their perceptions of teachers' roles in providing book access. Participants engaged in literacy-related community activities within the WKU Literacy Ambassadors student organization. Seven participants responded to initial and post-project questionnaires, as well as semi-structured interviews. Both qualitative and quantitative data were analyzed to provide insights into how teacher candidates perceive their own ability to teach diverse learners, both culturally and academically, as well as their perceptions of the barriers to literacy within the community. Participants also reflect on factors that prevent student access to literature and what they can do to enhance access. This project will build upon current research related to the impact of service-learning efforts and knowledge of book access on teacher candidates.

**Stewart, Tyson "Determining Tornadic Near-Misses via Oklahoma and Kentucky Mesonet Observations"** (Jerald Brotzge)

Determining a definition of a near-miss is a frequent frustration in regard to natural disasters. While previous definitions of a near-miss seek to define it as any event that has a significant

chance of causing property damage and/or casualties but did not due to chance, this framing of a near-miss fails when analyzing individual disasters and the footprint they leave within a community. This is especially prevalent with tornadic storms, as relatively small distances can be the difference between a direct hit or a miss when compared to larger, synoptic scale systems. By analyzing both direct and distant tornado encounters via mesonet station observation data, a rough figure of tornadic vicinity can be determined. Doing so results in tornadic signatures being present for all observations within one kilometer of a confirmed tornado, indicating a tornadic vicinity at such a distance beyond the radius of the damaging winds of a tornado. This vicinity range can be applied to generate a rough post-tornado model of what communities were particularly at risk enough to be deemed a near-miss encounter. Future research will focus on analyzing other spatial patterns from these observations and their prevalence on tornadic behavior.

**Stichter, Zachary** "Development of An Enhanced Sampling Workflow to Accelerate Molecular Docking with Sparse Biophysical Information" (Matthew Nee)

Rapid docking of flexible biological macromolecules remains a significant open challenge in protein structure determination. While rigid docking is relatively simple with toolkits such as TagDock, a key obstacle to rapid flexible docking is the complexity and roughness of the free energy surface associated with protein conformational motion (often termed the many-minima problem), meaning that conventional molecular dynamics methods do not effectively sample protein conformations near the interaction complex in accessible timescales. Methods such as metadynamics and replica exchange molecular dynamics exist to ameliorate this obstacle, yet these methods use nonphysical biases or random swaps to enhance sampling. In contrast, high temperature molecular dynamics simulations using simulated annealing offer rapid sampling of a continuous trajectory, biased only by an imposed external temperature. We report work to extend the rigid docking toolkit TagDock by implementing a simulated annealing workflow to sample protein conformational motion, extract relevant simulation frames, and perform TagDock analysis, yielding decoy structures as much as 39% closer to the target complex.

**Strehl, William; Kambesis, Patricia; Bledsoe, Lee Anne;** "Mapping Geochemistry of Capillary Water Within the Mammoth Cave Aquifer and Relationships With Overlying Geology, Great Onyx Cave, Mammoth Cave National Park" (Christopher Groves)

Cave passages in Great Onyx Cave, developed within the Girkin and Ste. Genevieve Limestones of Mammoth Cave National Park, contain a variety of secondary features on cave walls. These include speleothems such as stalactites, stalagmites, and flowstone, evaporite minerals, and dissolution features such as pits and domes. What secondary features are present on the walls of a cave passage depends on the flow and geochemistry of capillary water that has interacted with the cave passage. In the Mammoth Cave aquifer, five distinct geochemical zones have been broadly defined and each typically contains a particular set of secondary features. Geochemical zonation in Great Onyx Cave has not been thoroughly studied. This project is identifying the geochemistry of capillary water in this part of the aquifer by plotting the distribution of secondary features on a high-resolution map of the cave provided by the Cave Research Foundation and Mammoth Cave National Park. We will also conduct a survey from the entrance of the cave across the surface above the cave with the purpose of better understanding the relationships between these zones and the rock layers above the cave and how those may be influencing the flow of water downward from the surface.

**Stryker, Shane** "What Explains American Perceptions Of Russia And China?" (Scott Lasley)

This undergraduate senior thesis project aims to investigate the question of how Americans perceive the challenges posed by Russia and China comparatively, and which factors have the greatest influence on these perceptions. First, there will be a literature review concerning the importance of understanding public opinion, explanations, and theories as to what may be informing American opinions on Russia and China, and a discussion on partisanship and how it serves a large role in differences of opinion. Second, the methodology of the original survey that was sent out for this thesis project will be presented, initial data collection will be explained, and the survey questions will be presented. Third, implications and explanations of the data will be discussed, positioning the public opinions of Americans into an analytical lens. The final section will be a conclusion which will wrap up the analysis and provide recommendations for future research.

**Sunnygard, Jacob** "The Nature of Succession" (Aly Shahnaz)

How communities grow is through community engagement. Second Chance Rehabilitation and Community Center welcomes the community, those in, and those seeking recovery. For those not in recovery, the Community Center's folding wall system can be used to create four meeting rooms but also can be functional for larger scaled events. Parallel to the Obey River in Celina, TN, situated on 76 acres, hiking and horseback riding trails are provided for the clients and community, as well as seasonal water activities. The design for both buildings is a minimalistic take from Mies van der Rohe's Farnsworth House. This was chosen due to the benefits nature provides people. Given the purpose of these buildings to support mental health, bringing the outside in was key. Another reason for this was to stay away from over stimulation. Biophilic design also creates friendlier interior spaces further getting away from the common institutional design. Environmentally conscious, the building uses sustainable measures such as geothermal, grey water reuse, and heating recovery ventilation, energy recovery ventilation, and biophilic designs. These sustainable mechanisms on top of the 76 acres makes both the Rehabilitation and Community Center sustainable.

**Suresh, Harsha; Polak, Matthew; Harris, Jeremiah;** Harris, Kacy; Moore, Lora; Flanigan, Teresa; "Nursing Documentation Management Application" (Michael Galloway)

Western Kentucky University's Associate Nursing program currently has a physical system in place to manage and organize documents that are submitted by potential students who are applying for the program. The program receives over 360 applications annually, which equates to the submission of thousands of documents throughout the year. Our client has requested a software system that will heavily simplify this process for administrators and people facilitating the application process. Our team will follow the software engineering process to devise a solution for this problem and create appropriate documentation that will aid future work towards this system. We chose to develop our project using Next.js because it's a well-documented and modern tool for web development that will allow us to more easily integrate our solution to the issue. Several of the requirements that we'll be fulfilling through the website involve allowing applicants to upload or fill out documents online, connecting them to Western Kentucky University's secure drive, sorting them, parsing them for information, and notifying applicants of mistakes they've made in the submission process. Overall, our application will help administrators more easily view documents submitted for WKU's Associate Nursing Program.

**Swift, Alyssa; Rios, Logan; Borges, Hailey;** "Examining Individual Differences In Infant Regulation With Mothers And Fathers" (Diane Lickenbrock)

Specific behaviors emerge to support regulation during infancy, but behaviorally inhibited infants have heightened negative responses to novelty and are at risk (Henderson et al., 2015). Autonomic nervous system reactivity supports regulatory capacity and can be measured via cardiac indicators: respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP; Roder et al., 2020). Infant regulation depends on parents, but no study has explored dynamic infant cardiac reactivity with fathers (Richter & Lickenbrock, 2021). The current study examined associations between infant behavioral inhibition, autonomic reactivity, and regulatory behaviors. Families participated when infants were 4- and 8-months old. Parent-infant dyads completed the Still-Face Paradigm while cardiac physiology and regulatory behaviors were (Ekas et al., 2013; Tronick et al., 1978). Infant behavioral inhibition was experimenter-reported globally (Stifter et al., 2008). As behavioral inhibition increased, infants looked to mothers less ( $r = .338$ ,  $p = .012$ ) and used less distraction ( $r = -.344$ ,  $p = .010$ ,  $n = 60$ ). A significant Behavioral Inhibition X PEP Activation interaction emerged; infants low in PEP activation looked to fathers less as their behavioral inhibition increased ( $r = .509$ ,  $p = .046$ ,  $n = 22$ ). Results suggest that behaviorally inhibited infants depend heavily on mothers, which may prevent acquisition of developmentally appropriate regulatory strategies. However, PEP activation with fathers buffered this risk.

**Szczepanski, Justin; Jordan, Jeremy;** "Analysis Of Roundabout Safety Challenges In Kentucky: Findings From Survey Analysis" (Kirolos Haleem)

Roundabouts are becoming an increasingly popular alternative to signalized and stop-controlled intersections since they reduce crashes and severe injuries due to drivers' reduced speeds when approaching roundabouts. For roundabouts to function in the most optimal way, transportation engineers need input from those who navigate them. This study implemented a statewide Web-based survey funded by the Kentucky Transportation Cabinet (KYTC) to gather Kentucky residents' opinions on the functionality and safety of roundabouts in the Commonwealth. KYTC, with the largest transportation outreach in the Commonwealth, posted the survey on its social media platforms. The survey was also shared with major transportation companies in the Commonwealth (from both public and private sectors). Around 4,000 Kentucky residents have participated in the survey, and the survey is currently active until the end of February 2024. From the preliminary analysis, the primary roundabouts' challenge is the lack of drivers' knowledge on how to appropriately navigate them and many respondents have stressed the need of more driver education on "roundabouts navigation." The results of this study will provide the Kentucky Transportation Cabinet with valuable information that can be used to improve the geometric design of roundabouts and to better plan for new roundabout locations.

**Tareqe, MD Towhidul Isam** "Photochemical water splitting on TiO<sub>2</sub>: heterogenous nickel and iron-oxide interfaced co-catalysts as platinum alternatives." (Dr. Lawrence Hill)

Photocatalytic hydrogen evolution reaction (HER) via water splitting provides a pathway to generating renewable energy. One approach to photocatalysis uses metal-semiconductor hybrids to induce water splitting reactions where the metal acts as a photoelectrode collecting and transporting charges at the catalyst surface, and the semiconductor absorbs light to provide energy that creates the charges. Platinum is an excellent metal cocatalyst due to its strong proton binding energy that facilitates the reduction of water to produce hydrogen, but its high cost

drives the search for alternatives. Nickel and iron-based nanoparticles have been investigated individually as cocatalysts for photocatalytic HER, but their performance is still much lower than that of platinum. Recently, Suryanto et al. showed that, when nickel and iron are combined in bimetallic particles (Janus particles), the interface between these metals performs similarly to platinum for electrochemical reactions. Herein we detail three synthetic approaches to prepare nickel-iron oxide Janus nanoparticles on a commonly used semiconductor, titanium dioxide. The synthesized nanoparticles required characterization techniques including TEM, ICP-OES, STEM, and XRD. The catalytic activity of these cocatalysts will be examined in HER reactions where the amount of gas will be determined using GC, volumetric difference, and industrial gas analyzer FD-600.

**Taylor, Samantha** "A Radar Analysis Of The March 2-3, 2020 Severe Weather Outbreak" (Joshua Durkee)

On the evening of March 2nd, 2020, a collection of individual storms began to fire up in the bootheel of Missouri and make their way eastward, propelled by a powerful cold front and fueled by both ample wind shear and increased Convective Available Potential Energy values. Overnight, this complex would encounter pockets of instability that helped it to maintain its strength as it cut a treacherous path across Kentucky and Tennessee, spawning 15 different tornadoes and ultimately resulting in the loss of 25 lives. The most dangerous of these storms was a single supercell that propagated south of the original storm cluster and tracked due east through the state of Tennessee, generating 10 different tornadoes ranging from EF-0 to EF-4 in intensity. It may be possible to learn how and why this event overperformed so drastically by dissecting and analyzing the available radar data for this event. Through the utilization of an assortment of NEXRAD products accessed through GR2Analyst such as Base Reflectivity, Base Velocity, NROT, and the Correlation Coefficient, this event can be studied down to its base components, allowing meteorologists to deduce exactly how the atmosphere produced and maintained storms of their magnitude on what was perceived to be a relatively low-risk day.

**Tekoe, A** "Variability & Large-scale Weather Forcings Of Extreme Kentucky Precipitation Between 1949-2022" (Zachary Suriano)

Precipitation plays a crucial role in the Earth's water cycle, providing freshwater supplies for consumption, industrial, and agricultural needs. However, extreme precipitation, such as the July 2022 and 2023 events in Kentucky, has the potential to cause dangerous flash flooding. Previous studies have investigated the trends in precipitation across the U.S., including in Kentucky where findings indicate the presence of a small number of isolated regions with temporal trends in annual precipitation. Despite these previous efforts, many questions remain on how Extreme precipitation event frequency and intensity variation has changed across the Commonwealth. The objective of this study is to determine the climatology of extreme precipitation across Kentucky since 1949, specifically investigating the spatiotemporal variability and the trends in event frequency and intensity and evaluate how large-scale weather patterns contribute to extreme precipitation events. Here we find extreme precipitation events over the south-central and western parts of the state are 2-3 times more frequent relative to northern and eastern regions. Within a year, extreme events moved from higher frequency from November-May in the west to peak in mid-summer in the east. We find ten specific weather patterns associated with extreme Kentucky precipitation events that exhibit specific characteristics necessary for events.

**Thurman, Tanner; Rone, Regan; Mata, Jessica; ; Dumancic, Marko; Mountjoy, Natalie;** "Course-aid" (Michael Galloway)

This project aims to address the need for accessible and comprehensive course information and support at WKU by developing a chatbot application called "WKU Course Aid." The objective is to provide students with 24/7 access to course material, policies, schedules, and academic support resources, thereby reducing workload for instructors, and allowing students to seek assistance and clarification at their convenience. The project involves the creation and coding of the "WKU Course Aid" application. The team will develop a user-friendly interface (UI) and integrate it with the chatbot functionality to ensure seamless operation. Once implemented, the chatbot will be able to answer student inquiries on various topics, including syllabi, rubrics, course material, schedules, and academic support resources. The chat bot will also be tailored towards specific courses that the instructor uploads. The application's capabilities are expected to enhance overall student and instructor course satisfaction.

**Thweatt, Rachel; Carroll, Meradeth; Orndorff, Anna;** "The Immediate Effects Of Virtual Training On Postural Stability Using The Sot Test On The Bertec Balance Advantage System" (Sonia Young)

Introduction: The Sensory Organization Test (SOT) is used to assess fall risk, balance, and postural stability. Many different Computerized Dynamic Posturography (CDP) systems include a SOT assessment program, such as the Bertec Balance Advantage System (BBAS). The components of SOT have been assessed previously in young adults using the BBAS. Unique to the BBAS and less investigated, is the use of immersive virtual reality (IVR) training. The purpose of this project is to assess the immediate effects of a BBAS IVR intervention using the SOT for assessment of balance performance in an older adult population. We hypothesize there will be an immediate improvement in postural stability of older adults after IVR training on the BBAS. Methods: Balance performance of healthy older adults (age 65+) during the SOT will be assessed pre/post the delivery of a single session IVR training intervention using the BBAS. Dependent variables used to quantify balance performance will be SOT composite, equilibrium, and ratio scores. Results: Demographic data will be calculated. Paired t-tests will be conducted to assess pre-to-post training change in each DV using SPSS. Discussion: Findings from this study will contribute to understanding how IVR training may impact postural stability of healthy older adults.

**Tingle, Abram** "Test-Bed Development for Tactile Sensor Degradation Testing" (Farhad Ashrafzadeh)

The WKU Center for Energy Systems (CES) Lab was tasked with creating a test bed to conduct fatigue testing on a new type of tactile sensor being developed by the University of Louisville's LARRI Center. These nanosensors are to be implemented in the production of smart structures, such as 3-D prints with sensors integrated within their design. Students at Western's CES lab have created a testbed to enable automated test cycles to determine various metrics to fully characterize these new sensors and gather data on their degradation over time. The test bed can apply a fixed force to several sensors for thousands of iterations while saving test data using a custom LabVIEW program. An indenter attached to a lab-grade force sensor takes the ground truth data and compares it to the test data, allowing us to compare the sensor's expected output with the actual data to gauge each sensor's performance. This data will be used to further the development of LARRI's sensors.



**Tingle, Sebastian** "Beyond the Wardrobe: Exploring Contemporary Immersive Theatre Practices" (Shura Pollatsek)

Immersive theatre, epitomized by British theatrical company Punchdrunk's innovative approach, offers a unique blend of storytelling and audience engagement. Over the past 6 months, I've researched immersive theatre, particularly Punchdrunk's methodology, through firsthand experiences and attendance at The Burnt City, their latest show, in London. I additionally attended a series of immersive performances in London to better understand the evolving landscape of experimental theatre and explore the potential of immersive storytelling in pushing the boundaries of traditional theatrical experiences. My research in London consisted of attending immersive productions and analyzing my personal audience reactions. Insights gathered from the initial trip to London will inform the development of a staged test production at Western Kentucky University, expected to commence in March of 2024. This production is a fragment of a larger body of work which will be built upon this workshop performance, which will conclude with a talkback from audience members to best assess the ways in which applied immersive theater techniques were perceived. Overall, the project underscores the importance of physicality in theatre and the need for experiences beyond digital realms, paving the way for further exploration of immersive theatre's potential in captivating audiences and redefining theatrical storytelling.

**Todd, Chloe; Carlson, Vivian; Epeheimer, Marley; Risen, Noah; ; Witt, Kaitlyn; Raby, Meredith; Hernandez, Bridget; Hurt, Lauren;** "Documenting Gender In Gravestones: A Preliminary Analysis" (Kate Hudepohl)

This group project explored evidence of gender ideology exhibited in cemetery markers in one section of a local, public cemetery. Group members, classmates in Anthropology of Gender taught in Fall 2023, participated in fieldwork to double-check raw data previously gathered as part of an ongoing cemetery documentation project. Project members then analyzed that section of data using an analytical instrument developed by the primary researcher, Dr. Kate Hudepohl, paying particularly close attention to epitaphs. The results provide insight into the attitudes, values and beliefs in particular communities and how these ideas, specifically ideas about gender, may be represented in material culture.

**Towoju, Victor;** "Dynamics Of Large-scale Sediment Waves In The Northern Gulf Of Mexico Basin" (M. Royhan Gani)

The Gulf of Mexico basin is well known for its complex geological features, hydrocarbon reserves, and interactions between salt domes and sedimentations. This study utilizes seismic (2D and 3D) and bathymetric data to identify sediment waves in the Northern Gulf of Mexico basin, USA. These bedform structures, ranging in geologic age from upper Miocene to Recent, have been documented in the eastern, central, and western regions of the basin, with each region exhibiting distinct geomorphic characteristics of the sediment waves. On the Texas Slope, bathymetric data reveals alternating downslope-asymmetric cyclic steps and upslope-asymmetric antidunes on the seafloor. The formation of these sediment waves is probably influenced by the over-steepening of the slope that moved sediments from the shelf into the upper continental slope. In the abyssal plain, sediment waves are ubiquitous in the Neogene-Recent stratigraphic record but are absent beyond the mouth of the Alaminos canyon. Contrary to interpretations made by earlier workers, seismic evidence shows that these sediment waves were deposited by

sediment gravity flows. In the Fuji-Einstein region, a field of upslope-migrating sediment waves extends across the continental slope's Plio-Pleistocene succession. The dynamics of these sediment waves have implications for the depositional and palaeoceanographic history of the basin.

**Trammell, Tesla;** Norris, Pauline; Ramos, Josse; "Blood  $\beta$ -carotene And Vitamin A In Preweaning Bulls, Steers, And Heifers" (Luiz Silva)

Studies have shown that the development of marbling in beef can be manipulated by supplementing Vitamin A and pre-vitamin A ( $\beta$ -carotene), particularly from birth to weaning. However, the efficiency of converting  $\beta$ -carotene into Vitamin A may differ among sexual classes since they exhibit a distinct fat deposition. Therefore, this study aimed to evaluate the effect of calves' sexual class on blood  $\beta$ -carotene and Vitamin A before weaning. Thirty-six Angus calves (12 bulls, 12 steers, and 12 heifers) were used in this study. The calves were kept on the same pasture with their dams until weaning at 30 weeks. Blood samples were collected from calves at weeks 2, 16, and 30 and analyzed for  $\beta$ -carotene and Vitamin A via HPLC and ELISA assays, respectively. Blood  $\beta$ -carotene increased from week 2 to 30 ( $P < 0.01$ ) and it was also affected by the sexual class ( $P = 0.05$ ), showing that bulls had a lower  $\beta$ -carotene level compared to steers and heifers. Blood Vitamin A was not affected by the sexual class ( $P = 0.38$ ) averaging at weaning 155, 179, and 168 ng/mL for bulls, steers, and heifers, respectively. In conclusion, our data suggests that  $\beta$ -carotene metabolism differs among cattle sexual classes.

**Traxler, Sidney;** Briles, EmmaJo; Maddox, Emma; "Examining The Impact Of Sexual Assault As A Moderator Between Cannabis Use And Suicidal Ideation" (Jenni Teeters)

Sexual assault survivors often face many negative mental health outcomes following their victimization, including symptoms of depression, post-traumatic stress disorder (PTSD), suicidal ideation, and heavy substance use. Previous research has shown that frequent cannabis use may increase suicidal ideation, but considering how a traumatic experience may influence the connection between cannabis use frequency and suicidal ideation is mostly neglected. The current study examined whether experiencing a sexual assault moderates the association between cannabis use frequency and suicidal ideation. Participants were 408 emerging adults recruited through Prolific (48.4% white, 54.9% female, average age = 23). Participants responded to questions assessing suicidal ideation, cannabis use frequency, and sexual assault experiences. A moderation analysis controlling for PTSD symptoms showed that experiencing a sexual assault moderated the relationship between cannabis use frequency and suicidal ideation ( $p = .04$ , 95% CI [.02 - .65]). The results imply that the association between cannabis use, and suicidal ideation is significantly stronger for those who experienced a sexual assault. Notably, the interaction was found even when controlling for PTSD symptoms. This information is useful for suicide prevention and intervention efforts as well as interventions aiming to reduce the frequency of cannabis use among emerging adults.

**Tucker, Harrison** "Agritecture" (Aly Shahnaz)

This project involved the design of an agricultural mixed-use building. The goal of this building was to create a space for a community to have the available resources to learn agricultural practices. Most people are moving to urban and city environments and have been dislocated from farms. This creates a lack of space for people to grow their food and or have the knowledge to do so. This center provides all the needed spaces to learn and cultivate food from seed to plate. For

this project, I created something that can benefit the surrounding communities. The main goal was to help communities by giving them the resources they needed to start growing their food. The facility can grow, cook, sell, and research different crops and foods. Having all these elements in growing urban communities allows people to be more self-sufficient. This building sits on a previously run farm giving the soil very nutrients and beneficial to the goal of the building. The sustainability of the structure was important, and active and passive strategies were added. Also, this building houses a large kitchen and restaurant that teaches people how to cook and use the food they have grown.

**Updegraff, Carrie** "Study of Dolomite in South Central Kentucky" (Michael May)

Conditions necessary for formation of the mineral dolomite ( $\text{CaMg}(\text{CO}_3)_2$ ) has for decades been defined as the "dolomite problem", a phrase used to describe a geologic anomaly due to a lack of volumetrically significant formation of modern-day dolomite. Despite modern conditions seeming ideal for dolomite formation (such as an Mg:Ca ratio in mineralizing fluids that is 1:1), the observed amounts of dolomite produced are miniscule, and would not account for the vast quantities documented in the geologic record, particularly in the early Paleozoic. Recent studies have proposed that dolomite formation involves a back and forth "refining" process, which would slowly create a layer of pure (ordered) dolomite nucleation of crystals absent of a pre-existing carbonate (i.e., calcitic rocks) and this is termed primary dolomite. In contrast, secondary dolomite is formed through chemical changes (diagenesis replacement) of an existing carbonate. Select limestone units of South Central Kentucky, specifically the Ste. Genevieve and Haney contain secondary dolomite, as is evident by recognizing euhedral rhombic crystals within such limestones. Petrographic investigation documents rhombic dolomite crystals replacing pre-existing calcite in both muddy and grainy rocks and indicate that in the context of textural evidence most dolomite in this study area of Kentucky is secondary.

**Vance, Zachary; Kerney, Trevor; Irizarry, Matthew;** Thomason, Sara; "WKU Filmatrix" (Micheal Galloway)

The WKU Filmatrix project addresses the need for a management system for the WKU Film and Journalism Department. They create about sixty short films each year and for each one of these is a variety of data associated with each film. For example, essential data about the films including cast and crew details, project landmarks and tasks, and legal documents such as location and vendor contracts. Currently, this data is currently stored in Google Drive, which is not only inefficient, but also is burdened by scaling issues. To combat this problem, our solution is the development of a secure, user-friendly platform designed with the department's faculty and students in mind from the beginning. Our system boasts secure authentication by implementing the existing Outlook logins via OAuth. Further, the user experience is extended by providing a user interface that not only adheres to WKU's style guidelines but is also effective in completing processes in an efficient manner. Another feature is a project checklist outlining major milestones in the film creation process. In summary, this app will aid the WKU film and journalism department to more securely and efficiently manage their data and processes related to film creation.

**VanHook, Hayden;** Atchley, Robert; "WKU Red Towel 3D Model Creation" (Joel Lenoir)

The research project's objective is to create a printable, three-dimensional model of the "Red Towel" Statue outside of the Downing Student Union. The model will be created using a process

called photogrammetry. Photogrammetry is a type of program for creating a three-dimensional model using two-dimensional images. The two-dimensional images are stitched together in the photogrammetry software. 3DFZephyr will be the photogrammetry program utilized in this project along with a Nikon D780 and a forty-millimeter prime. The entire structure will be captured in close-up photos that will accurately translate into a three-dimensional structure within the photogrammetry program. The expected result of the project is to have a tangible three-dimensional model of the Red Towel. The project aims to add to the collection of WKU-centric models and data that the Ogden College of Science and Engineering has.

**Veith, Evalynn;** Williams, Julian; Patterson, Kellen; "Poly (methyl methacrylate) beads as photocatalytic substrates for water remediation" (Matthew Nee)

The escalating contamination of global water sources demands innovative strategies for efficient and effective water remediation. Photocatalysis, a method of remediation that uses light energy and environmental byproducts to degrade organic pollutants, has proven to be a promising method for the removal of organic pollutants. However, many photocatalysts fail to perform adequately on their own due to their habit of forming stable suspensions in water. A variety of substrates to improve the effectiveness of a photocatalyst have been researched including microparticles, aerogels, hydrogels, composite sheets, and polymer beads. In researching a suitable substrate, the buoyancy and surface area to volume ratios of a product are crucial points of consideration. Improving these characteristics allows the photocatalyst to have more optimal access to UV-light energy and organic pollutants. Poly (methyl methacrylate) beads, a biocompatible and recyclable polymer, have been synthesized using radical emulsion polymerization with an efficient photocatalyst, titanium dioxide. To optimize the surface area to volume ratios of these beads, a variety of organic phases were tested during the emulsification part of synthesis. The resulting beads were then analyzed for potential efficacy using a combination of electron microscopy, UV-vis spectroscopy, and the Brunauer-Emmett-Teller surface area to mass ratio.

**Wallace, Christopher** "Impediments To Effective High School Teaching In Kentucky" (Kevin Modlin)

This quantitative study examines Kentucky public high school teachers' beliefs and attitudes regarding the impediments they face when striving to effectively educate their students. Data was collected using a survey sent to nearly 14,000 high school teachers in the Commonwealth. Using Likert-style scales, the survey captures perceived barriers to education identified by public high school teachers. Concluding questions sought additional personal experiences to elaborate findings. Further information was gathered via interviews with several Commonwealth Superintendents. This study answers the following hypotheses: 1) Barriers to effective high school teaching are due to insufficient allocation of state funds, 2) Kentucky counties with low socioeconomic statuses witness inequitable student assessment outcomes, and 3) The most prevalent barriers to effective high school education, as perceived by teachers, are mitigated with proper policymaking, so long as school administrators act in addressing the socioeconomic issues of their students through use of the implemented policy. Formula restructure suggestions are presented following the analysis of these hypothesis. Recommended changes to the language of specific public education statutes are presented as well.

**Washington, Tani** "Viva Wakanda: What Afrofuturism Gives To An Emancipated Diaspora" (Andrew Rosa)

This paper aims to examine Afrofuturism as a disruptive rhetorical strategy, focusing first on the operative definition of Afrofuturism, then on its disruption of post-colonial identity, and finally its applicability to sociopolitical institutions both in and out of the African Diaspora. Using rhetoric from historical records as well as field interviews with Senegalese political figures, I contend that Afrofuturism is a form of disruptive racial rhetoric, flowing first from the minds of Afro-diasporic creatives, then beholden to Black activists as a way to contextualize their experiences and dreams for a post-emancipatory world.

**Weaver, Vivianna** "Understanding The Impact Of Environmental Pollution On Brain And Vascular Systems On The Zebrafish Model, Danio Rerio." (Samuel Earls)

D. Rerio are commonly utilized to evaluate environmental pollution effects on human health, due to their genetics and structure being similar to those in humans. Significant disruptions can be seen when exposed to a class of chemicals known as dioxins. One type of dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), activates the aryl-hydrocarbon receptor through a ligand-activated response. This activation triggers disruption in DNA sequencing and gene expression. Our study evaluated the effects of this gene-expression disruption on D. Rerio cerebral vasculature and lymphatics. We concluded that both the vascular and lymphatic endothelium are disrupted in TCDD-exposed embryos and that brain lymphatics are not developed at the same time point as the vasculature in D. Rerio. These findings indicate that TCDD may trigger gene-expression disruption in the human model and potentially have effects on the vasculature of the human brain.

**White, Serena** "Public Support In Taiwan For Extending Conscription And The Extent Of That Support" (Timothy Rich)

In a press conference in late December of 2022, Taiwanese President Tsai-Ing Wen announced that Taiwan would amend their conscription policy, extending the mandatory service draft from four months to one year. While many surveys have addressed broad support for this conscription reform, there is less emphasis on measuring the extent of Taiwanese support. What is the maximum time that mandatory military service can be extended to before it is no longer perceived as acceptable? Could an increased economic burden on Taiwanese taxpayers influence their perceptions of compulsory conscription? If America fully committed to protecting Taiwan, would their support for compulsory military service prevail? Using a 2023 web survey of Taiwanese citizens, the data finds that a majority of respondents support this change, and many are even open to further lengthening conscription despite other extraneous factors like increased tax burden, the possible inclusion of women, and American military support.

**Wilborn, Edwin** "A Government For The People: The American Administrative State, 1800-1850." (Patricia Minter)

At the nation's founding, the Founders envisioned a government that took place through individual states acting as union, not a nation where an overpowerful national government dominated. The American administrative state has always existed in some way, shape, or form, even prior to President Franklin D. Roosevelt's New Deal. Before the Civil War, the Administrative State looked much different than it does today, but it was just as important. Federal regulation existed, but much more important were the state and local regulations that

impacted the everyday lives of Americans. Social moods and technical abilities meant that most Americans did not have much interaction with federal government. Although the federal government began to create an administrative state during this time, to better protect the *salus populi*, or the people's welfare, local government was best suited. The pre-New Deal administrative state came into its own from 1800 to 1850, prior to the Civil War, and was meant to protect the people and bring the government to the people through local and state administration. The New Deal found its origins in these local moods and state and local administrative regulations, and without them, the New Deal would not have existed.

**Williams, Danielle;** Gregory, Caitlin; Canen, Jenessa; "Sleep Duration As A Risk Factor For Suicide Ideation And Attempts In Minoritized Youth" (Amy Brausch)

Suicide is the second leading cause of death in the United States for adolescents and poor sleep is a significant risk factor for suicide ideation and attempts. However, research shows that suicide risk factors identified in predominantly white samples of youth do not have the same association for racial minority youth; sleep may be one such factor. The current study evaluated how the association of total sleep duration with past-year suicide ideation and attempts may be different for youth from different racial backgrounds. Data from the Youth Risk Behavior Survey (YRBS; CDC, 2020) were used for this study which included 13,725 high school students. The sample was 50.3% female and 49.2% male. Adolescents identified as White (48.8%), Black or African American (14.9%), Hispanic/Latinx (22.2%), and 10.9% "other." The first moderation model found that race was a significant moderator in the relationship between sleep duration and past-year suicide ideation. The second model found that race also moderated the relationship between sleep duration and frequency of past-year suicide attempts. Black youth reported the least amount of sleep, the lowest prevalence of suicide ideation (17.7%), but the highest rates of suicide attempts (14.6%). Future research should examine all possible suicide risk factors for minoritized youth to illuminate our understanding of increasing suicide rates.

**Williams, Julian;** Veith, Gracie; Cline, Kal-El; Patterson, Kellen; "Synthesis Of Photocatalytic Beads For Water Remediation" (Matthew Nee)

Water remediation methods have become more effective and efficient in recent years. Despite this, modern methods are still unable to fully cleanse water of microscopic persistent organic pollutants (POPs), like pesticides or industrial chemicals. Our group has adopted a novel water remediation method: the synthesis of millimeter-scale, buoyant polymer beads to degrade POPs on the molecular level. Degradation is achieved with a nano-crystalline photocatalyst: a compound embedded in the beads' surface which breaks down POPs in the presence of sunlight. In order to optimize the rate of POP degradation, our group has looked to optimize certain experimental parameters to maximize the surface-area-to-volume ratio and relative size of the synthesized polymer beads. Our group has successfully incorporated the photocatalyst in cheap plastics/acrylics such as (poly)dimethyl-siloxane (PDMS), polystyrene (PS), (poly)methyl-methacrylate (PMMA), but look to use biodegradable polymers such (poly)lactic (PLA) and (poly)glutamic acid (PGA) in the future. A scanning electron microscope (SEM) and Bruaner-Emmett-Teller surface area analyzer were used in tandem to assess morphology and surface area-to-volume-ratio, while the rate of photocatalytic degradation was determined by UV/visible spectroscopy.

**Willis-Warthan, Callie** "Reliability Estimates Of The Social, Academic, And Emotional Behavior Risk Screener-student Rating Scale" (Thomas Gross)

We sought to examine if students give consistent responses to behavioral screening across weekly time points. The purpose of this study is to assess the internal consistency and test-retest reliability of the Social, Academic, and Emotional Behavior Risk Screener Student Rating Scale (SAEBRS-SRS). The SAEBRS-SRS has three subscales (social, academic, and emotional behavior) and a total behavior score. Research questions include: (1) What is the internal consistency of the SAEBRS-SRS? and (2) What is the test-retest reliability of the SAEBRS-SRS? Participants include 57 second and fourth grade students from a semi-urban public elementary school. They completed the SAEBRS-SRS weekly as part of progress monitored during a class-wide behavioral intervention. Cronbach's alpha and McDonald's omega were computed for internal consistency. Pearson's r was computed for each SAEBRS-SRS subscale score from one week to the next. Overall, the alphas ranged from low to acceptable (range = .50 to .88) as did the omegas (range = .57 to .88). For test-retest reliability, the coefficients ranged between .55 and .75 for social, .66 and .80 for academic, .55 and .66 for emotional, and .69 and .80 for the total behavior scores. Implications related to expectations for consistency in student behavioral screening will be addressed.

**Wilson, Kate; Petrouske, Lauren**; ; Borges, Hailey; "Exploring The Dynamics Of Infant Temperament And Maternal Engagement" (Diane Lickenbrock)

Infant temperament, shaped by genetics and environment, influences individual differences in responsiveness and self-regulation (Rothbart & Bates, in press; Rothbart & Derryberry, 1981). Parent involvement and play are crucial for infant socioemotional development. However, research findings on parent-infant interactions remain mixed. Some literature suggests that caregivers engage less with negatively tempered infants, while others suggest the opposite (Slagt et al., 2015). Over time, research has overwhelmingly focused on negative temperamental tendencies in infants. The present study aimed to examine the associations of cuddliness, high-intensity pleasure, smile & laughter, and mother involvement during play. Mothers rated caregiving and play interactions during the week (Planalp et al., 2013), as well as infant temperament (IBQ; Gartstein & Rothbart, 2003), with their 8-month-olds. Results (n=77 mothers and infant dyads) revealed a negative association between smiling and laughter with childcare ( $r = -.234, p = .040$ ) and a negative association with time spent with infants ( $r = -.238, p = .038$ ). Less maternal play interaction and caregiving are correlated with more infant laughter and smiling. These results could be attributed to the notion that less temperamentally reactive infants may require less attention or support from caregivers.

**Wirth, Hannah**; "Fathers' Descriptions of Their Autistic Daughters Social Communication and Repetitive Behaviors and Interests: A Qualitative Investigation" (Jenny Burton)

Fathers play an important parenting role and may have a unique perspective on their autistic daughter's social communication skills and interests. This phenomenological qualitative study included two fathers with autistic daughters. Each father described their daughter's social communication skills and repetitive behaviors and interests. (M age=12;2; M IQ =119). The individual semi-structured interviews with the fathers were conducted by the second author. Themes from the interviews will be generated. Clinical implications will be discussed.

**Wittkopf, Michael; Hehn, Connor; "Happy Feet Data Grab" (Michael Galloway)**

This project consists of sensors attached to a dancer's foot which collect force data over time. These points are located at the bottom of the first metatarsal, between the fourth and fifth metatarsal, and the bottom of the heel. That data is used as input for an Apple Mac application which outputs an informative graph overlaid on a video. This data will be used to analyze the dancer's weight distribution while dancing. Ideally, after enough study, there could be a correlation developed between pressure spikes and certain injuries. In the future, this could allow AI to be introduced that would immediately see a possible injury due to certain pressure points being hit. This could be used to treat an injury before it gets any worse, preventing long-term disabilities. The main issue at hand is that, like most sports, injuries are the leading cause of early retirement. The target audience is any researcher who would be interested in studying the correlation between landing positions and injuries. It is helpful to know whether dancers evenly distribute weight to avoid injury.

**Wylie, Bryanna "An Analysis Of Microplastic Concentrations Effected By Rainfall In Jennings Creek, Bowling Green, Ky" (Patricia Kambesis)**

Research conducted on the terrestrial sources of microplastics in freshwater bodies remains limited regarding the possible effects of rain and atmospheric deposition on streams. Microplastics present in precipitation pose a unique threat, as they have the ability to transport pollutants to remote locations. This study aims to collect and present microplastic concentration findings from three separate sample types at Jennings Creek in Bowling Green, KY: stream base level, post-storm event flow, and direct rainfall. The samples will be collected from the sample sites in the following quantities: two base-level, two post-storm events, and one direct rainfall. Two sample sites will be used to compare microplastic concentrations based on proximity to urbanized areas, resulting in a total of 10 samples. Samples will be filtered using a vacuum pump to collect any particles on filtration paper, where the particles can be counted and analyzed further. Using separate sample sites and types to account for the effects of urbanization on microplastic concentrations, this study will determine whether precipitation has a significant effect on the microplastic concentration of streams.

**Yocum, Chastity "Longing For The Unfound" (Sara Thomason)**

"Longing For The Unfound" is a story that comes from the depths of within. For much of my life, I've battled with issues surrounding my reproductive health. During a summer filled with weekly visits to my gynecologist, doctor, and other specialists they each gave me conflicting explanations, this made my frustration build within myself. I couldn't help but think: Why was my body letting me down? Why wasn't it working properly? In one of my many moments of anger, I poured out all my feelings into words. What came out was a stripped and raw world. Our main characters, Addie, and Naomi, embody life and decay in this bareness. Through them, I explore jealousy and love not only within your partner but ultimate self-destruction.

**Youngblood, Kristen; Burks, Sydney; "The Association of Cross-training and Dance Related Injuries" (Melissa Tolbert)**

Introduction Injuries in the performing arts community are prevalent and often overlooked due to the normalization of pain compared to the general population. Although injury risk factors have been identified, a gap in evidence exists surrounding cross-training's impact. The purpose of this study is to compare a dancer's current functional abilities to the duration of cross-training. The



researchers hypothesize a negative association between the two variables in the performing arts population. Methods Individuals, aged 18-25, currently enrolled in a WKU performing arts major will be recruited in a prospective, longitudinal survey study. The initial survey will include demographic questions, and the Dance Functional Outcome Survey (DFOS). Participants will also report current injuries and weekly duration of cross-training. A final survey will consist of the DFOS and the number of injuries. Results The independent variable is duration of cross-training. The dependent variable is the DFOS score and number of injuries. Pearson's Correlation Coefficient will be used to identify a relationship within the parametric data. Conclusion This study aims to educate the performing arts community about the association between cross-training duration and potential risks of injury. This research hopes to aid in pre-season wellness screenings and education for performing artists.