Ackermann, Shelby "The Financial Reality of a Career in Veterinary Medicine for Kentucky Residents" (Michael Stokes)
The financial burden of a veterinary medical education continues to increase with rising tuition prices. According to the American Veterinary Medical Association, the average veterinary school graduate of 2016 faced debt exceeding $140,000 (AVMA 2020). Studies published by the Journal of the American Veterinary Medical Association suggest that suicide rates among veterinarians are higher than that of the general population and list debt as a primary contributing factor. The purpose of this project is to expose students to the financial reality of veterinary medicine, increase awareness of financial and career opportunities, and compile information gathered from interviews to assist Kentucky residents in making informed and financially stable decisions about a career in veterinary medicine. This project consists of interviews with admissions representatives and students from an institution offering reciprocity to Kentucky residents (Auburn University), a stateside school without reciprocity (University of California – Davis), an off-shore veterinary school (St. George's University), and a school without its own teaching hospital (Lincoln Memorial University). The types of veterinarians interviewed include a general practice owner, veterinary specialist, large animal veterinarian, and a government-employed veterinarian. Although the debt resulting from veterinary school is daunting, it is not insurmountable and can be minimized.

Adams, Ashton; Rich, Timothy; "Impact of Demographic Variables on the Public Opinion of White-collar Criminals" (Timothy Rich)
This research investigates how criminal demographic factors (race, gender, age, and income level) in white-collar crimes affect public perceptions of sentencing. The study has shown that there is a slight difference when these factors were put to different types of white-collar crimes. One of the most impactful relationship being how income levels influences perceptions of tax evasion. Another interesting finding was the lack of influence has on sentencing views. The subject is important because of the lack of research in white-collar crime when compared to other types of crimes. Most researchers tend to focus on violent or drug related crimes, leaving the public with little knowledge on the white-collar side of crime.

Al madhani, Mohammed "Tornado Outbreak of December 16–17, 2019" (Josh Durkee)
Contributions from large-scale atmospheric circulation toward the 16-17 December 2019 tornado outbreak across the southern United States. Tornadoes cause tremendous environmental destruction, loss of lives and disability. It is described as a fast-revolving column of air that spins around a trivial space of extremely low atmospheric pressure with a rotation that touches the ground. This study paper explores one of the worst tornadoes to hit majority regions of the United States on December 16-17, 2019. The December 2019 tornado outbreak established the availability of several risk factors within the United States by analyzing the Enhanced Fujita Scale, the atmospheric layers, and the contributing atmospheric variables within those layers. The preliminary severe weather report database demonstrated how useful it is in integrating the atmospheric maps to analyze the events through a synoptic scale. This analysis has sub-variables such as Differential Vorticity Advection and Omega Equation. Based on the analysis, the synoptic variables indicated their favorability in creating the tornado outbreak in December 2019. The Integrated Data Viewer (IDV) Undated is the program that used to simulate the atmospheric conditions of the event day and creating maps in order to examine the event in synoptic scale.

Almarri, Hamed "In Shape Gym" (Shahnaz Aly)
The project involves the design of a gymnasium and fitness center for men in Saudi Arabia. There are many interesting areas at the building such as: a swimming pool, Basketball court, and training room. The site, it is located at Alhafouf, Saudi Arabia near to mall of alhassa. The goal of the project is to build a culture of non-judgment and celebration of each other's progress, to build a supportive and inclusive culture, free from assumptions about identity and appearance, and to empower people to create healthy training habits. For this project I visited the site to help me with the design. I did case studies for three different gyms around the world to get a good idea about gym's design. I conducted relevant research on the climate of the region. I conducted extensive building code analysis. As a result, the project's design is done, so the site plan, the elevations of the building, and floorplans are done. The code requirements are completed. I am working now on design developments.

Almarry, Jaber "Kfu Student Center" (Shahnaz Aly)
KFU Student Center, the project involved the design of student center for the King Faisal University. The building included 30,000 square-foot space that features an extended-hours study room, meeting room, food court, game hall, playground room. As there is low exposure to and knowledge of foreign cultures in the city, this place will bring about change helpful to students, but also bring different cultures together. The student center serves as a fulcrum between different cultures. Student able to socialize and take part in different recreational activities. This project has contributed greatly toward education opportunities for the students, many seminars as well as public lectures was be arranged, it will also helpful to wellness and health of the students by the opportunities of different sport activities and wellness events. My goal was to create a space for students to gather for both learning and entertainment, and to bring foreign culture to the university. They will be able to connected and foster relationship, share ideas, and enhance cultures and make this architecture worthwhile for the whole university. During the project research was undertaken on the site, case studies of student center, and climate.

Alvey, MacKenzie "Aqua Vitae Distillery" (Shahnaz Aly)
Bourbon is a big part of Kentucky culture. Bardstown, Kentucky is home to the Kentucky Bourbon Trail with eight of the most popular brands of bourbon: Four Roses, Heaven Hill, Jim Beam, Maker's Mark, Wild Turkey, Town Branch, Woodford Reserve and Evan Williams. The bourbon industry is booming and could benefit from a modern facility that incorporates more than the production. My goal was to produce a large scale, all- in- one, distillery that allows the consumer to be a part of the process. My facility includes more than just bourbon production, it gives the consumer a full experience of the bourbon culture. In order to achieve this, I researched and toured the existing bourbon distilleries in Bardstown, KY. This research along with code research, drafting floor plans, and 3D modeling the facility, has allowed me to reach my goal to design a large scale, all- in- one, distillery that provides an experience.

Archey, Casey "An Analysis of the May 3rd, 2020 Derecho" (Josh Durkee)
The May 3rd Derecho was a complex line of storms that was widespread, and moved quickly across five states and caused millions of dollars in damage. Hundreds of miles of damage and numerous injuries were recorded. As an area of low pressure, along with an abundance of moisture and a healthy atmosphere all came together, it produced a derecho that moved across 5

states in the course of 12 hours. When the line initiated in southeastern Kansas, it carried a main threat of hail. As the storm progressed and moved into the southeastern Missouri area, it carried a bigger threat of damaging winds in excess of 70 miles-per-hour, and by the map of reports, this followed through. As the complex started in Kansas, it was predominantly a cluster of strong storms, but upon its relocating into Missouri, it became linear. This study was to identify patterns synoptically for assisting in the forecast of threats as the system moved across the Midwest.

Arora, Shreeya "Detecting Gerrymandering with Computational Algorithms" (Bruce Kessler)
Partisan gerrymandering is the manipulation of district boundaries in order to establish an unfair political advantage for a particular party or group. The goal of this research project is to develop code to evaluate the current districting of a state using computational mathematics. We developed a random walk model using Wolfram Mathematica that generates thousands of district plans. The new districts continue to meet criteria regarding population bounds and precinct adjacencies. These plans are then analyzed to find normal distributions. In order to validate the algorithm, a model state, “Pentucky,” made up of 6 districts and 100 precincts, was used. Two disparate initial district plans were used as inputs for the algorithm; a consistent winning-party average resulted from both district plans. This concept is being further applied with the 3,692 precincts within Kentucky. Using registration statistics, the algorithm will generate a distribution of districting plans with hopes to guarantee equal voter representation.

Ateyeh, Ahmad "Simulation of high-speed metal forming processes" (Morteza Nurcheshmeh)
High-speed metal forming processes have been attracting increasing attention for their applicability in many industries. These processes allow the deformation of high-strength and low-density metals. Using these materials in the automobile industry would lower the overall weight of the vehicle, making it more fuel-efficient, which in turn, will help the environment. With the increase in strength and the decrease in density comes the inevitable loss of formability. Because of this, traditional forming methods are not practical and safe when forming these in-demand metals. Due to this obstacle, more promising techniques, such as electrohydraulic forming (EHF), are being explored. In this research, the Johnson-Cook material model and damage model were used to investigate the effectiveness of EHF in deforming high-strength, low-density metals. More specifically, free-forming deformation was explored from a damage standpoint using ANSYS Finite Element Analysis software. In the simulation, pressure was imposed on an aluminum 6061-T6 sheet metal and an IF 210 steel sheet metal to mimic the effect of electrodes deforming the metal in EHF. A user-defined probe was created to keep track of the damage at any given point on the sheet. Trends were noted, and in the end, an optimal setup for conducting EHF was determined.

Ayorinde, Kehinde "Synthesis Of CdS/ZnS Core/shell Nanoparticles for Hydrogen Gas Production from Water Splitting" (Lawrence Hill)
The utilization of semiconductors for the photocatalytic production of environmentally clean energy from sunlight, such as the production of hydrogen from water splitting is considered as a potential alternative to fossil fuel. In this research, we synthesized core/shell CdS/ZnS nanoparticles which can be employed as a photocatalyst. The combination of CdS together with ZnS shell enhancing the absorption of sunlight which effectively prohibits the recombination of the photogenerated electron-hole carrier. In this experiment, we used UV-Vis and fluorimetry to characterize the synthesized CdS/ZnS core/shell nanoparticles.

Bailey, Dalton "Political Identity Fusion Magnifies Liking for Political Policies Proposed by Our Own Party" (Aaron Wichman)
Research has suggested that politically motivated reasoning plays a role in forming opinions on political policies. People generally endorse whatever policies their party proposes without much regard for the policy consequences. We hypothesized that political identity fusion, a state where a person's political identity is an extension of their own personal identity, would magnify political motivated reasoning when evaluating political policies. More specifically, we sought to investigate the relationship of political ideology and political identity fusion for the liking of policies that were arbitrarily attributed to different political parties. We randomly attributed different policies to either the Democratic or Republican party, and measured how much participants liked them. We also collected information on political identity fusion and political ideology. We found support for the role of identity fusion when policies were attributed to Democrats. For these policies, identity fusion and ideology interacted such that for low-fused individuals, ideology played little role in policy liking. In highly-fused people, though, ideology predicted policy liking; liberals liked them, but conservatives did not. For Republican-attributed policies, ideology predicted liking with little effect from identity fusion.

Barnaby, Koji "Antibiotic Resistant Bacteria Gene Presence and Quantification In Karst Groundwater Systems From Fertilizer Application Under Agricultural Landuse" (Jason Polk)
The overuse of antibiotics has led to an increase in antibiotic resistance bacteria, since some antibiotics are sent into the wastewater system by waste produced by both humans and agriculture, making these bacteria more difficult to treat. The evolution of these bacteria in groundwater are a particular concern, as groundwater is used as a source of drinking water, so diseases associated with these bacteria could spread rapidly. There are no policies in place to monitor or regulate antibiotic resistance bacteria in groundwater, leaving the threat to public health unknown. The study area of Crumps Cave in Smith's Grove, Kentucky, located beneath agricultural land, is useful for examining the bacteria in the groundwater to determine if agricultural waste (fertilizer use) has an impact on the antibiotic resistant gene expression in bacteria, particularly *E. coli*. DNA isolated from these bacteria is used to determine the presence of antibiotic resistant genes for common antibiotics, and the exact concentration of certain genes present, using PCR and quantitative PCR (qPCR), respectively. Trends between the concentration of antibiotic resistant bacteria in the groundwater and the disposal of manure will be determined and used to inform best management practices for amendment application in agricultural karst settings.

Barnaby, Sachi; Krishnani, Sahil; "The Best Laid Plans of Drones in Flight: Drone Trajectory Planning and Object Avoidance" (Farhad Ashrafzadeh)
Unmanned Aerial Vehicles (UAV's) have applications in a variety of fields, including surveillance and geospatial mapping. By using a pre-programmed flight path, scientists can use drones and other UAV's with minimal experience and in various outdoor environments which increases the efficiency of their data collection; maximum efficiency for UAV's involves no human operator at all. The goal of this project is to develop a program so the Tello Ryze drone can conduct autonomous flight. We will use the MathWorks MATLAB software and its OpenCV library for computer vision to create flight plans for the drone, and we will add capabilities for object avoidance. To develop the code, we will define the flight plan with waypoints and then establish a wireless connection between the drone's sensors and the computer program. Once

established, the drone will proceed along the designated flight plan and use its camera to avoid objects in its path and adjust the flight plan accordingly. Our project connects to the Center for Energy Systems' mission to engage students using technology and will contribute to the long-term development of the Center's robotics program and student outreach. These activities were supported under the NSF Cooperative Agreement No. 1849213.

Beavin, Amanda "Pathways to Self-governance And Resilience: An Exploratory Study of Community Gardens in Louisville, Kentucky" (Molly Kerby)
Community gardens face multiple challenges to survival, including land tenure, lack of funding, lack of sustained interest, and poor infrastructure, but many successful, long-lasting gardens have found management style to be a key aspect of their success. This project studies three community gardens in Louisville, Kentucky, to investigate how self-governance, or internal management by gardeners, overlaps with other success indicators and what development processes lead to successful self-governance. Using qualitative methods of semi-structure interviews and participant observation, the researcher gathered and analyzed data relative to each garden sites land tenure, community engagement, environmental design, resource mobilization, and style of management. The researcher discovered that various pathways to self-governance exist, but some overlapping patterns relating to the social cohesiveness of the community enable effective group decision making and management. Using these insights, this report concludes with a list of recommendations for the organizers to encourage self-management and long-lasting success for Louisville community gardens. While this project is a case study with results specific to the research sites, certain findings and recommendations might be relevant to community gardens in other regions of the United States.

Birkhead, Andrew; Jacobshagen, Sigrid; "Lower Temperature Limits of Circadian Rhythms Of Phototaxis in Chlamydomonas Reinhardtii" (Sigrid Jacobshagen)
The green alga *Chlamydomonas reinhardtii* has long served as a model organism in studies on the circadian clock, a time-keeping device in all eukaryotes controlling when an organism desires to be asleep or awake. The period of the circadian clock-controlled rhythms in *C. reinhardtii* are similar to that of humans, somewhere between 24-25 hours. Knowledge of the lower temperature limits of the circadian rhythms in *C. reinhardtii* is relatively inadequate. We aspire to gain insight on how the clock responds to these low temperatures. To study the lower temperature limits, we utilized a phototaxis (algae's response to light) measuring machine and three different strains of *C. reinhardtii*. Samples from each strain were inoculated in two different media. Samples of each given combination of strain, medium, and age were placed in the phototaxis machine at 4˚C, 6˚C, and 8˚C to observe how the low temperature affects the circadian rhythm of phototaxis and its period. Early results indicate that the lower temperature limit in *C. reinhardtii* is higher than previously thought, likely being closer to ten degrees Celsius. Experimentation is still ongoing.

Bishop, Riley; Mazzoni, Brian; Hollingsworth, Elena; Fisher, Wesley; Doom, Alex; "Force Balance Development for Wind Tunnel Research" (Manohar Chidurala)
The study of aerodynamic forces induced by external air flow over objects provides significant findings that apply to an array of engineering applications such as aircraft fuel efficiency and wind turbine performance. Utilizing an educational-purpose wind tunnel in the WKU Thermofluids Laboratory, a data acquisition system through LabVIEW was created to

experimentally analyze the aerodynamic forces experienced by objects in uniform external flow by automatically performing trials and interpreting electrical measurement signals. To verify experimental results from pressure distribution data around an object, a force balance was designed to mount objects stationarily in the wind tunnel test section while directly measuring the total lift and drag forces, calculating the moment about the leading edge (for airfoils), and monitoring the angle of attack. The design includes three load cells, programmed through Arduino software and hardware, to measure the aerodynamic forces and an accelerometer, programmed through LabVIEW, that monitors angle of attack for airfoils. Successful data acquisition adequately supported by theoretical and numerical models of external flow along with credible explanation of sources of error may promote implementation of the experimental setup as a laboratory experiment for future WKU students and funding for a more capable wind tunnel.

Boling, Tyler "Daviess County High School: Reinventing Educational Buildings" (Shahnaz Aly)
Education today seems to be evolving. As technology advances, school systems around the world are making efforts to advance along with it. As we realize how beneficial technology can be for our students, we incorporate it into daily classroom activities as much as possible. But, if 2020 and the Covid-19 pandemic have taught us anything, it's that our students need more than technology. We have all the technology needed to continue teaching and learning, yet our students and our schools are still struggling. Technology is made to assist students in their interaction and learning, not replace it. Now more than ever, we are seeing how crucial social interaction is to young learning and development. Education has evolved, but our schools have not. This realization, paired with thorough research and case studies, led me to reinvent the way educational buildings are designed. Daviess County High school is a new learning environment designed to be modern, safe, easily-navigated, and technologically-advanced so that students and the community have the best opportunity to learn, socialize, educate, and play.

Bowen, Jacob; Philips, Keith; "Dung Beetle (Scarabaeinae) Species Diversity of the Highest Mountain Range in West Africa: The Nimba Mountains" (Keith Philips)
A survey of the high elevation dung beetle species diversity of the Nimba Mountain Range in Guinea was undertaken. This region is within the Upper Guinean Forest, a critical biodiversity hotspot highly threatened by human activities. The goal of this survey is to document the dung beetle species diversity of the area, describe undocumented species, investigate elevational and habitat trends in species abundance and diversity, and finally, provide baseline data for monitoring the biotic integrity of this ecosystem. Samples were collected from the study area using baited pitfall traps. Traps were strategically placed in habitats of differing type including high elevation grassland, high and low elevation moist forest, and protea savannah. Captured specimens were identified to species using taxonomic keys and voucher specimens. Abundance and diversity of each species, as well as bait and habitat type, were compared across sites. From 762 specimens studied, 46 species were diagnosed. Comparatively lower diversity than what was expected in some sites unfortunately reflect overall a declining ecosystem likely due to bushmeat hunting. Preservation will require protection from human activities and viable alternatives for the local population.

Bowen, John "An Overview of the May 20, 2019 High-risk Day in the 2019 May Tornado Outbreak" (Josh Durkee)

Severe weather has a large impact on many people who live in areas that are prone to tornadoes. That is why when the Storm Prediction Center (SPC) issues a high-risk warning for severe weather people pay attention. Weather service, storm chasers, TV meteorologists, and the average citizen all pay attention as they know lives are at risks. While the atmosphere is primed for severe weather on high-risk days the outcome may not be as predicted. On May 20, 2019 the SPC issued its first high-risk outlook since 2017, but the severe weather that did occur was not as intense as anticipated. With the language used by the SPC, large, long track, and dangerous tornados were expected. However, while there were tornadoes, there was only 1 injury and minimal damage, which is an incredible outcome compared to what was expected. This study will examine the synoptic scale forcing and mesoscale ingredients that developed leading up to the day of this event. It will look at the system as it developed and show that might have contributed to the muted severe weather that took place. The SPC is not always correct with their predictions, but it is important to understand why they made the prediction and what could have happened to cause that prediction to be off.

Bragg, Rachel; Redifer, Jenni; "Cognitive Resources and the Modality Effect: Input Modality Pairings Influence Dual-task Costs" (Jenni Redifer)
We investigated recall performance and cognitive load during simultaneous tasks in different vs. same modalities. We expected larger dual-task performance costs (H1) and higher cognitive load (H2) when participants completed two tasks in the same modality than when two tasks were completed in different modalities. Participants completed a list-learning task simultaneously with a distractor task in a visual-control, visual-visual, and visual-auditory condition. Following each condition, participants completed the NASA-TLX to measure their perceived cognitive load. A repeated measures ANOVA revealed significant differences in recall performance between conditions. Participants recalled fewer words with a visual secondary task, compared to an auditory secondary task, or no secondary task. There were significant differences in cognitive load between conditions. Although both the visual and auditory conditions produced significantly more cognitive load than the control condition, they did not differ significantly from each other, failing to support H2. The results supported H1, which suggests that completing dual-tasks in the same modality leads to a greater decrease in performance. Performance on the primary task was minimally affected by the presence of a secondary task in a different modality. However, the results did not support H2 in that there was no significant difference in perceived cognitive load between the experimental conditions.

Bray, Kylie "Investigating Special Education Services for Elementary English Language Learners within the South-central US:" (Trini Stickle)
This study explores the nationally-reported lack of special education intervention for elementary-level, English Language Learners (ELLs) (Batt, 2008) within the local area of South-central Kentucky. Current research indicates that the English Language Learner (ELL) population falls victim to disproportionality in special education (Shenoy, 2014, pp. 33-34). This is often the case when second language instruction is insufficient and ELL students do not receive proper language support (ESL teachers, instruments in native languages); thus, ELLs are approximately three times more likely to be referred to special education (Artiles & Ortiz, 2002). A survey measure was provided to in-service teachers who work in areas of high immigration and refugee populations, areas in which service and financial constraints are likely in tension. From my 26 survey respondents, a minority reported difficulties in ELLs assessment for special education

needs; a greater concern reported was the lack of human and material resources for ELLs' language development in order for student to participate and/or be assessed. Preliminary implications suggest the need for changes in general education teacher programs to better prepare all teachers for the increased population of ELLs seen across the US, particularly in areas in which funding for designated TESOL educators and materials are absent due to already constrained budgets.

Brosky, Madeline; Gani, Nahid; "Investigating Volcanic Eruption of The Ethiopian Plateau Flood Basalt in Relation to Past Climate Change" (Nahid Gani)
The Ethiopian Plateau in East Africa has undergone a widespread flood basalt volcanic event around Oligocene time, covering an area of >500,000 km2. This was followed by numerous younger shield volcano-building episodes in the Miocene and Pliocene times, as well as continental rifting. The extent of the flood basalt was mapped using ASTER band combination for basalt spectral signature and basalt extraction index (BEI). Twelve basalt samples were collected from the plateau for thin-section to characterize their texture, mineralogical composition, and degree of chemical alteration. Petrographic and SEM results were combined with the basalt extent map to investigate magma source and spatial variation of magma composition. Results of our thin-section petrography indicate that these basalts are composed of mostly plagioclase feldspar, olivine, and opaque minerals. The textures of the samples included porphyritic, flow-aligned, amygdaloidal, and poikilitic. The analysis of the mineral content and texture provides insights into the geologic and environmental conditions present on the Ethiopian Plateau at the time of these basalts' crystallization and emplacement. Results of this study will provide fresh perspectives of the nature of volcanic eruption of the Ethiopian Plateau flood basalts and its potential impact on past climate change.

Brown, James "A Synoptic and Mesoscale Analysis of the April 12-13, 2020 Easter Tornado Outbreak" (Josh Durkee)
An upper-level low over the southwest United States evolved into a negatively tilted shortwave trough as it moved over the southeastern United States. A warm front steadily moved northward during the morning and afternoon hours on Sunday, April 12. Throughout the outbreak, a total of 140 tornadoes touched down across 10 states, inflicting widespread and locally catastrophic damage. The strongest tornado was rated high-end EF4 and occurred in Southern Mississippi. The SPC remarked that "this is an exceptionally rare event" producing estimated winds of 190 mph and a width of 2.25 mi. With a total of 32 tornado-related fatalities, it was the deadliest tornado outbreak since. 2014. The data sources were acquired using https://www.ncdc.noaa.gov/ from the Archived NAM and GFS models from April 09-13, 2020. With the analysis, the QG Forcing was based primarily on the Omega equation. Both terms contributed significantly to vertical motion in the area of interest, Positive Vorticity and warm thermal advection. This outbreak was directly related to Cyclogenesis from the cut off low developing across the US. The purpose of the paper is to examine this outbreak through different synoptic and mesoscale analysis to better understand how it developed.

Brown, John "Synoptic and Mesoscale Analysis of the Derecho Event On June 28, 2018" (Joshua Durkee)
The purpose of the research paper is to conduct a thorough synoptic and mesoscale analysis of the June 28th, 2018 derecho event. The study aims to understand the synoptic and mesoscale

ingredients that resulted to the derecho that occurred on June 28th. From June 25-27th, a low-pressure system developed in the Great Plains which brought some precipitation and several thunderstorms. However, the low-pressure system moved to the Northeast and deepened from building ridge caused by the strong high pressure which then created a major heatwave in the central United States. From the strong high pressure, there was a stationary front that was formed but then became to destabilized on June 28th. From the high temperatures and dew points along with the establishing stationary front which created extreme instability in the atmosphere lead to a spark of mesoscale convective systems which eventually lead to a derecho event from their strong downbursts that occurred in the afternoon hours of June 28th. The derecho affected many parts of the southeast which included central Tennessee and the state of Alabama. The archive data for the derecho was collected from ncdc.noaa.gov and the maps were processed with utilizing the IDV software.

Brunt, William; Hancock, Dylan; Lee, Ting-Hui; "Light Curves of the Rr Lyrae Variable Star Rx For" (Ting-Hui Lee)
RR Lyrae stars are stars whose brightness changes with a period of a few hours to a day. This period is longer for stars that are intrinsically brighter. Using this relationship, we can find the intrinsic brightness of an RR Lyrae star by measuring its period and compare it to the apparent brightness to determine its distance from our solar system -- a very important quantity in astronomy. We have obtained observations of RX Fornacis (RX For) every 5 hours from the Las Cumbres Observatory in four color filters (B, V, ip and zs) over a time range of three weeks. Our observations allow us to plot the star’s light curves and determine its period in each color. These results will subsequently be used to determine the distance to the star and compare it to other estimates from other research groups. This project is part of a larger investigation into variable stars using robotic telescopes.

Buoncristiani, Nicholas "The Validity of Perceptual Recovery Status as a Marker of Intra-Session Recovery During Intermittent Sprint Work" (Danilo Tolusso)
Monitoring recovery status is crucial in sports performance for limiting fatigue and maximizing performance. A variety of tools have been developed to assess recovery, though they are often impractical due to their time inefficiency, cost, and invasive nature. The perceptual recovery status scale (PRS) is a subjective scale developed to monitor recovery status between bouts of exercise. The aim of the current study was to assess the validity of PRS as a marker of recovery between bouts of sprinting. Ten healthy men volunteered for the study. Participants completed two separate experimental sessions separated by 24 hours. Each session consisted of three running-based anaerobic sprint tests (RAST) separated by a 7-min recovery period. Peak and mean power outputs for each RAST were used as objective recovery indicators and PRS was queried with 10 seconds left within each recovery window. Repeated measures correlations were used to assess relationship between objective and subjective performance indices. A strong correlation was found for PRS and mean and peak power during both baseline (r=.540; r=.869) and 24 hours (r=.631; r=.849). Results indicated that PRS offers a non-invasive means by which sport coaches can assess intra-individual recovery status before performance begins and during the associated rest periods.

Burden, Taylor "To Worship and Conserve: The Role of American Christian Churches in the Conservation of Deaf Culture" (Ann Ferrell)

In this paper, I will draw on my fieldwork in the Owensboro, Kentucky deaf community. This research primarily focuses on Gospel Community Church, one of 39 deaf churches in the United States and an advocate for deaf individuals in Owensboro. My fieldwork at Gospel Community Church serves as a case study for the relationship between evangelical churches, like GCC, and deaf congregation members. With churches poised as cultural hubs for deaf individuals, churches must respond by working with deaf individuals to conserve deaf culture. This manifests as giving authority to deaf individuals to control the conservation and growth of their own language, especially in the context of church-sponsored ASL classes and performances. Other steps include providing tools that allow deaf individuals to equally participate in worship services and group gatherings and making a committed effort to empowering deaf individuals by visibly using deaf individuals in its worship services. In short, this paper reveals that churches must be champions of equity by intentionally, willfully, and joyfully offering tools that allow deaf individuals the same access to the Gospel with conservation in mind.

Bush, Austin "Convergence of Reno: Utilization of Design to Assist Mental Health Care" (Shahnaz Aly)
My project is an Outpatient and Partial Inpatient Mental Health Center located in Nevada. Nevada is considered the worst State in the US overall for Mental Health Care, with one of the main reasons being the poor distribution of facilities across the state. All but one county is labelled a shortage area for mental health, this is all areas except 2/3rds of Las Vegas. Some additional problems like low-income areas and significant travelling distance have affected many people's options for receiving mental health care, and a large and strategically placed center can alleviate that. Mental health can also be assisted through design and landscape; this project has heavily focused on how architecture assists in the care of mental health and the wellness of the users. Design choices and layouts have been strongly influenced both by how individuals will perceive them, and through scientific studies which recommend particular materials, styles, designs, and other features. This project also helps to solve natural issues linked to mental health, such as Nevada's low amount of greenery and vegetation.

Caldwell, Emily "Effective Community Engagement Programs in Contemporary Concert Dance Companies" (Amanda Clark)
Arts education is extremely important yet underrated and underfunded in our country today. A variety of professional dance companies provide educational opportunities in dance and other areas of the arts for youth and others within the community as a means to combat this problem. This project is a compilation and synthesis of the student's research on how to most effectively create and implement children's outreach programs in contemporary modern concert dance companies. The purpose of this research is to analyze how professional dance companies give back to their communities through engagement with children via classes, performances, workshops, etc. and to determine the most effective methods to create, advertise, and execute these various programs. A model program devised with this information will also be presented.

Camfield, Caroline; Ashrafzadeh, Farhad; Priddy, Clay; Buendia, Ali; "KFC: Kentucky Factory Cobots" (Farhad Ashrafzadeh)
This yearlong project created the foundation for a research and educational platform to teach collaborative robotics (cobotics) to interdisciplinary WKU engineering students. Since collaborative robots (cobots) are becoming increasingly common in the manufacturing field, this

project's goal was workforce development. In the first half of our work, we defined and planned for the project by completing a literature review, choosing a cobot to purchase and the appropriate simulation tools to utilize, and the learning of preexisting robot simulations. In the second half of the project, we more thoroughly learned the required simulation tools and developed a preliminary cobot perception simulation, created four different educational modules, outlined a grant proposal and future course, and presented a poster at an international engineering education conference. As this project is continued, the Center for Energy Systems (CES) will build off of our work, using it as a foundation for future research, which, through grants, will provide additional funding to the school. Embracing cobotics will expand our research capabilities at WKU and engage students in emerging technology, aiding in their recruitment and retention. These activities were supported under the NSF Cooperative Agreement No. 1849213.

Campbell, Olivia; Goodrich, Greg; "Drought in the Breadbasket of America and the Influence of Oceanic Teleconnections" (Greg Goodrich)
From 1980 to 2020, drought events accounted for only 11.4% of the billion-dollar disasters in the United States (U.S.) yet caused the second highest total amount in damages at $236.6 billion. With the average cost of a drought being upwards of $9.5 billion, these natural disasters can create serious problems in agriculture. Drought is defined as a period of below average precipitation that causes damage to agriculture and water supply. Previous research has linked drought events in the U.S. Great Plains to oceanic teleconnections in the Pacific and Atlantic basins, indicating the influence of the El Niño – Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and the Atlantic Multidecadal Oscillation (AMO). This study looks to identify areas of the Great Plains where drought has the strongest correlations to ENSO, PDO, and AMO. The states studied are Iowa, Texas, Illinois, Minnesota, Texas, Nebraska, and Kansas because these rank as the second through seventh most agriculturally productive states in terms of crop and livestock production. Preliminary results show that most of this region displays a relationship between drought and the ENSO and PDO, with less of the region displaying a relationship with the AMO.

Casada, Nicholas "Bowling Green Entertainment Venue" (Shahnaz Aly)
My project involved designing a large entertainment center containing an auditorium, café, and lobby with concessions. Entering the project, my design philosophy included having a modern design, an auditorium with maximum comfort and convenience, and a fully functioning café. The building holds an audience of 2,000 while providing areas for individuals to eat and lounge in the café and lobby seating. The location chosen was a low sloped plot of land at the intersection of Dillard Road and Nashville Road in Bowling Green, KY. This area provided a comfortable amount of space for the construction process and extra parking. My case studies had a large influence on the look and structure of the building including the steel panel curves roof, triangular glass panel extrusions on each side, and the open design of the indoor lobby. I started with forming my design philosophy, which helped me to make decisions throughout the entire design and then designed the entire building around the flow and egress of customers. Next, I added the extruded panels, cutouts, and curved roof before finally checking all designs with code. The result is a spacious entertainment center providing comfort and convenience to anyone using its facilities.

Cassity, Hunter "Old Style with a Touch of Modern" (Shahnaz Aly)
How did I bring an old idea to new light? This is the question I asked myself when designing a new orchard. During my childhood I was always fascinated by Jackson's Orchard in Bowling Green, KY, however once you grow up this place no longer seems as magical. Jackson's Orchard has been a great place for many but leaves room for improvement. That was the purpose in designing this new orchard close to the Bowling Green area. Throughout the project the ideal location, floor plans, attractions, and even what crops would be grown on site were decided. The key features of this orchard include a large restaurant which serves food grown on-site as well as from local vendors, a place where students come to learn about agriculture, wedding venue, area where outside vendors have a space to sell and spread their knowledge, and much more. This orchard not only serves as a great place to get away from the city, but also learn new things, hold a wedding event, and come have some of the freshest food possible.

Caswell, Nicholas; Stenger-Ramsey, Tammie; McCreary, Allie; "Camp Staff Burnout" (Tammie Stenger-Ramsey)
Summer camp staff, without a doubt, will face the challenge of 'burn out' within the duration of their time at camp. Wanting to get a basic idea of where camp staff are mentally at the start and at the end of the summer (2019) session is a way to quantitate which camps suffer from 'burn out' more or less than others. The purpose/goal of this study was to see where the staff from each camp within the Kentucky 4-H organization was within a 'burn out' mindset, testing their responses to questions at the beginning of the summer session and at the end of the summer session. The way the data was collected was through a Qualtrics online survey that the participants were able to access freely. The questions range from the participant energy level, overall mood, and average stress level at the beginning and end of the summer session. What this can show future camp administrators is how they can potentially alter their leadership approaches throughout the summer session so the camp staff are less likely to burn out. This was a basic research approach that will be tested again in the future to lead to a more applicable approach.

Cate, Allison ""They Say a Jewish Demon Has Possessed The Groom": Folklore and the Folkloresque in The Film "demon"" (Ann Ferrell)
The 2015 Polish horror film "Demon," written and directed by Marcin Wrona, chronicles the possession of a young groom on his wedding day by a dybbuk. In Jewish folklore, a dybbuk is the soul of a dead person that is capable of possessing the living. Alongside the literal narrative of possession, the film also serves as a poignant allegory for relations between Polish Jews and non-Jewish Poles during and after the Second World War. The use of a revenant specific to Jewish folklore positions the film to effectively scrutinize contemporary Polish discourses surrounding the Holocaust—particularly those concerning the extent to which Poles were complicit or even active participants in the extermination of their Jewish neighbors. In this capacity, the film's dybbuk provides a metaphor of being haunted or possessed by a disquiet past that remains a persistent presence and that actively refuses to be forgotten. This paper will apply a folkloristic perspective in analyzing "Demon," as well as locating it within current academic discourse surrounding the influence of folklore on film. This paper will also address the film's use of dybbuk possession to comment on Polish society's struggle to reckon with its history of anti-Semitism.

Cecil, Matthew; Polk, Jason; "Examining Hydrogeological Dynamics of Baselevel and Reverse Flow of the Green River and Major Springs of Mammoth Cave, Kentucky" (Jason Polk)
Mammoth Cave is one of the most studied caves in the world, but lacks hydrological data on the recharge/discharge dynamics of its primary spring outlets, Echo and Styx Springs, during varying moisture conditions and reversal events. The Green River, which is the primary receiving stream for these springs, can backflood and reverse flow into the springs, causing an influx of river water that can cause contamination and influence the dissolution of the cave. Data were collected starting in January 2021 and included water samples for isotope and geochemical analyses at 13 sites, water levels at five sites, and GIS analysis of groundwater basins. These data were used to determine the conditions during which river reversals occur at the two springs and how epikarst and surface rainfall recharge the system during storm events to create competing hydraulic head pressures. Results from this study aim to improve the understanding of karst groundwater flow and its implications in teleogenetic karst systems under the influence of human impacts, including dams and landuse change. River reversals appear to be moderated by cave recharge dynamics during certain flow conditions, while during high river discharge, it can exceed this threshold and reverse into the cave.

Chang, Samuel; Zhao, Qin; "Could Directly Shifting Self-doubt Mindset Reduce the Negative Effects of Self-doubt?" (Qin Zhao)
An experiment was conducted to examine (a) the malleability of the mindset/attitude about self-doubt; and (b) whether shifting to a more positive mindset would reduce or reverse the typically observed negative effects of self-doubt on psychological well-being and task performance. Participants were randomly assigned to view one of two versions of a slideshow: “Self-Doubt: The Strong Motivator” or “Self-Doubt: The Silent Antagonist”. The two slideshows presented arguments and research evidence about the positive and negative effects of self-doubt, respectively. Participants’ mindset toward self-doubt was measured before and after viewing the slideshow. In addition, participants completed measures of self-esteem, positive and negative affect, reasoning performance, task anxiety, and task engagement (attention, effort, and enjoyment). The results showed a significant change in self-doubt mindset in the hypothesized direction, showing its malleability. However, counter to the hypothesis, shifting to a more positive attitude about self-doubt increased (rather than reduced) the negative effects of self-doubt on task score and engagement.

Cherry, Meredith "Hallucinogenic and Sedative Drug Treatment and Its Impact on Mental Health Nursing" (Kim Link)
Mental health nursing is a complex and radically changing discipline that must continuously adapt to evidence-based practices, including the use of alternative options for the treatment of mental illness. There has recently been increased research into the use of hallucinogenic and sedative drugs for the treatment of mental illness. Hallucinogenic and sedative drugs were examined as potential treatment options for a variety of mental illnesses in the 1960s, although these trials were ceased by the government due to human safety concerns. The United States Food and Drug Administration (FDA) has recently approved trials to study the use of hallucinogenic drugs to treat mental illness, and sedative drugs, such as ketamine are currently FDA approved to treat major depressive disorder. This presentation will provide an overview of the literature regarding the history of hallucinogenic and sedative drug trials, as well as current research on the use of these drugs to treat mental illness. The potential impact that these drugs

could have on mental health treatment will be discussed, as well as the evolution of the mental health nursing role, especially as it pertains to these innovative treatment options.

Chestnut, Alyvia "Sustainable City of Virtual Reality" (Shahnaz Aly)
Volhoubarr Grad Realite by Elon Musk lives up to be an innovative smart hotel designed to be its own city. Showcasing how modern architecture can be paired with today's advanced technology to create an educational utopia. The first objective was the idea of switching the traditional concept of humans as the main inhabitors to Tesla vehicles being the main guest allowed for a system of underground tracks and channels within the hotel to be developed into a vending system where cars are able to sleep within the hotel. This allows for individual guests to sleep with their cars at night and test them by day on excursions within innovative museums located throughout the hotel. Advanced integration does not stop here for technology can be used to allow guests to express their individualism through virtual customization of all hotel walls. The result is a modern marvel of technology that allows the guest a different experience each time they lodge, whether it be in the virtual exhibits, or in the unique room designs created with each stay. Volhoubarr Grad Realite will be equipped to educate individuals from on-site food sourcing, to methods of care around the hotel, to the hotels surrounding environment. Thus, creating a safe and enjoyable environment at all times for all living organisms.

Chhabra, Sahil; King, Rodney; "Discovery and Analysis of Novel Mycobacteriophage Lucifer906" (Rodney King)
Lucifer906 is a newly discovered mycobacteriophage isolated from a soil sample gathered from a flower bed in Brentwood, TN. Plaque purification was repeated several times. A small amount of the soil was added to growth media containing the host Mycobacterium smegmatis. After overnight growth (enrichment), the material was filtered to remove the bacteria. Dilutions of the filtered enrichment were plated with *M. smegmatis* cells and the formation of plaques was monitored. A single, isolated plaque was recovered and suspended in phage buffer. This process was repeated several times to ensure purity of the phage. Genomic DNA was extracted from purified phage and the concentration was measured. The DNA was digested with different restriction enzymes and the products were examined by gel electrophoreses. The gel electrophoresis patterns were compared to other phages in a database to determine genetic similarity. Lucifer906 was archived at the University of Pittsburgh and is awaiting sequencing and subsequent annotation.

Clark, Caroline "Autism and the Foster Care System in Kentucky" (Christina Noel)
According to the CDC, one in 59 children are diagnosed with a condition that would fall under the Autism Spectrum Disorder. (Centers for Diseases and Prevention, 2020). With this number in mind, over 10% of those in the foster care system also have an autism diagnosis. The purpose of this project was to uncover what the general public knew and believed about both subjects. Any misconceptions, assumed facts, and opinions about both foster care and autism were collected through anonymous surveys. The data were then analyzed and examined to create an app to benefit current and future foster parents who foster those on the spectrum. This paper includes the methods of this research, as well as the implications of the data. This paper also uncovers the connections between individuals with autism who are in the foster care system in Kentucky, and identifies several ways to bridge the gap for foster parents to foster an individual with autism.

Cooper, Chloe "Enhancing WKU Sustainable Food Systems Through Education and Local Agriculture Development" (Leslie North)
In an effort to increase the amount of locally sourced food utilized by dining services at WKU, the Office of Sustainability and the WKU Agricultural Farm have partnered to establish garden spaces on campus. This project developed a detailed plan for implementation of this effort. In addition, a plan to educate students and the local community alike on the benefits of sustainable farming and locally sourced food, while also creating profiles on local farmers from whom the university could buy crops in order to further supplement items for dining services. Using these spaces to supplement available options for dining services will provide nutritional value as an added benefit of growing food that is sustainable and locally sourced. In addition, the use of these crops will be used as way to educate the WKU community on the ways in which food can be grown sustainably and importance of doing so.

Copeland, Allyson; Amacendes, Lizbeth; Hatfield, Makenna; "Age Differences in the Effects of Plausibility and Perspective-Taking While Reading Counterfactuals" (Matthew Shake)
Prior research suggests that cognitive aging has multidirectional effects on reading (Stine-Morrow et al., 2006), such that skilled readers may be better able to compensate for declines (Shake et al., 2009). However, it remains unclear how cognitive aging might affect the online processing of counterfactual sentences, which are similar to hypothetical scenarios. To help address this gap, I investigated whether cognitive aging causes changes in how we read counterfactuals, and whether this is moderated by (a) plausibility and (b) perspective. Reading patterns were measured using eye-tracking technology. Individual differences were measured using working memory, processing speed, and vocabulary tasks. I expect that reading will be disrupted immediately for anomalous implements, with delayed effects for implausible implements. I predict that personalization will improve processing depth. Data was collected from 24 participants, which included 20 younger adults (YA; mean = 19.7 years) and 4 older adults (OA; mean = 69.5 years). Operation span scores were higher for YA (mean = 29.75) relative to OA (mean = 21.75), while vocabulary scores were lower for YA (mean = 10.2) relative to OA (mean = 19.4). This study helps reveal subtleties in the time-course of semantic access and sentence comprehension in readers of different ages.

Craig, Kaitlynn "The Effect of School Return During Covid-19 Pandemic on Children's Physical And Mental Health" (Miranda Peterson)
Flashback to midnight on January 1, 2020. It was New Year's Day, the beginning of a new decade. Many were filled with excitement and hope to make this year the best one yet. Little did we know that our entire world would be turned upside down a short two months later with a worldwide pandemic, the coronavirus. COVID-19 has affected us all in many ways. Some of us lost our jobs, others struggled to maintain our education virtually, and unfortunately, too many lost their lives. As a nursing student, fear grew while imagining the role of becoming one of the frontline workers battling this invisible enemy. One of the most challenging and divisive decisions during this pandemic has been what to do with our schools. While no one knows for sure what the right choice is, through a nursing perspective and love for children, the investigator wonders how our youth is facing this pandemic, and what impact social isolation and a sudden halt in their everyday routine and schooling has made on them. In this thesis, we will examine the effect COVID-19 has had on our youth, both physically and mentally, and how reopening schools plays a factor.

Danford, Ellen "Informing Sustainable Policy with Carbon Sequestration Analysis" (Leslie North)
Urban forestry is an environmental solution for an increasingly city-centered world. The ecosystem services that trees provide in natural settings, including, carbon sequestration, oxygen production and aesthetic beauty also apply in urban settings. Every tree on the Western Kentucky University (WKU) urban forest provides these services and each tree was measured to determine how much carbon they sequestered a year on average between 2015 and 2020. With an interactive map of the forest and its carbon sequestration, the condition of the forest and change over the five year period was analyzed. Comparing the welfare of the forest with the plans and management strategies of WKU produced an understanding of the effectiveness of the WKU tree care policies. Consistent construction was found to be the main obstacle to growth of the forest and the main cause of tree loss. A lack of communication between departments was found to be the main barrier between the tree care plan and its realization.

Davis, Britton; Polk, Jason; "Karst Hydrogeologic Investigation of Cave Inputs Related to the Lost River Cave Gasoline Leak" (Jason Polk)
This research project revolves around a newly-discovered cave in Bowling Green, Kentucky. This cave, named Pit Stop Cave, was discovered during the investigation of the gasoline spill within Lost River Cave in 2019. The goal of this research is to study and understand the hydrologic connectivity of Pit Stop Cave within the Lost River Cave System. Several methods of investigation will be used to understand the role that the cave plays in the karst groundwater system as an epikarst input. These methods include cave survey to measure the extent of the cave, using fluorescent dyes to trace the flow route of water through the cave and its contribution to groundwater flow, and measuring water levels and water quality using dataloggers to collect continuous, high-resolution (1-minute) data on cave's hydrologic response during storm events. These data will also be used to analyze how the cave responds to rainfall, how fast it flows into the Lost River, and any residual water quality issues from the gasoline leak. The results will be shared with agencies within Bowling Green in order to improve contaminant monitoring and response planning for future spills or pollutants entering the system.

DeCelle, Christian "Developing an Integrated Karst Evaluation and Management Priority Tool Using a Comparative Case Study Application in Alaska and Belize" (Jason Polk)
Karst terrains are complex landscapes which are sensitive to human disturbance. Human activities have destroyed caves and polluted karst across the world. Many of these landscapes are protected and designated as national parks or UNESCO Biosphere Reserves. Despite the widespread protection of karst landscapes globally, there is no standard method of evaluating and prioritizing management of karst areas. In recent decades, karst management has typically taken form in cave and watershed protections while ignoring the wider needs of karst. Since 1996, researchers have been developing indices to help managers assess the groundwater vulnerability, karst disturbance, and karst significance. These indices vary in their application, validity and ease of use, but have never been combined into a single toolbox for managers of protected karst lands. This project aims to reconcile the independent uses of cave and karst indices, each covering only one aspect of karst management, into a comprehensive, holistic, and easy to use toolbox for identifying Karst Management Priority Zones on protected lands. The project will attempt to achieve this through a thorough review of existing karst management plans, strategies,

and goals, as well as a systematic review of existing karst indices.

Deering, Austin; Polk, Jason; "An Investigation of Groundwater Hydroclimate Dynamics Using an Isotopic Calibration Study in South-central Kentucky" (Jason Polk)
Epikarst systems are often very complex and dynamic, with storage, flowpaths, and mixing dynamics considered highly variable. This research better characterizes the epikarst zone using high-resolution data in south-central Kentucky's Crumps Cave. Data and statistical analyses were applied to high-resolution geochemical data collected from a multi-parameter water quality sonde set to 10-minute intervals, isotope samples (18O/16O and2H/1H) collected on a weekly basis, and data loggers collecting discharge measurements between the years 2011-2018 at an epikarstic waterfall (WF1) and surface site. Weather data were collected at 10-minute resolution to aid in evapotranspiration calculations and to create a LMWL with precipitation amount-weighted isotope values. The results indicate a homogenizing effect in the isotopic signature at WF1, which implies mixing taking place in the epikarst zone. The LMWL deviated slightly from the GMWL due to relative humidity and evaporation differences shown by d-excess. Using these data, epikarst storage times are better understood to vary based upon storm intensity, precipitation amount, and evapotranspiration rates. The results of this study should help aid water management organizations to better understand the dynamics of this epikarst system leading to BMP's to provide greater protection for the water quality in agricultural settings relying on groundwater.

Dellecave, Olivia "Synoptic and Mesoscale Analysis of the May 27th, 2019 Nuckolls County, Nebraska EF-0 Tornado" (Josh Durkee)
From May 17th-30th, 2019, a tornado outbreak shook the nation, producing 374 tornadoes that ranged from EF-0 to EF-4 on the Enhanced Fujita scale. Of the states impacted, Nebraska saw an EF-0 touchdown on the most active day of the outbreak, May 27th. No lives were lost, but the storm showed no mercy for local infrastructure across the city of Superior. To understand why a storm of this status took place, a synoptic and mesoscale analysis is imperative. In order for a proper discussion, specific levels of the atmosphere, with the exception of differentials that contain multiple layers, and Skew-T diagrams must be considered. The maps that portray these levels provide an outlook of how atmospheric factors such as jet streaks influence the progression of both shape and path of synoptic-scale features. Other noteworthy variables include vorticity and thickness, as well as the advections of both. Skew-T diagrams provide a vertical profile of the atmosphere, including the presence of wind shear through hodographs. Essentially, these will be tested through equations based in theory to determine if quasi-geostrophic (QG) forcing played a role in the formation of this storm with the help of mesoscale components.

Dick, Olivia; Benningfield, Chloe; Mills, Emma; Woodward, Kelsey; Ellis, Annalee; "Examining the Relationship Between Coronavirus Infection and Mental Health" (Matthew Woodward)
Approximately 8% of individuals will develop Posttraumatic Stress Disorder (PTSD) at some point in their lifetime. Furthermore, PTSD has been associated with other mental health disorders and risky behaviors, including substance use, increased levels of depression and anxiety, and suicidal ideation. Notably, although studies have documented elevated rates of mental health problems in general during the COVID-19 pandemic, little is known regarding whether COVID-

19 infection increases the risk of PTSD and other mental health problems. The present study will address this gap by examining the relationship between COVID-19 infections, either directly or of loved ones, and a variety of mental health outcomes. Participants included 254 young adults attending a large Midwestern university who completed an online survey assessing COVID-19 infection history and various mental health outcomes, including PTSD, depression, anxiety, stress, and loneliness. Analyses will examine COVID-19 infection severity of participants and their loved ones, including hospitalization and/or death, and examine whether severity of COVID-19 infection is linked with worse mental health outcomes. The results from this study will contribute to the much-needed research surrounding the psychological impact of COVID-19, and pandemics in general, as well as how disease-related trauma affects mental health.

Dickinson, Eli; Burch, Katrina; "Psychosocial Work Influences on Adaptive Performance" (Katrina Burch)
The present study seeks to understand why some employees may be more or less able to adapt to the changing work environment. Adaptive performance can help employees to be resilient to technological advances, economic factors, and/or cultural shifts, making it an important form of extra-role performance. According to conservation of resources (COR) theory, one reason employees may fail to adapt is because they lack resources that are required in order to be adaptive. We propose that the resources needed for adaptive performance aggregate in a resource caravan. Job embeddedness is comprised of links, fit, and sacrifice that is directly related to turnover, and is a proposed resource caravan that may facilitate more adaptive performance of employees. One resource that may be associated with adaptive performance through job embeddedness is psychological capital. On the other hand, job demands (i.e., family-to-work conflict, stress) can theoretically deplete or diminish resource caravans, thus impacting adaptive performance. In this study we will examine the direct and indirect effects of job demands and resources on adaptive performance via job embeddedness using COR theory as a framework for understanding this increasingly important form of extra-role performance. Future research and practical implications will be discussed.

Dominguez, Raquel "A Meteorological Analysis of the March 3, 2020 Tornadic Event Over Macon and Lee County, Alabama" (Joshua Durkee)
The devastating severe weather outbreak that occurred on 03 March 2019 led to one EF-4 tornado that roared through eastern Alabama. Known for its extreme wind speeds, size, and duration, this tornado came close the high death toll seen with the 20 May 2013 Moore tornado. This study takes into account the Quasi-Geostrophic and the Pressure Tendency equations in order to analyze the necessary synoptic and mesoscale scale features that led to this catastrophic event, with a specific focus on Macon and Lee County, Alabama. Thus, an overview of what these equations are and what their components mean will be discussed for better understanding. Upon analysis, upper air maps, hodographs, and skew T's displayed the required forces, such as upward motion and warm air advection, present prior to and during the event for it to be well forecasted by the two theoretical equations. Assessing these features with the guidance of these two equations will provide insight as to whether or not this tornado was forecasted well by the National Weather Service office at Birmingham, Alabama and the Storm Prediction Center.

Driehaus, Alexandra; Dobrokhotov, Vladimir; Novikov, Ivan; "Collection of Gas Chromatography Signals for the Development of Scent Categorization Algorithm" (Ivan

Novikov)
We present the development of an experimental gas chromatography (GC) apparatus for chemical analysis. Obtained data is used to create an algorithm that generates a verbal description of chemical scents. Scents belong to different families, decided by common descriptors. For example, scents with notes of lavender and rose fit into the floral family, whereas notes of cut grass fall into the green family. Andrew Dravnieks released “The Atlas of Odor Character Profiles” (1985), a collection of verbal descriptors ranked for various chemicals. The applicability of the descriptors is used to categorize each scent into their corresponding families. Analyzing chemicals using an experimental apparatus can quantize these known scents, and can create a chromatogram for each. Collecting chromatograms of known scents corresponding to known descriptors provides a database. A Convolutional Neural Network created with this correspondence generates a verbal description of unknown scents. The project is supported by the KY NSF EPSCoR URE program.

Duchette, Cathryn; Tinius, Rachel; Stone, Whitley; Blankenship, Maire; Tomes, Ariel; "The Influence of Prenatal Yoga on Mental Health in Pregnancy During the COVID-19 Pandemic" (Rachel Tinius)
During the COVID-19 pandemic, the mental health of expecting mothers is critical. Studies have demonstrated increased levels of stress and anxiety for expecting mothers. Prenatal yoga has been shown to be effective for improving mental health during pregnancy, but no research has been done to determine the efficacy of prenatal yoga for mental health during a pandemic. The purpose of this study was to determine the influence of a 10-week prenatal yoga program on mental health in pregnancy during the COVID-19 pandemic. Women were randomized to a yoga intervention group or control group. The yoga group participated in 10 weeks of prenatal yoga. Baseline surveys demonstrate high levels of anxiety and depression, with an average depression score of 8.33 ± 4.89 (score of 10 represents possible depression) and an average anxiety score of 39.04 ± 12.54 (score of 39+ represents clinical significance). Post-intervention, the yoga group had significantly lower anxiety ($p=0.007$) and depression than the control group. Surveys administered before and after one session of yoga suggest that immediately post-yoga session, women feel significantly less depressed ($p=0.015$) and less tense ($p<0.001$). The findings of this study may provide clinicians with valuable information regarding exercise options for patients during this pandemic.

Einhorn, Madelynn "How Often Do South Koreans Think About Inter-Korean Issues? Evidence from an Experimental Survey" (Timothy Rich)
How often do South Koreans think about North Korea? Conventional wisdom assumes that South Koreans frequently think of their Northern counterpart, whether due to interest in unification, concerns about security, or other factors. Yet, this assumption has rarely been tested. Through two original surveys, I find that South Koreans rarely think of North Korea in general or the specific issues of North Korea’s nuclear weapons, citizens, or reunification. Additionally, I find that thinking about North Korea influences perceptions ranging from unification, humanitarian issues, and the military. These findings suggest challenges to crafting effective North Korea policy with public consent.

Ellis, Annalee; Cotney, Sarah; Collins, Makayla; Woodward, Kelsey; Woodward, Matthew;

"Examining the Emotional Effects of Social Media Use" (Matthew Woodward)
Several studies have identified a link between social media use and worse mental health problems, such as anxiety and depression. Despite this, little research has examined whether increased social media used is associated with worse PTSD symptoms, which is a related but distinct condition. The current submission will present data examining whether social media use, assessed as amount of time spent on social media, number of social media platforms used, and smartphone addiction, are associated with worse mental health symptoms, including PTSD. We will also examine whether negative posttraumatic cognitions mediate the association between PTSD and social media use. A sample of 200 students from Western Kentucky University, consisting of 77.6% females, 19.4% males with an average age of 19.6 years old, completed an online survey assessing social media use, smartphone addiction, and mental health problems (i.e., PTSD, depression, anxiety, and loneliness). It is hypothesized that social media use will be positively associated with mental health problems, and that this association will be mediated by negative posttraumatic cognitions. This study will provide information to assist in whether social media is a risk for problems beyond anxiety and depression and factors that may link these outcomes together.

Eltzroth, Becca; Reece, Michelle; "A Review of the Covid-19 Pandemic in Spain and the USA" (Michelle Reece)
The COVID-19 pandemic continues to rock the world. There is much that can be learned through observing the spread of the disease in different countries and the national responses to the pandemic. The USA and Spain are among the top ten countries for the total number of COVID-19 cases and the highest number of deaths. Spain is among the lowest ranked in how it has dealt with COVID-19. The aim of this project is to demonstrate these two nations' experience and response to COVID-19, to examine the ways they may have handled the pandemic well, and suggest areas or the ways they could have done better. The importance of this research review lies in the fact that COVID-19 has proven to be a deadly virus and highlights the need to better understand how to mitigate the spread and assist those already infected with the virus, on a national level.

Farley, Corbin; Alashour, Ali; Stahl, Brenton; ; Galloway, Michael; "Virtual Experiment with Operational Amplifiers" (Walter Collett)
This project is the development of a virtual experiment intended to help undergraduate electrical engineering majors master simple operational amplifier circuits. The students will be able to access this software from the internet and it will be used to augment labs and homework from their courses. This tool aims to provide students with a deeper level of understanding than they would otherwise obtain. The current project will allow the users to select one of five operational amplifier circuits to model by placing components in either a symbolic circuit view or a breadboard view and invite them to check their work. The team is developing this product through the span of two semesters: the first was used to design and define the scope, while the second semester is being devoted to implementation and testing. This software is intended to be stand-alone or can be deployed via a web-based framework developed by others.

Farmer, Sofia; Bieze Wilson, Ashley; "Preservice Teachers' Beliefs as Predictors of Response Style Toward Tgnc Victimization" (Lisa Duffin-Rexroat)
This project explores the relationship between preservice teachers' (PSTs) beliefs about

transgender and gender nonconforming (TGNC) individuals and how these beliefs predict PSTs responses to situations of TGNC victimization in schools. This investigation is important because TGNC youth often face higher rates of bullying and discrimination than their cisgender peers. These students have higher rates of suicide and depression, along with absenteeism and poorer academic performance. Teachers are the first responders in school, but their behavior can be influenced by personal beliefs and societal norms. PSTs' beliefs are more malleable; thus, this study focuses on these individuals. Participants were PSTs (N=177) enrolled in teacher education programs in Kentucky and Illinois. All participants completed an online survey containing measures of: religious fundamentalism (RF), ally identity, attitudes toward TGNC individuals, and response style. Strong negative correlations were found between RF and attitudes; and RF and ally identity. Ally identity and attitudes showed a significant positive correlation. Ally identity and attitudes toward TGNC individuals were found to be predictors of response style. RF showed no significant prediction of response style. Findings from this study have important implications for teacher preparation programs, future research, and policy.

Fisher, Wesley; Chidurala, Manohar; Bishop, Riley; Hollingsworth, Elena; Mazzoni, Brian; Doom, Alex; Harper, Doug; "Measuring Aerodynamic Forces" (Manohar Chidurala)
To further broaden the range of topics covered by laboratory experiments in the Mechanical Engineering department at WKU, a senior design team set out to develop an experiment to observe the aerodynamic behavior of objects using a subsonic wind tunnel. In particular, the drag and lift forces acting on an object are of value to know. One such method of analyzing these forces involves mapping the pressure distribution of air as it flows around an object. Thus, a critical piece of the project involved designing a measurement system that can gather and record raw pressure data, and then interpret that data as drag and lift forces acting on the object. The measurement system includes pressure and temperature sensors, as well as other National Instruments devices needed for collecting data. Coding was written in the LabVIEW software program to communicate with the measurement system hardware, allowing the user to control the entire data collection process through a single user interface. While the measurement system has not been fully tested in practice, it has been tested using simulated data and is expected to perform well and provide accurate data.

Flora, Kirbey; Garrett-Wright, Dawn; Sturgeon, Liz; "Parental Health Literacy: Comparing Perceptions of Pediatricians and Nurse Practitioners" (Dawn Garrett-Wright)
Throughout life, most people will interact with the healthcare system to manage information in order to make health decisions that are best for them. Health literacy is the ability to comprehend health information to make healthcare decisions. Pediatric patients often do not have a voice in their healthcare decisions; therefore, their health outcomes may be affected by the health literacy of their caregiver. In addition, the child's health may be impacted by the ability of the healthcare team to provide appropriate health education. The purpose of this honors thesis is to determine pediatric healthcare providers' perception of health literacy in their practice. Furthermore, the findings will be analyzed to determine how providers might impact pediatric health outcomes by understanding the level of health literacy of patients and their caregivers. Qualitative data was collected through semi-structured interviews with two pediatric nurse practitioners and one pediatrician. Results of the interviews indicated that providers obtained information through history taking and determined caregiver health literacy based on their ability to follow verbal and written instructions. Although lack of time is a barrier to best practice, healthcare providers can

increase health literacy in their practices by providing feedback to caregivers in a caring, nonjudgmental manner.

Fontes, Cameron "Crafting Character: An Exploration of Elder Identity Through Story" (Trini Stickle)
Identity manifests itself differently in each stage of our lives. One might fulfill the role of a child in youth, an employee in early adulthood, and then a spouse at midlife. But as we age, our ability to maintain all the facets of our identities begins to slip beyond our grasp. Our bodies lose function. Our social networks shrink. Our lives slow down while the world around us keeps moving at a breakneck pace. This project draws from research and personal experience to investigate the societal issues that influence elder identity and explores these issues through literary interpretation. To represent these issues accurately, research was conducted of scholarly journals, anthologies, and other publications, and storytelling workshops were conducted with local elders, both in-person and virtually. The stories crafted from this research illustrated the possibility of creating elderly characters through fiction that reflect issues affecting elders while simultaneously giving them agency of and pride in their own narratives. On this basis, existing authors should be encouraged to incorporate realistic yet dynamic elderly characters into their work and to work with elders in their communities to help them learn how to write their own stories.

Foust, Kelly; Funge, Simon; Foust, Kelly; "“Get Out There, Learn Something New”: Impact of a Short-term Domestic Academic Sojourn on Social Work Students’ Identity" (Simon Funge)
The purpose of this qualitative research study was to determine the impact of a two-week Faculty-Led USA study away program to Los Angeles, CA on undergraduate Social Work students’ understanding of the scope of social work practice, their identity as professional social workers, and their professional interests in the field. Program participants visited a variety of social service programs focused on mental health, homelessness, the LGBTQ community, refugees, veterans, older adults, and other vulnerable populations. The nine WKU Social Work participants were interviewed two years following the program. Data from semi-structured interviews, journals completed on the program, and reflection papers completed immediately following the program were analyzed. Findings indicated that participants experienced transformational learning enhancing their social work education, increasing their confidence, self-awareness, and cultural competence, their understanding of social, economic, and environmental injustice, and increasing their appreciation of the importance of human relationships. The reported effects of the program were still strong two years post-program. Given the cost of travel expenses, it is possible for universities to develop meaningful short-term domestic programs that offer transformational experiences.

Fragnoli, Joseph "Cointegration in House Prices And Wages" (Christopher Biolsi)
Traditional economic theory would tell you that prices and wages rise together. However, the view that wages and prices rise together has increasingly been challenged. Housing has the potential to drive an increase in prices without wages following due the fixed nature of land as an input. This paper seeks to find out if house prices and wages are cointegrated. The data used for this paper is the middle tier home price index and average weekly wages from the Federal Reserve going back to 1990. The data is for fifteen cities. The Engle-Granger test was used to test for cointegration between the house price index and average weekly wages. Six cities were

cointegrated or at least close to statistical significance. Speed of adjustment parameters were estimated for these cities. Among all cites, parameter on average weekly wages was very large while the parameter on house price index was relatively small. It is possible house prices and wages are cointegrated in some cities and not in others. The other possibility is house prices and wages are cointegrated in general, but due to the low power of the Engle-Granger test, some cities show up as a false acceptance of the null hypothesis.

Frederick, Caity "March 2, 2012, Tornado Outbreak" (Josh Durkee)
On March 2nd, 2012, the South and Midwest were hit by a severe weather outbreak. These storms produced over 70 tornadoes, hail, and strong wind. Forty-one people lost their lives during this tornado outbreak. Three days before the outbreak, a mid-latitude cyclone developed and matured as it moved from the Rocky Mountains to the Great Lakes, setting the stage for severe storms. The South was unusually warm, and the jet stream was centered over the South and Midwest. The low-pressure system associated with the tornado outbreak began to develop on the evening of March 1st. As the system evolved and moved to the northeast, it brought strong warm air advection across the South and Midwest, creating record high temperatures. In the late afternoon, storms began to develop across the region. Upon analysis, quasi-geostrophic theory can help explain the development of severe weather, with strong warm air advection and slight positive vorticity indicating lift. Warm air advection was the main driver of this event synoptically. The existence of strong vertical wind shear also contributed to the severity of the event. On the mesoscale, the geography, moisture, and high levels of CAPE and helicity contributed to the outbreak's severity.

Gabbard, Annika; Weiler, Brian; Neils-Strunjas, Jean; Crandall, Jason; Green, Kimberly; "Social Engagement of Nursing Home Residents: A Comparison of Two Observation Methods" (Brian Weiler)
In Kentucky, low levels of exercise and social engagement negatively impact health. This problem led to the creation of Bingocize®, an exercise program that combines the game of Bingo with intermittent exercises in a group setting. Since clear benefits of social engagement have been established, documentation of this behavior can assist in determining potential benefit from Bingocize®. This study compared the opinions of healthcare workers with Bingocize® experience on two measures of social engagement, the Fun and Social Engagement (FUSE) instrument and the Engagement of a Person with Dementia Scale (EWPDS). An online survey questionnaire about each measure was completed by 40 qualified healthcare workers. These participants provided demographic information, their opinion on the importance of engagement, their impressions of each measure, and which measure they would be most likely to choose. Paired sample t-tests completed for shared questions about both measures indicate that the FUSE's listed behaviors are more relevant to Bingocize® when compared to the behaviors on the EWPDS. 81% of participants reported they would choose the FUSE to measure social engagement. Based on the study findings, a user-preferred measure is one that is concise, has a specificity for common diagnoses in nursing homes, and has clear instructions.

Garden, Harrison "Sustainable Design in Commercial and Landscape Architecture" (Shahnaz Aly)
This project revolves around the sustainable and aesthetically pleasing aspects of both landscape architecture as well as commercial architecture. To achieve this, I created the Chattanooga

Botanical Center: a state-of-the-art botanical garden that focuses on sustainability and the magnificent beauty of the natural world. The Chattanooga Botanical Center is a two-part experience, in which patrons can decide which to experience first. Patrons may decide to walk the paths through the botanical garden or utilize the abundant green spaces or they may choose to venture inside the main visitor center for a class about propagating plants or a quick bite to eat. The visitor center is a spectacle all on its own as its unique shape and use of natural lighting make it comforting and inviting. Both the visitor center and the botanical garden combine seamlessly to enhance each other and drive home the idea that the natural world's beauty can and should be utilized in modern day commercial architecture.

Gomez, Carlos "Parallels in Physics" (Farhad Ashrafzadeh)
This project aims to identify the existing parallels in physics, specifically within the domains of electrical and mechanical systems. By designing an interactive application via MatLab, we are to portray these parallels in a simple manner. The core of these parallels lies within its mathematical equations, which we built using Simulink. Furthermore, linking AppDesigner with Simulink enables us to display the behaviors of these equations in a visual platform. In essence, this interactive application will help underclassmen students to understand and fill in gaps among different chapters of physics. The results will be delivered as a standalone application and user manual.

Gorski, Kathleen "School-based Stress and Trauma Management Intervention and Prevention for Elementary School Students" (Thomas Gross)
The purpose of this literature review was to examine research on school-based stress management and trauma intervention and prevention programs for elementary school students. These consisted of programs aimed to teach students skills they need to cope with social, academic and emotional stressors. Stress management might have a positive effect on elementary school aged children, so they can cope with social and academic obstacles in the future. We categorized stress management programming into class-based or individual based intervention or prevention programming. Class-based interventions were programs that required teaching the whole classroom stress management skills; whereas individual based programs were implemented to selected participants based on social/emotional screening or other assessments. Intervention programming was identified as programs used after a child was exposed to stress or trauma; whereas prevention programming was defined as general programs to teach stress management or coping skills with or without exposure to stress or trauma. After reviewing the literature there was a pattern that suggested prevention and intervention programs are most effective when they are directly related to school problems, or are targeted toward students with stressful life events or trauma.

Gover, Harrison; Pimienta, Matthew; "How Much Curvature is in a Knot?" (Claus Ernst)
We describe several ways of how a knot can curve when drawn on paper. Using braid diagrams, which are characterized by rotation around a single point, and spiral diagrams, which are characterized by a constant turning direction, the braid index and spiral index, respectively, of a knot can be found. A curly knot is a knot where the braid index is greater than the spiral index. We use this definition to map out families of curly knots and their qualities.

Greis, Rachel "The Development and Validation of the General Attitudes Toward Police Scale

(gaps)" (Melissa Baker)
For more than 60 years, researchers have been interested in the public's attitudes toward police. However, a measure of attitudes toward police has not been established. The main goal of the present research was to develop and validate a brief questionnaire that measures people's general attitudes toward police. In Study 1, participants completed a 60-item questionnaire consisting of questions regarding attitudes toward police. An item response analysis was used to develop a 14-item questionnaire that captured general attitudes toward police: the General Attitudes Toward Police Scale (GAPS). In Study 2, participants completed the GAPS, watched an officer-civilian confrontation video, and completed an excessive force questionnaire. Predictive validity of the GAPS was established by examining whether participants' scores on the GAPS predicted their judgments of police use of force. In the present research, I developed a brief scale that captured general attitudes toward police (Exp 1) and found evidence for the predictive validity of the scale (Exp 2). My hope is that the GAPS will be used by future researchers who wish to capture people's attitudes toward police. The GAPS might also be used to measure changes in the general public's attitudes toward police after police policy changes.

Grey, Kelli "An Analysis of The 6-7 June 2020 Derecho and Accompanying Mesoscale Events" (Josh Durkee)
On 6-7 June 2020 a derecho formed in Utah cutting a path northeast through North Dakota. The day was marked with a record number of significant wind gust reports since at least 2004. A couple of short-lived tornadoes were also spawned which flipped a vehicle and its camper over and tore a cabin from its foundation. A cutoff low created by an upper-level jet stream reemerged with the jet stream as a new jet streak formed on the leading edge of the trough where the low was forcing the low and trough to move northeast. As the low reemerged with the jet stream, the ridge to the east became amplified creating a strong pressure gradient. Positive vorticity at the 500 mg level, as well as warm air advection at the 850 mb level, lifted the air as noted by the Quasi Geostrophic Omega equation and Potential Height equation. The stage at which the system was in could be judged by stronger vorticity advection viewed earlier at the 500 mb level over Utah while the later stage was seen as thermal advection dominated at the 850 mb level in South Dakota.

Gumbel, Rachel "The Federal Prosecution of Al Capone and its Impact on the Evidentiary Evolution of Forensic Accounting" (Stacy Bibelhauser)
In 1931, tax documentation or lack thereof, was examined and utilized to prosecute infamous Chicago gangster Alphonse Capone. In the prohibition-era, Capone's notoriety in Chicago was at its height, and a Federal conglomerate investigation of multiple agencies was launched to take down the impenetrable mobster. Capone's sound completion of crimes and the threat of retaliation towards key-witnesses inhibited the fertility of the investigation for the Federal government. Therefore, the IRS special investigation unit took charge, seeking to unveil the vast income that Capone failed to report on tax filings. Their efforts led to the successful prosecution of the seemingly untouchable man. In order to determine the methodology of the investigative efforts of the prosecution team, the financial records and practices of the investigation were examined to determine the impact of forensic accounting. Landmark cases that cite the Capone verdict as precedent were examined to outline the usage of tax evasion as a means of achieving criminal prosecution as outlined in a legal chronology. Through this research investigation, tax evasion's impact on the increased prevalence of pretextual prosecution was determined.

Hakimov, Somon; Hurley, Jordyn; "Improved Antimicrobial Effect of Silver Nanoparticles With Methylene Blue" (Ali Oguz Er)
Photodynamic therapy (PDT) is the treatment of tumors and infectious diseases that uses photosensitizer and light source to produce highly reactive singlet oxygen, which damages cell wall and causes death to targeted bacteria. In this research, methylene blue (MB) was used as photosensitizer and in order to increase the production of singlet oxygen silver nanoparticles (Ag NPs) were added. Silver NPs were synthesized by using pulsed laser ablation in liquid. Characterization of silver NPs was performed using UV-spectrophotometer, photoluminescence, transmission electron microscopy (TEM). To measure the effectiveness of MB and Ag NPs, E. coli and S. aureus bacteria were irradiated with red light of wavelength 660nm. The average size of synthesized Ag NPs in deionized water, PVP, and citrate solutions were 23, 15, 10nm respectively. The combination of MB and Ag NPs showed higher production of singlet oxygen, hence, higher effectiveness in deactivating both types of bacteria comparing to MB and Ag NPs alone.

Hamilton, Jazzlin "Inside the Minds of Persons with TBI" (Trini Stickle)
The incidence rates of traumatic brain injuries (TBI) are increasing (Centers for Disease Control and Prevention, 2019), yet educators report a lack of training on how best to serve students with TBIs (Davies & Ray, 2014). My research highlights the educational experiences of three college students with TBIs, building upon the surveys and findings of Mealings et al. (2012) and Todis & Glang et al. (2008). Consonant with the previous finding, my work provides added insights on the barriers to resuming school, the general lack of understanding of TBIs from the learner's position, and, more importantly, the limited awareness of teachers (at all levels) of students' special educational needs and support mechanisms. Moreover, this research reiterates the continued negative stigma brain injuries have, preventing students from sharing their need of or seeking out the support available to them. I will show the need for continued research and advocacy that bring into light the challenges of students living with TBIs, an added 1.5 million each year (CDC, 2020). I am also hopeful my work will help correct the stereotyped and biased views of and toward persons with brain injuries (Schutz et al., 2010).

Hamm, Lillian "Answers In The East: An Examination of China's Renewable Energy and its Application to Central Appalachia" (Patricia Kambesis)
While much of China's electrification efforts had been fueled by coal, recent decades illustrate the country is heavily investing in and implementing renewable energy as a power source. Even coal-rich provinces like the northeastern province of Shanxi have been making the transition to renewable energy. The central Appalachian states comprised of eastern Kentucky, West Virginia, western Virginia, and northeastern Tennessee share many characteristics with China's Shanxi province including economic resources, climate, and geography. Yet, central Appalachia has not been able to easily transition to renewable energy. However, there are various cultural, political, and technological differences between the two regions to explain this. The aim of this analysis is to illustrate the methods and policies that China has implemented to create a market conducive to renewable energy and to suggest the applications these methods and policies have to central Appalachia. Specifically, renewable energy could assist in poverty alleviation in central Appalachia through economic revitalization as well as remediate environmental hazards associated with coal mining.

Hanson, Benjamin "The Socioeconomics of Homelessness in Bowling Green, Kentucky" (Joel Turner)
Adequate housing or shelter is generally regarded as essential for human beings. Though the city of Bowling Green, Kentucky has experienced tremendous economic growth in recent years, poverty and homelessness have become a problem for residents and city officials. This project seeks to expand research on homelessness in Bowling Green, Kentucky in order to prescribe policies that could be enacted by local government entities. This research will first analyze various policies from an economic perspective. An analysis of benefits versus costs will determine whether a solution is economically feasible. The second portion of the research will focus on constituent mindsets towards policies aimed to alleviate homelessness in Bowling Green. Using Mind Geonomics software developed by Howard Moskowitz, this project samples 100 random individuals from Bowling Green to measure constituent attitudes on policy. The two sources of information are then combined in order to make policy prescriptions that could realistically be enacted by the City Council of Bowling Green, Kentucky. This project has two large implications. First, it demonstrates the utility of Mind Geonomics research and its application to political science. Second, this project contributes to literature on homelessness in Bowling Green and political responses.

Harris, Kaleb "Offering Opportunity: Community Impact of Sports Architecture" (Shahnaz Aly)
The purpose of this project was to study a variety of functional means by which sports architecture can increase Bowling Green community members' opportunities to capitalize on their athletic talents. This was achieved by completing the entirety of the architectural design process, from project proposal and acceptance to production of functional construction documents. Research was conducted on applicable building codes, sustainable strategies and components, and site analysis. Schematic floor plans, sections, a three-dimensional model, and conceptual renders were developed. Implementation of professional feedback on the schematic concept led to the creation of accurate, finalized construction documentation. The completed result of this process was a grand indoor sport complex featuring three individual arenas where community athletes can train and perform. This project holds a significance not only involving the building itself, but the entirety of Bowling Green as well. A facility such as this would assist in the development of new local athletic communities, strengthen existing communities, attract visitors from outside the area, and benefit the local economy. By hosting a variety of communities in one building and welcoming new, developing communities, the project becomes an identity staple for Bowling Green and its residents.

Hartman, Sarah "Effects of COVID-19 on Kentucky Air Pollutant Levels" (Jacqueline Basham)
COVID-19 has proven to be a deadly disease with nearly 28.1 million cases and 496,000 deaths in the US as of February 20th, 2021. One unexpected result of the pandemic has been an apparent improvement in air quality levels due to reduced travel at the global, national, and regional levels. One air quality study found that nitrogen dioxide (NO_2) and particulate matter (PM) levels decreased from before to after the beginning of the pandemic. On a smaller scale, another study examined the effects of air quality in the cities of Barcelona and Madrid (Spain). This study focused on the time period after the pandemic occurred and assessed the NO_2 data for

each hour. The study observed a decrease in air pollutant levels, but the results were not significant between the years studied. The purpose of this study is to determine whether there is a difference in the emission rates of the six criteria pollutants in Kentucky along with overall air quality in the 5-month period of January 1st - June 1st of 2016-2020. This will be used to evaluate the environmental impact of COVID-19 and contrast air quality before and after the start of the pandemic.

Hatch, Landyn ""A labor of love": The Creation of Sperr Memorial Park" (Ann Ferrell)
Sperr Memorial Park, located in the Southern Tier region of Upstate New York, honors the life and legacy of New York State Trooper Andrew J. “AJ” Sperr (1972-2006). Trooper Sperr, a ten-year veteran of law enforcement, was killed in the line of duty March 1, 2006 after stopping a suspicious vehicle on a dead-end road just off Pennsylvania-New York Interstate 86. The tragedy galvanized a community-sourced response that, within just six months’ time, had transformed the scene of his death into the present-day memorial park. Drawing on examples from fieldwork, this paper seeks to detail the circumstances that went into the creation of Sperr Memorial Park as it relates to both temporary memorial culture and grief-informed placemaking. In addition, as the fifteenth anniversary of Sperr’s death is observed, this paper seeks to engage the politics of memorialization as it relates to the park’s dual remembrance and recreation functions, as well as the official memory narratives available for “Trooper Sperr” versus those that continue to be enacted by the friends and loved ones of “AJ.”

Hatfield, Brooke "History Has Its Eyes On Hamilton’s Dissent" (Anthony Harkins)
Hamilton builds a bridge between foundational American history and 21st century pop culture. As it addresses society’s perspectives - past and present - on history, culture, politics, and entertainment, it draws attention to the musical’s influence on its audience. Due to its increasing popularity, it is debatable whether Hamilton’s efforts to stir up dissent will be overlooked as just “equality entertainment” or instead make pivotal changes within the minds and lives of its viewers. Having analyzed popular and scholarly reactions to the musical and having seen it myself, I argue that Hamilton’s increasing popularity only strengthens its dissent by creating personal connections with a greater number of viewers. As a result, Hamilton not only tells a unique and memorable story of symbolic dissent on the Broadway stage, it also stirs up lasting intellectual dissent by expanding its audience’s knowledge of the past and challenging them to enact change in the world around them.

Head, Ryan; McGowan, Ian; "Mitigating Washing Machine Vibration" (Morteza Nurcheshmeh)
The cost of washing machines is increasing as more features are added; as such, buyers desire their costly machines to last. However, washing machines may fail and threaten safety when an unbalanced load accumulates in the tub and causes excessive vibrations. We are a team of mechanical engineering students, and we undertook the task of designing and implementing design modifications on one of these washing machines to prevent the destruction caused by the unbalanced load. We intended to measure the effectiveness of each design modification in preventing the machine’s destruction. Our team used a decision matrix to decide which of many modifications would be executed, and mathematical and computer models were developed to demonstrate that the chosen designs by our team would in fact reduce the vibrations. Ultimately, our team chose to attach tension springs to the bottom of the tub, attach elastic straps to the tub, and add compression springs to the suspension rods. The team is currently testing the chosen

design modifications by manipulating the tub's angular velocity and documenting the adjustments' effect on vibration. Our team expects one of the designs to significantly reduce the vibrations, prevent failure, and aid the washing machine company's future commercial success.

Hebenstiel, Lars; Harper, Doug; Novikov, Ivan; "Current Status of an Experimental Damped Driven Duffing Oscillator" (Ivan Novikov)
We report the status of an experimental damped driven duffing oscillator and present some preliminary experimental results. The Duffing Oscillator (DO) is a bistable, nonlinear oscillator initially described by Georg Duffing in 1918. Because of its characteristics, the DO is an excellent system to study a stochastic resonance, a phenomenon also occurring in ring lasers, electron paramagnetic resonance and other nonlinear systems. Stochastic resonance is a phenomenon whereby a system experiences resonance due to noise being added to it, and experiences optimal resonance when the optimal amount of noise is added. In this talk, we present the status of a Damped Driven Duffing Oscillator apparatus development and preliminary experimental results on a SR. This project is supported by the KAS Research Grant, project ID # 23270225.

Henson, Chloe; Hill, Lawrence; Cook, Elizabeth; "Synthesis of Semiconductor Nanoparticles in an Ionic Liquid" (Lawrence Hill)
Semiconductor nanoparticles display a range of unique physical properties, particularly in the optics and electronics fields, due to quantum size effects tunable to the size of the particle . We recently found that the ionic liquid 1-butyl-3-methylimidazolium methylsulfate is able to partially dissolve bulk cadmium oxide, resulting in the formation of nanoscopic crystals. Similar results have been observed for a small number of ionic liquids in the literature. Ionic liquids are known to maintain hydrophilic and hydrophobic domains as a liquid, and the observed nanoscopic particle sizes are attributed to the dissolution of bulk materials halting as it approaches the size of these domains. The goal of this research is to investigate this ionic liquid further and develop a method to synthesize a variety of semiconductor nanoparticles simply by heating bulk powders of these materials. Our initial study will examine a single reaction condition for six semiconductors in this ionic liquid: CdO, CdSe, CdS, ZnO, ZnSe, and ZnS. Reaction conditions and purification procedures will then be developed to maximize the yield from the original bulk materials. Samples will be characterized using transmission electron microscopy, UV-vis spectroscopy, and fluorimetry. Average particle size, peak absorbance wavelength, and emission profiles will be reported and discussed.

Hoffman, Seth "Atlantic Mudskippers Signal Through the Substrate During Territorial Behavior" (Michael Smith)
Mudskippers are intertidal fishes of the family Gobiidae that live both in and out of water. We recorded behavior via digital video and vibrational signals via geophones of pairs of the mudskipper Periophthalmus barbarus. Twelve fishes varying in size and sex were used in this experiment. A resident fish was placed in an aquarium and allowed to set up a territory for at least 3 days. Then an intruder was placed in a plastic mesh arena in the aquarium that allowed the two fishes to interact. 158 vibration signals were recorded and characterized as either pulse trains, tones, or grunts. Tones and grunts were approximately half a second in duration, while pulse trains lasted longer (approximately 2 to 4 seconds). Mean peak frequencies in tones were lower (40-60 Hz) than those of grunts and pulse trains (60-80 Hz). In a majority of the trials,

resident fishes produced a majority of the vibrations and outcompeted intruding fishes unless intruders were considerably larger fishes. It is clear that vibrational communication through the mud is an important mode of communication in mudskippers. It is likely that this form of communication is a modification of underwater sound production that is common in gobioid fishes.

Horner, Wilson "Analysis of Boundary Observability of Strongly Coupled One-dimensional Wave Equations With Mixed Boundary Conditions" (Ahmet Ozkan Ozer)
First, we study equations for a multi-functional piezoelectric material. The model strongly couples longitudinal vibrations with the electromagnetic effects due to the Maxwell's equations. Even though the system is known to be exactly observable with two sensor measurements at the tip of the beam, its approximations by well-known techniques do not retain exact observability uniformly with respect to the approximation parameter. This is mainly due to the loss of the uniform gap among two branches of eigenvalues. To obtain a uniform gap, and therefore, a uniform observability result with respect to mesh parameter, a direct filtering method is adopted to eliminate artificial high-frequency eigenvalues of the approximated model. The discrete multipliers are successfully utilized for proving main results.

Hourigan, Amy; Groves, Chris; Kambesis, Patricia; Gripshover, Margaret; Bledsoe, Lee Anne; Singer, Autumn; "Hidden Landscapes: Potentially Vulnerable Communities in the Karst Groundwater Region" (Chris Groves)
“Plain” (Amish and Mennonite) communities in Kentucky’s Pennyroyal Plateau live without modern infrastructure and rely on karst water sources. The karst landscape offers little or no surface water, and karst springs are likely to be contaminated. A one-year study found that every sample of untreated water from karst springs supporting four families was positive for total coliforms and E. coli. A family of nine using karst spring water contracted Hepatitis A in 2018. We are developing a GIS database for the Barren River Area Development District, to identify the extent of the intersection of the region’s karst hydrogeology and communities with limited treatment and transportation technology.

Indulkar, Ajinkya Vishwas "K-means Clustering Using Gravitation" (Qi Li)
Clustering is a process in which a set of data points is grouped into a data number of subsets, such that data points in the same subset shares similar properties. There are several types of clustering, including partitional clustering, hierarchical clustering, density-based clustering, and grid-based clustering. K-means is a popular algorithm used for partitioning clustering. Now the similarity of data points or data instances is based on the similarity measure. In general, K-means clustering relies on Euclidean distance. We propose a new similarity measure based on the gravitational force between subsets of data points. We use WEKA a data mining tool created by the University of Waikato; we use the source code which is in java as well as python. Experiments are performed to validate the effectiveness of the new similarity measure

Jaybhaye, Amol "Synthesis of Amine and Thiol Functionalized Ionic Liquids to Control Platinum Nanoparticle Morphology for Catalytic Hydrogenation Reaction" (Lawrence Hill)
Nanotechnology is being developed for industries like IT, homeland security, medicine, transportation, energy, food security, and environmental science. Nanotechnologies have risen to prominence as a result of their tunable physical, chemical, and biological properties, as well as

their superior performance over bulk counterparts, and noble-metal nanoparticles are widely utilized as catalysts. In particular, platinum-based nanoparticles have attracted interest in fields related to energy and environmental catalysts. Engineering the shape and thus surface structure of platinum nanoparticles is an effective strategy for optimizing their catalytic activities toward specific reactions. We are focusing on synthesizing task-specific ionic liquids to control the size and shape of platinum nanoparticles for use in catalytic hydrogenation reactions. This presentation will cover our progress towards the synthesis of amine and thiol functionalized ionic liquids and synthesis of platinum nanoparticles with controlled morphologies.

Johns, Emily "Determining Who is Willing to Pay for Conservation at Mammoth Cave National Park" (Jacob Byl)
In this study, we assess how much people value the conservation of Mammoth Cave National Park (MCNP), a UNESCO World Heritage Site that is home to many endangered species. Understanding how people think about the tradeoffs involved in interventions to protect complex ecosystems helps us better manage the dominant role of humans in relation to other species in ecosystems. This project measures willingness-to-pay for the protection of various species and the entire MCNP, which quantifies the benefits of actions that help protect biodiversity. We used an online survey of research subjects who had recently been to MCNP to ask a series of questions about whether the subject would be willing to contribute funds to protect the species at MCNP and the park as a whole. Regression models allow us to assess differences in how subgroups of respondents answered these questions. Overall, 64% of respondents were in favor of increasing park fees to improve conservation. Controlling for other features, those more likely to be in favor of conservation were younger people, self-identified environmentalists, and Republicans. The average willingness-to-pay for additional conservation at MCNP was $54, indicating that there is a substantial desire for conservation and willingness to pay for it.

Johnson, Lilly "The Architecture and Design Building" (Shahnaz Aly)
Research in Environmentally Friendly Techniques for the Architecture and Design Building The Architecture and Design Building was designed as a replacement educational building for Architecture students on Western Kentucky University's campus, so case studies with similar building uses were researched. Multiple aspects of green construction were found and incorporated in the planning of the building, including electrochromic windows and a roof garden. Planning how a building will be used can dramatically affect energy use and cost. There was a focus on researching ways a building can produce its own energy, and to reduce energy use altogether. The goal of this project was to design and plan a building that would have zero-net energy use, meaning it produces all the energy it utilizes. This is significant specifically to WKU because the more buildings that would start utilizing these green practices, the more environmentally friendly the campus would be, also reducing overall cost. If green building techniques were more widespread, buildings everywhere would be more energy-efficient and cost less to own or use.

Johnson, Miles "Studying Financial Risk Aversion with the Jeopardy! Daily Double" (Susane Leguizamon)
It has long been up for debate as to whether there is a link between financial risk aversion and wealth in individuals. This study's purpose is to, using data from the game show Jeopardy!, investigate this question through analytical research. This study made use of multiple regression

analyses in order to examine the relationship between wealth and risk aversion in Jeopardy! contestants who appeared on the show between January 2019 and October 2020. Specifically, this study looked to isolate the potential impact a contestant's estimated annual income had on their willingness to bet on the Jeopardy! Daily Double question. It was found that, under certain circumstances, a contestant's estimated annual income had a significant positive impact on their willingness to bet a larger percentage of their respective pot. This study provides evidence that suggests there may be a possible significant correlation between wealth and financial risk aversion in individuals. Further studies could expand this research through the investigation of bettor rationality; such information could then be used to further isolate the impact of wealth on contestant risk aversion.

Johnston, Laurel "Choose Your Sorry Carefully: How Corporate Apology Elements Affect Consumer Responses" (Joanna Phillips-Melancon)
Corporate social responsibility (CSR) failures are in constant view of the consumer via social media. Such failures threaten brand reputation and motivate the need for corporate apology when organizations violate consumer expectations. Corporate apologies are effective remedies for corporate failures, often reducing negative online posts, spurring positive attitude change, and renewing purchase intentions. Source characteristics, timing, and linguistic components impact the effectiveness of a corporate apology. However, less is known about the effect of individual elements of corporate apologies in the wake of CSR failures. Detailed linguistic components of brand apologies have been identified, but not tested. Additionally, the effects of pre-allegation CSR claims on subsequent consumer behavior are overlooked in the literature. This research explores how linguistic components of a corporate apology influence consumer attitudes, advocacy, and purchase intentions. To this end, hypothetical scenarios will manipulate key linguistic elements of apologies (offers of repair, restating the offense, and acknowledgement of responsibility) and test the effect of such apology components on consumer behavior and attitudes. This study will give organizations practical insights for apology construction, provide data on the effects of specific corporate apology components, and address gaps in the corporate apology literature.

Jones, Ashton "I Hear You: The Everyday Struggle Living with Misophonia" (Brad Pfranger)
The term misophonia is derivated from the Greek words misos, (hate), and phónè, (voice); it translates as hatred of sound. It is the term used to describe people who are irregularly affected by everyday noises. The first scientific observations by Pawel J. Jastreboff regarding misophonia indicate "individuals with misophonia are sensitive to a specific set of trigger sounds, which are usually recognized since childhood." These types of sounds tend to be trivial noises, such as chewing or crunching, sniffing, breathing, clicking, lip smacking, and tapping. The noises can trigger an onslaught of negative emotions and violent reactions. This documentary film focuses on exposing the public to a disorder with few comprehensive studies. Interviews conducted with both medical professionals and sufferers of misophonia work together to create a depiction of how the disorder affects all people and why others should be considerate of those impacted by the disorder. The documentary delves into the stressful, emotional, human aspect of misophonia in a way that a scientific journal cannot provide. The intention of this study is to form a connection between the subject and the viewer the a will invoke a stronger desire to understand why this disorder is so difficult to live with.

Jones, Margaret; Stone, Martin; "Hypergravity Inhibits Crop Growth: Implications For Space Farming" (Martin Stone)
Food production in space is at the forefront of agricultural innovation and human space exploration. Understanding the effects of gravity on plant growth is critical. During the fall and spring of 2020, we conducted greenhouse experiments to investigate the effects of hypergravity on the growth of radish and lettuce, plants that are suitable for farming in space. Plants were grown on a centrifugal device, which simulated 2G and 4G gravity environments. A control was grown at 1G (normal gravity) for comparison. We measured plant height, leaf number, and final dry mass of the plant roots and shoots over the course of 28 days. The results showed that plants grown in higher gravity environments were significantly shorter, produced fewer leaves, and produced less dry shoot and root biomass compared to those grown under normal earth gravity ($p<0.05$). These results show that plant growth is inversely related to gravity over the range studied and, thus, have important implications for crop selection for human space exploration.

Kendrick, Mia; Hurt, Cora; Andrulonis, Emily; Burch, Katrina; "Examining The Work And Personal Determinants Of Technology Use Among Seniors" (Katrina Burch)
Technology has become indispensable to our every-day life, with a greater emphasis on the importance of technology gaining ground during the COVID-19 pandemic. However, one of the largest growing age demographics, globally, remains on the disadvantaged side of the digital divide, namely seniors (individuals aged 60 or higher). Therefore, we sought to understand technology use among seniors using a mixed-methods study. Specifically, we sought to examine the work and personal determinants in understanding how work and social inequality impact technology use among seniors utilizing the motivational theory of lifespan development to provide an organizing framework. Using a sample of approximately 68 seniors in South Central Kentucky, a primarily economically disadvantaged region with a high proportion of seniors, we conducted ethnographic interviews and collected survey-based measures on technology proficiency, demographics, and personal work history. Results are forthcoming. Theoretical and practical implications will be discussed.

Knapp, Emily "“Is My Mop Angry With Me?”: Understanding How People Use Emotion Labels Via Pareidolia" (Andrew Mienaltowski)
Past studies have asked participants to observe overly-posed faces and choose a category word from a set of universal emotion labels to characterize each face. However, being forced to choose from possible labels acts as a top-down influence on facial emotion perception that constrains what ones sees and prevent one from generating alternative labels that also reflect the emotion portrayed. This study investigated emotion perception through a different lens by using pareidolia images instead of overly-posed human faces and by asking participants to freely label images without constraining their initial evaluations through a forced choice. Pareidolia is the phenomenon of observing face-like characteristics in everyday objects. The images used were found online and preliminarily categorized by raters as depicting specific human emotional expressions. Participants were randomly divided into three conditions that had them first view human faces and either generate an emotion word, select an emotion label from a provided selection, or make a judgment about gender. All participants then viewed the pareidolia images and freely provided their own emotion label. Overall, participants who were not exposed to previously provided emotion words used a much more diverse set of labels than those commonly considered by social scientists to be “universal.”

Krause, Hannah; Wulff, Andrew; Groves, Chris; "Characterization of Minerals in Great Onyx Cave, Kentucky" (Andrew Wulff)
Great Onyx Cave is developed in the Girkin and Ste. Genevieve Limestone Formations of Flint Ridge in Kentucky's Mammoth Cave National Park. Although the nearby Mammoth Cave system has a variety of minerals present, there has been little published research on the mineralogy of Great Onyx Cave. The systematic dissolution of strata below ground reveals features such as internal depositional features or sedimentary structures that facilitate the detailed characterization of stratigraphic units. Precipitation of ions out of cave dripwaters, for example, results in delicate crystalline structures such as helictites and other cave formations that are indicators of dripwater chemistry. This research involves examining and characterizing the mineralogy of Great Onyx Cave using short and long-wave ultraviolet light during reconnaissance, and Scanning Electron Microscopy (SEM) and Raman Microscopy (RM) during laboratory analysis. Preliminary instrumental analysis has identified gypsum, celestine, calcite, calcium phosphate, and dolomite. Some of these are often found in contact with each other in several locations, possibly representing different periods of mineralization. Results from this study will be the basis for developing a catalog of fluorescent minerals that could be used throughout the Mammoth Cave system.

Krohman, Kayla "Using Streamflow Forecasts, in Addition to Soil Moisture, to Indicate the Impacts of Floods in Agricultural Areas of Kisumu, Kenya" (Joshua Durkee)
Kenya has historically been vulnerable to disasters such as riverine floods and flash floods. For a country that depends on agriculture for over a third of its gross domestic product, these floods pose a national threat to the economy and food security. The Kisumu region is a large producer of food crops thanks to quality soils of two rainy seasons. While the region already has a few strategies to cope with the disaster risk of floods, there is a gap between the time a flood forecast is released and the time the first actions are taken to mitigate the impacts of the flood. This project aims to explore whether or not soil moisture can be used as an additional indicator, along with streamflow forecasts, to identify the potential impacts of floods in agricultural areas of Kisumu. We used 7-day historical streamflow forecasts to identify two similar flooding events that occurred in different years. Soil moisture wetness values for these events were determined using a SMAP L4 product. We created daily composites for every day, two weeks out ahead of each chosen flood event using geotiffs from the SMAP product. After charting and correlating the necessary values, we found there was not enough evidence to conclude that there was significant flood inundation within our watershed.

Kubala, Josie; Wulff, Andrew; Suggs, Mike; McDavid, Courtney; "Characterizing Mesonet Clay Samples" (Andrew Wulff)
The Kentucky Mesonet is a statewide weather and climate monitoring infrastructure that has sites located in open areas of flat ground distanced from surroundings most likely to experience major land use change. The soils at these sites are ideal to present accurate measurements of soil temperature and moisture. However, multiple farms statewide are experiencing varying degrees of soil moisture despite having similar soil types and weather. This project examines the mineralogy of clays that affect soil moisture from several monitoring stations in different counties. Core samples are extracted at lengths between 2" to 40" and are dried and sieved. Acetic acid is added to remove carbonate minerals, and samples are placed in the oven. Then

samples are made into a slurry with acetone and set flat on slides to prevent flocculation. The hydrated samples are shaken and mixed with anti-flocculant to keep particles separate. Using ethylene glycol treatment, samples are deposited on slides to analyze using X-Ray Diffraction (XRD). The results from the XRD will be compared with measurements of soil moisture and soil types provided by the Kentucky Mesonet to determine how the clay mineralogy of the clay in the soils affect the outcome of agricultural growth.

Kylychbekov, Salizhan; Menon, Ashwin; Hakimov, Somon; "Laser Patterning of Niti Shape Memory Alloys" (Ali Oguz Er)
NiTi is a shape memory alloy (SMA) that memorizes its shape and retains back to programmed form once subjected to a certain stimulus like temperature range. If utilized properly, its potential in industry is immense. However, it has not been used widely due to its defects such as fatigue life, low transformation temperature range, and higher production cost[1]. In this presentation, we report a potential way of treating the Shape Memory Alloys for better fatigue life and shape memorizing properties using nanosecond laser and magnetic field. Laser patterning of NiTi SMA is highly tunable and low-cost compared to existing methods such as mechanical hammering or laser shot peening. Our results from SEM and Optical Profilometry show that magnetic fields have positively affected the uniformity of the shockwaves produced by laser pulses. Ongoing experiments on material and stress properties, and simulations of shockwave propagation inside the material will be presented.

Lancaster, Emily "No Day But Today: The Cultural Impact of Rent 25 Years Later" (Ted Hovet)
“No Day but Today: The Cultural Impact of RENT 25 Years Later” addresses how Jonathan Larson’s musical changed the theater industry and the lives of those living in the shadows. RENT gave struggling artists, drag queens, and those suffering from HIV/AIDS a voice during a time in which they were being pushed aside and disposed of by the mainstream media. Larson’s untimely death the night before his Off-Broadway premiere did not allow him to see his masterpiece soar, but the message of love that his show promotes is still being spread all across the world through anniversary tour productions and interviews from original cast members in Larson’s remembrance. Using in-depth analysis of RENT and interviews from those closest to Larson, as well as current cast members, leaders of HIV support groups, and Rentheads, this project is an in-depth focus on the life of Larson and the show that changed the lives of many.

Lawler, Trayson; Polk, Jason; Shelley, Adam; "Spatiotemporal Analysis of Precipitation Distribution Influences on Water Levels in the Lost River/Jennings Creek Watershed, Bowling Green, Kentucky" (Jason Polk)
The complex karst hydrology of Bowling Green’s Lost River karst aquifer makes it difficult to understand storm-related flooding both in the cave and on the surface. The Lost River is a tributary to Jennings Creek and is vulnerable to rapid flooding. The objective of this research is to model flood predictability using high-resolution water level and rainfall data from within the Lost River/Jennings Creek watershed. Precipitation data were collected at weather stations at 1-minute resolution at ten sites spatially distributed in the study area. Water level loggers were used to track water levels at 1-minute resolution at multiple spring and surface stream sites within the watershed. As it rains, the intensity and duration of precipitation varies across the stations and influence the timing of water level rise within the basin. Data were collected for the

major January 25, 2021 storm, where the precipitation and flood level data exhibited a strong relationship, but with high spatial variability across the watershed. Hydrograph responses varied with the rainfall intensity and duration at a local scale. Spatiotemporal comparisons to other storms are being conducted to determine relationships between precipitation and flood response timing toward a predictive model.

Lenihan, Avery "The Informational Role of Self-Reported Importance and Credibility of Information Sources" (Jacob Byl)
To promote public health behavior like taking a vaccine, we must understand how the credibility of information sources and the importance of what they share influence consumers' risk beliefs. If you watch television regularly, you have seen commercials by pharmaceutical companies touting the wonders of a new drug. You have probably also seen attorneys advertising the dangers of prescription drugs, seeking clients to join class-action lawsuits. It is easy to assume that the average consumer is desensitized to the extreme claims coming from these biased sources. However, our study finds that consumers allow biased sources to influence their risk beliefs about drug side effects. Despite acknowledging that a source does not seem credible, consumers still factor in information from that source into their decision making. A consumer's self-assessment of the importance of information coming from a source more closely predicts how they will update their risk beliefs. This study indicates that disclaimers around claims may not be enough and that language in advertisements may require a more standardized regulatory approach. Results from this study suggest paths forward for public health campaigns to promote vaccination for Covid-19—advertising campaigns may want to emphasize relaying information that seems important, rather than focusing on having a credible source for that information.

Lin, Allen "Values of Dirichlet Series" (Dominic Lanphier)
We generalize the results of the alternating Dirichlet series first examined by Junesung Choi. Specifically, we examine its analytical continuation and its special values. We also connect values of the Choi Dirichlet series to values of another Dirichlet series. Finally, we connect this last class of Dirichlet series to Dirichlet L-functions, ultimately obtaining values of the alternating Dirichlet series.

Loxley, Colin "Identifying Effective Practices in a Standards-Based Grading System" (Scott Bonham)
Standards-based grading is a grading system in which scores are given based on certain learning objectives in a course, instead of scores be given for tests and other assignments. The score shows a student's mastery of that particular learning objective. Standards-based grading is more popular in K-12 education but has not been greatly studied at a university level. In order to evaluate effective practices for standards-based grading, I will be analyzing student work, administering a survey to students, and interviewing students about standards-based grading. The goal of the survey and interviews are to gather student perceptions and experiences about standards-based grading in the class, while the goal of analyzing student work will be looking at patterns in student success in a standards-based grading system. All of these will be analyzed together to determine effective practices in a standards-based grading system. This research is expected to provide valuable guidance on how to make standard-based grading more effective for student learning and may also be valuable to other instructors looking to adopt this method of grading.

Mack, Darius "August 10-11, 2020 Derecho: An Extraordinary Severe Wind Event" (Joshua Durkee)
On the morning of August 10, 2020, a severe weather outbreak was initiated over the northern plains and upper mid-west regions in the United States. This severe weather outbreak is known as a derecho. A derecho is a quasi-linear convective system (QLCS) that contains vastly strong wind-speeds and creates destructive wind damage along its path. The event in this essay was analyzed on a synoptic scale. Quasi-Geostrophic theory was applied during the analysis of this study. The Quasi-Geostrophic Omega equation was utilized to diagnose the synoptic mechanisms that triggered the outbreak. When reviewing the synoptic scale forcing that led to the genesis of the outbreak, it was concluded that the temperature advection term in the QG-Omega equation was in fact, the leading term that created this event courtesy of warm air advection (WAA) ahead of the squall line and northwesterly cold air advection (CAA) behind it.

Mack, Makayla; Baker, Kayla; Tinius, Rachel; "The Effect of Warm-up Protocols on the Prevalence of Medial Tibial Stress Syndrome In High School Cross Country Athletes" (Kayla Baker)
Medial Tibial Stress Syndrome (MTSS) is among one of the most frequently reported running-related musculoskeletal injuries. There is currently no common standard for warm-up protocols in high school cross-country programs; therefore, these protocols need to be identified and evaluated to determine associations between warm-up and the prevalence of MTSS. Therefore, the purpose of this study is to gain a better understanding of which method of warming up could yield the most promising results for the prevention of MTSS in high school cross country athletes. Participants will be recruited via communication with high school cross country coaches and will include male and female high school cross-country runners (14-18 years). Data will be collected through an electronic Qualtrics Survey. The questions will address potential risk factors for MTSS, any warm-up protocols they currently engage in before running, and any measures they may or may not take to prevent and/or treat MTSS. Data will be analyzed using Pearson product-moment correlations to investigate the relationship between warmup and prevalence of MTSS. It is hypothesized that strengthening-based exercises for the muscles surrounding the shins will be the most efficacious preventative measure based on the physiological origins of the syndrome described in the introduction.

Mahmutovic, Adis "The Towers of Nature" (Shahnaz Aly)
This project involved the design of two-tower residential mixed occupancy high-rises. The residence has multiple levels of living spaces with commercial shops and adequate parking and amenities. The research for this project also included that nature had an impact to the lives of those around it. Nature played a huge part in individuals' mental health and surrounded individuals in nature filled environments have shown to have a boost in their mental health. Included are the natural aspects in the building and then how those effects go onto the occupants in that area is the goal of this research project. A sustainable project and insured performance of a created sustainable consumption of energy by the use of spaces inside the buildings and created spaces for the equipment needed where key factors in the design of this building. Nature and stability have been the way to go and with those two together, the occupants of the building had benefited mentally and that kept them on their stay to live there and have more interaction with one another.

Martinez-Ramon, Lizbeth "Social Media Analysis: St. Jude Children's Research Hospital" (Kumi Ishii)
Martinez-Ramon, Lizbeth; "Social Media Analysis: St. Jude Children's Research Hospital" (Kumi Ishii). Using social media has become an integral part of modern life and largely influences how individuals communicate with the world; however, this reality is not only true for individuals but organizations and nonprofits alike. Despite the importance of social media, the realm of how it can best be used by organizations—specifically nonprofits—to interact with and gain shareholder support is unexplored. This study, conducted over a two-and-a-half-month span, aims to analyze how the use of Facebook, Instagram, and Twitter enables St. Jude Children's Research Hospital to interact with its shareholders. Specifically, elements of social media, such as posting frequency, comments, and post content, were all examined. The findings of this study reveal that each platform has unique strengths and weaknesses that with research-based suggestions can provide practical ways for St. Jude to improve its reach and interactions with stakeholders. The results of the study show that organizations can benefit from having an individual or team managing the social media accounts to positively establish an online presence and connect with their public audience. The results, therefore, create research-based principles that organizations can implement to increase the effectiveness of their social media use.

Mason, Ruby; Jacobsgahen, Sigrid; "Persistence of the Circadian Rhythm of Phototaxis in *Chlamydomonas Reinhardtii* After Acclimation to Elevated Temperatures" (Sigrid Jacobshagen)
Chlamydomonas reinhardtii is a species of unicellular green alga that can be used as a model organism for the circadian clock. This clock mediates the daily rhythms of an organism's physiology, which lets it take advantage of the daily changing environmental factors. In *C. reinhardtii*, the circadian clock can be observed through phototaxis - the movement of an organism in response to light. When the alga's circadian clock indicates that it is daytime, the organism takes advantage by swimming towards light. Phototaxis is measured using a homebuilt machine. In this study, the effect of temperature on the circadian rhythm of phototaxis was evaluated. In previous experiments, three strains of *C. reinhardtii* were grown at room temperature and then placed into the phototaxis machine at elevated temperatures up to 35oC. Results showed that the circadian rhythm of phototaxis is not preserved at elevated temperatures. The current study focuses on growing *C. reinhardtii* at elevated temperatures prior to measuring phototaxis. The aim is to eliminate a "heat shock" when placing the cultures into the hot phototaxis machine. Initial results at 30oC indicate that growing cultures at this temperature prior to testing phototaxis increases the persistence of the circadian rhythm of phototaxis.

Matheny, Steven "Traffic Safety Impact Of Covid-19 Pandemic in the City of Bowling Green, KY" (Kirolos Haleem)
A major sector in the U.S. that was heavily impacted due to the COVID-19 pandemic is the transportation sector. This paper compares traffic crash and traffic flow patterns in the city of Bowling Green before and during COVID-19. The study compares the safety of different corridors (including road segments and intersections) and interstate ramp segments before and during COVID-19 within the city limit of Bowling Green. Crashes during the shutdown (March 6 through July 31, 2020) were downloaded from the Kentucky State Police website and compared with the five-year average crashes before the pandemic ("March 6 through July 31" in each of "2015 to 2019"). The safety assessment was made by contrasting crash rate changes and

percentage changes in total, injury, and severe crashes. Overall, the majority of roadway corridors in Bowling Green experienced a reduction in traffic volumes. Safety-wise, there was up to 28% increase in single-vehicle crashes and an increase in injury crash rates during the pandemic for the majority of analyzed roadway corridors in Bowling Green. Some recommendations were proposed to guide the city of Bowling Green transportation professionals on which roadway corridors to closely monitor that experienced a significant increase in crash rates during the pandemic.

Mattingly, Joseph "Seasonal Cycles of Zooplankton Abundance in Barren River Lake, With Special Emphasis on the Introduced Water Flea Daphnia Lumholtzi" (Philip Lienesch)
Zooplankton are an important component in aquatic ecosystems. With such ecological importance, it was of interest when an invasive zooplankter, Daphnia Lumholtzi, was recently discovered in southcentral Kentucky, including Barren River Lake. We sought to describe the seasonal population dynamics of zooplankton in Barren River Lake, especially the abundance of D. lumholtzi. We were also interested in determining if there were differences in the zooplankton community in the main basin compared to a shallow coves of Barren River Lake We collected monthly samples from six locations on the lake (three in the main basin, and 3 in a shallow tributary arm) for over a year. We then used a microscope to examine a subsample from each site to estimate the density of each zooplankton taxon present. Preliminary analyses from 2 sites, one in the main basin and one in Skaggs Creek, show seasonal and spatial variance exhibited by all species of zooplankton in the lake. We have yet to detect any Daphnia Lumholtzi in the lake since the initial sample which prompted our research. This indicates that the introduction of the Daphnia Lumholtzi into Barren River Lake is not yet showing any effect on the native species.

Mazzoni, Brian; Thompson, Tate; Palmquist, Shane; "Finites & Omnifinites Honoring Prof. Dr. Georg Cantor’s Legacy" (Shane Palmquist)
The dedicated work of Prof. Dr. Georg Cantor is of significant importance to mathematics as it clearly demonstrates that differing sized infinities exist, and infinity is far more than just a concept. While his work offers a unique and critical view on the subject of infinities especially regarding alephs and omegas, other perspectives are possible and equally as valid and impactful. This work builds upon Cantor’s foundation, offering a new and differing perspective on the subject of numbers especially zero and infinity. Differing sized infinities and zeros as numbers and their mathematical properties will be the focus of this work. A new and larger set of numbers similar to hyperreals and surreals referred to as omnifinites is proposed. However, this new set of numbers is directly connected and related back to Cantor’s paradise to help unify mathematics. This work helps to bridge the divide between our current understanding of infinities and absolute infinity as well as zeros and null zero by offering an approach which is closer to mathematical truth than presently exists. It is hoped that this work will serve as a catalyst for future mathematical developments impacting many areas of knowledge requiring greater quantitative and numerical understanding such as applied mathematics, science, engineering, and technology.

McKee, Madison "Implementing Virtual Manipulatives into the Elementary Math Classroom" (Janet Tassell)
Concrete, or physical, manipulatives have been used for many years to help elementary students better understand abstract concepts in math. These manipulatives include tools such as counters, base-ten blocks, and ten frames. According to research, learning is most valuable when students

are provided with opportunities to actively construct mathematical knowledge. Manipulatives assist students in not only building knowledge of abstract ideas but also communicating these ideas to others. In recent years, virtual manipulatives have begun to surface in many classrooms. Studies show that virtual manipulatives can provide students with the same opportunities to explore a variety of relationships in math. In fact, some virtual manipulatives have distinctive features that allow students to extend their mathematical thinking beyond the limits of physical manipulatives. Due to the COVID-19 pandemic, the use of virtual manipulatives is perhaps more relevant than ever before. The purpose of this study was to identify exceptional virtual manipulatives intended to aid students in constructing knowledge of the following topics: data analysis and probability, fractions and decimals, geometry, measurement, and number and operations. Findings from the study were organized in a website created to help elementary math educators discover virtual manipulatives and recognize their importance in the classroom.

McKinney, Heather "Suicide Risk in LGBQ College Students: The Role of Social Support, Internalized Homophobia, and Outness" (Amy Brausch)
It is well established that lesbian, gay, bisexual, and questioning (LGBQ) individuals experience higher rates of suicide ideation, suicide attempts, and nonsuicidal self-injury (NSSI), and that perceived social support can provide protection from these behaviors (Taliaferro & Muehlenkamp, 2017). Internalized homophobia has been theorized to contribute to increased risk of NSSI among LGBTQ youth (Muehlenkamp, Hilt, Ehlinger, & McMillan, 2015). This study examines differences between LGBQ and heterosexual students on perceived support sources (family, other adults, friends, peers) and self-harm outcomes (NSSI, suicide ideation, suicide attempts). LGBQ students were expected to report less perceived support across sources and higher rates of self-harm than heterosexual students. Within the LGBQ subsample, it was predicted that internalized homophobia and outness would be related to NSSI, suicide ideation, and suicide attempts. 319 students (17.2% LGBQ) completed measures on demographics, internalized homophobia, outness, social support, and self-harm. With data collection ongoing, preliminary results indicate that LGBQ students report significantly less family support than heterosexual students, but did not differ in other sources of support; and LGBQ students reported higher rates of NSSI and suicide ideation, but did not differ on attempts. Preliminarily, we conclude that family support is lacking for LGBQ students.

McKinney, Katelyn; Brausch, Amy; "Suicide Risk, Reasons for Living, and Protective Factors in Individuals With Disabilities." (Amy Brausch)
Existing research on NSSI and suicidality shows that individuals with disabilities are at a higher risk than individuals without disabilities. The goal of this study was to examine differences between individuals with and without disabilities on measures of life satisfaction, NSSI, reasons for living, suicide ideation and behaviors, and optimism. It was predicted that individuals with disabilities would report more suicide ideation and behaviors, as well as NSSI, than individuals without disabilities. It was also predicted that individuals with disabilities would report lower overall life satisfaction, reasons for living, and optimism. Several measures related to NSSI, optimism, suicide ideation, and life satisfaction were given to a sample of 579 college students the majority of whom were female (73%) and White (81.3%). About 23% of the participants reported having a disability that substantially limits one or more areas of their lives. Individuals with disabilities reported higher scores on suicide risk, lower scores on optimism and satisfaction with life, less fear of suicide and death, more hopelessness about the future, higher frequencies of

NSSI in the past year, and were more likely to have made a suicide attempt in the past year than the control group.

Menon, Ashwin; Er, Ali; Kylychbekov, Salizhan; "Laser Shock Peening to Improve Fatigue Resistance of Nickel Titanium Alloy" (Ali Er)
Laser shock peening (LSP) is a process using the thermal and compressive force of a laser beam to strengthen a metal. In this process, a laser beam is directed at the workpiece, creating shockwaves. The resultant compressive force can reduce stress on the surface of the workpiece and improve fatigue resistance. In this investigation, LSP was applied to the shape memory alloy Nitinol. Due to its shape memory property and its biocompatibility, Nitinol is highly useful in creating stents, braces, and implants. LSP on Nitinol has not been extensively documented, therefore, further investigation addresses a critical knowledge gap. Our approach utilizes a transverse magnetic field to confine the plasma produced by the laser shock. LSP of Nitinol wires was conducted with and without a magnetic field at three different laser power outputs. Analysis using Scanning Electron and Optical Microscopy was conducted. It was observed that a magnetic field of 400 mT at a power output of 2000 mW decreased the crater size formed by the laser shock and more uniformly machined the microstructure compared to LSP without the magnetic field. This provides evidence that LSP is a useful process in strengthening Nitinol.

Merdian, David "Impact of Monetary Shocks on the Optimal Currency Area status of the United States" (Christopher Biolsi)
While it is generally assumed that the US constitutes an optimal currency area, there has been some disagreement in the academic literature as to whether or not this is indeed the case. This paper seeks to answer this question by using a more robust metric for monetary policy shocks than have previous papers on the subject, namely the method for quantifying monetary policy shocks developed by Christina and David Romer in their seminal 2004 paper. This policy shock series is used in conjunction with monthly state-level output data to replicate Beckworth's 2009 paper, "One Nation Under the Fed," and utilizes an impulse response function for each state to quantify impact. The results of this analysis show that monetary policy shocks had a moderately positive effect on every state, albeit that the degree and certainty of such conclusions varied widely from state to state, with only a few states responding in a definitively positive manner. Those caveats notwithstanding, these results suggest the US does indeed constitute an optimal currency area.

Meredith, Austin; Spargo, Will; "Modeling Stresses on Wind Turbine Blades" (Manohar Chidurala)
The use of wind turbines as a means of generating clean, renewable power has risen in recent years. These turbines have experienced blade failures due to excess stresses caused by irregular wind conditions. Additionally, fluid-structure interaction simulations have become increasingly accurate and effective as a means of estimating the stresses and deformation experienced by solids when interacting with a moving fluid. This research aims to create a model to predict the stresses experienced by wind turbine blades due to the wind. In this research, we consider a theoretical fluid-structure interaction between the wind and a simplified model of a wind turbine blade. The blade is subjected to a steady, incompressible fluid flow, analogous to real applications, to determine the forces experienced by the components in order to theoretically express the cause of failure. Both ANSYS Workbench and SolidWorks Simulation were used to

numerically analyze these systems. Additionally, a mathematical model for these systems was created using standard assumptions. This model is compared to fluid-structure interactions simulations. Plans for a proposed experimental procedure to verify these results are also outlined in this research.

Mills, John; Tinius, Rachel; Rowland, Naomi; Meece, Kylee; Lawrence, Stephanie; "Gene Expression & Metabolic Health in Pregnancy" (Rachel Tinius)
Nearly 55% of women enter pregnancy overweight. Such women are significantly more likely to be affected by adverse maternal-fetal health conditions including gestational diabetes, hypertension, and preterm labor and delivery. With high prevalence of these complications, it is integral to fully understand maternal-fetal relationships and how obesity may contribute to unfavorable infant outcomes. Metabolic adaptations, specifically changes in lipid metabolism, occur during normal pregnancy to provide nutrients to the fetus. However, in obese pregnant women these adaptations may be intensified by metabolic dysfunction, which may have serious consequences. One relationship that merits exploration is that between maternal and infant lipid metabolism. Previous studies in pregnant women have focused on protein expression; gene expression will offer additional information about cellular activity and lipid metabolism regulation. Further, it is possible that maternal metabolic health could be programming the infant to metabolic dysregulation later in life which could contribute to weight management and health. Therefore, the goals of this research are to 1) determine the relationship between maternal and infant metabolic health by examining the expression of genes critical for fat metabolism in both maternal blood and infant cord blood and 2) determine whether the expression of these genes (in mother and infant) is different between lean and obese pregnant women.

Miracle, Sebastian "Optical Spectrum of Pn G309.0+00.8" (Ting-Hui Lee)
Planetary nebulae are envelopes of gas and dust that are ejected by stars that are 1-8 solar masses near the end of their lives. We present an analysis of optical spectrum of planetary nebula PN G309.0+00.8. The spectrum was obtained with the Southern Astrophysical Research Telescope in Chile. We manually identified the emission lines and measured the line intensities, and then we compared the results with measurements from the ALFA automated software package to verify both methods. The line intensities were then used to derive the physical conditions of the nebula, and the elemental abundances of He, N, O, Ne, S and Ar were calculated. These abundances are used to describe the environment in which the star was formed and to describe the progenitor star. This is a part of an ongoing survey using planetary nebula to add new constraints to the stellar evolution model.

Mohr, Blake "Tomorrow's Community in Today's World" (Shahnaz Aly)
The Morgen Community was a project based on creating a solution to turning an apartment building into a building of many homes. Built on the principles “a home in a unit” and “a community under one roof” the Morgan Community was designed to give people a private and comfortable home, while having the abilities to grow as a person. Whether it be physically from the pool, fitness center, and walking paths, to socially with a game room, useable conference rooms, and outdoor seating. People can also grow financially from the twelve business units located on the front of the first floor of the building available for rent to both residents and outside people in the community. One of the major factors to set the apartment units apart from other apartment buildings is simply the size and spaces of the apartment units. Larger than

normal living spaces allow for greater comfort and use, as well as large outdoor “yards”; partially paved, partially artificially turfed balconies provide a sense of a personal yard and patio to use for relaxation and entertainment. From one bedroom apartments, to four bedroom units, the Morgen Community truly stands for “Tomorrow’s Community.”

Moore, Emma; Ozer, Ahmet Ozkan; "Reliable Exact Observability and Stabilization of the One-dimensional Wave Equation on a String" (Ahmet Ozkan Ozer)
In control theory, a system is exactly observable if, when you measure a certain system property for a finite time, you can distinguish any two different initial states. With partial differential equations (PDEs), like the one-dimensional wave equation, there are infinitely many eigenvalues, which makes the PDE infinite-dimensional, so exactly observing all vibrations on a string is an infinite-dimensional problem. In practice, however, system properties are observed by sensors that can only observe finitely many vibrational modes. Therefore, sensor design for the observed property has to be done for a numerical approximation of the PDE, which makes it a finite dimensional system. However, approximated models with well-known numerical approximation techniques like Finite Difference Method (FDM) and Finite Element Method (FEM) are not exactly observable since these numerical techniques cause artificial, high-frequency eigenvalues, which result in the sensor being unable to distinguish between high-frequency vibrations. In this project, we study a direct Fourier filtering approach for a remedy. This talk will focus on the lack of observability for the FEM space-approximation of the wave equation, how filtering techniques enable us to prove exact observability, and designing a stabilizing feedback controller to suppress the vibrations.

Musick, Matthew; Aldossary, Sami; Johnson, Brentley; Newton, Samuel; ; Galloway, Michael; "Virtual Experiment on Frequency Response and Bode Plots" (Walter Collett)
A virtual experiment on the topic of electric circuit frequency response is being developed. In this software approach to experimentation, electrical engineering students will be able to view various electric circuits and take virtual measurements of key quantities. These measurements will then be used to generate plots of the frequency response of each circuit. Students will be able to modify various parameters related to the circuit and to see the effects of their changes. The current version of this software will allow users to work with passive electric filters, with development teams in future semesters adding more functionality. Although this project does not replace the need for a physical lab on the topic, it may fill a gap for students working remotely. It will also provide a way for students to gain more “lab experience” without needing a scheduled lab time.

Myers, Jeffrey "Learning How to Get Good" (Huanjing Wang)
Often times, people have difficulty knowing why they failed or what to do to get better so that they don't fail again. Machine learning can help. Given a dataset, some attributes can affect the classification of new data much less than other attributes in the dataset. Knowing which attributes most heavily impact the classification can help us learn how to do something better. The goal of this project is to learn by using machine learning with R code by predicting the classification of new data in a dataset and identifying what attributes of the dataset most heavily impact the classification result of new data. The purpose of the project is to learn what attributes and what attribute values are required for a higher probability of positive classification. The datasets used will be required to have positive and negative classifications such as gpa,

success/failure, etc. The R code should be able to classify new data given any dataset with adequate information and determine which attributes of the dataset affect the classification the greatest by listing them in a hierarchical order. Once the attribute hierarchy is determined, the values, or a range of values, should be determined which will give a greater probability of a positive classification for new data.

Ndayirukiye, Frederic "Elevate Fitness" (Shahnaz Aly)
The senior capstone project involved the design of a community wellness center and Which consists of multiple rooms that are designed to meet the goals and needs of the community. It has a main weightlifting room, CrossFit, pool, yoga, basketball, self-defense, and many more. There is also childcare, plus a restaurant that serves nutritious meals. The site around the building has a running/walking track and outdoor courts for tennis, basketball, and volleyball. First, the goal of the building is to attract people and get them started on a healthy fitness lifestyle because getting started is half the battle. Second, to provide a healthy and safe environment where the community can train and grow both mentally and physically, because once the mental and physical health is checked, one is ready to tackle whatever obstacle lies ahead. Third, to help expand the city of Bowling Green; modernize it. Lastly, the overall goal is to lead the community to better health.

Negron, Marcus; Heck, Aaron; Kitchen, Gabrielle; Wheeler, Nicholas; Galindo, Cristi L.; "Sex-based Differences in Cardiac Gene Expression and Function in BDNF Val66met Mice" (Cristi Galindo)
Brain-derived neurotrophic factor (BDNF) is a pleiotropic neuronal growth and survival factor that is indispensable in the brain and cardiovascular system. In approximately 30% of the general population, BDNF harbors a nonsynonymous single nucleotide polymorphism that may be associated with cardiometabolic disorders and coronary artery disease. We recently showed that Val66Met mice exhibit altered cardiac function, and cardiomyocytes isolated from these mice are less contractile. To identify the underlying mechanisms involved, we compared cardiac function by echocardiography and performed deep sequencing of RNA extracted from whole hearts of all three genotypes (Val/Val, Val/Met, and Met/Met) of both male and female Val66Met mice. We found female-specific cardiac alterations in both heterozygous and homozygous carriers, including increased systolic (26.8%, p=0.047) and diastolic diameters (14.9%, p=0.022), increased systolic (57.9%, p=0.039) and diastolic volumes (32.7%, p=0.026), and increased stroke volume (25.9%, p=0.033), with preserved ejection fraction and fractional shortening. In hearts of female Val/Met and Met/Met mice, 121 and 118 genes respectively, were significantly altered compared to littermate controls. Enriched functions in females with the Met allele included cardiac stress, with down-regulation of Titin (Tcap) and BNP (Nppb). These results provide evidence for sex-based differences in a polymorphic cardiac modifier of disease.

Nguyen, Teresa San; Kendrick, Mia; Hurt, Cora; Burch, Katrina; "Examining Incivility and Micro-aggressions Against Ethnic Minorities in Academia" (Katrina Burch)
Discrimination is still prevalent and pervasive in society, though there have many attempts to mitigate its impact. Though often not as overt, “modern” discrimination is more subtle in nature, often slipping through as passable social interactions because of its ambiguity. However, the negative impact that ethnic and racial minorities experience because of this subtle discrimination cannot be ignored. In academia, as with many other workplaces, ethnic and racial minorities are

impacted by subtle discrimination. During the Black Lives Matter movement that has surged in 2020 in the wake of social injustices against Black and Brown people, this issue has been brought to the forefront. Though academia is often held to a higher standard, discrimination still permeates throughout the institution. The present study investigates the incidences of subtle discrimination via workplace incivility and microaggressions experienced by ethnic and racial minorities in academia by utilizing Twitter as a data source and datamining experiences through various hashtags that promote the sharing of said experiences. Specifically, we are analyzing self-reported discriminatory (incivility and microaggressions) experiences reported through the use of #BlackintheIvory, #BlackinSTEM, and #BlackIvyStories. Frequencies of reported experiences, narrative descriptions, and analyses of intersectionalities will be reported.

Norman, Bella; King, Rodney; Rinehart, Claire; "The Discovery and Genomic Analysis of Bacteriophage Venture" (Rodney King)
Bacteriophages, the most numerous and diverse biological entities on earth, have sparked a lot of interest within the scientific community. Programs, such as SEA-PHAGES, are working to uncover the full potential of bacteriophages by isolating and characterizing novel bacteriophages from the environment. This research aims to further our understanding of bacteriophages' diversity, evolution and potential therapeutic application. The novel bacteriophage Venture was isolated from a soil sample collected in Alvaton, Kentucky. Venture specifically grows on the host *Mycobacterium smegmatis*, a common soil microbe. Venture's physical morphology was explored using a transmission electron microscope. Venture has a defined hexagonal capsid and a non-contractile tail. These features are characteristic of phages that belong to the Siphoviridae family. To characterize Venture genetically, its DNA was purified, digested with restriction enzymes and analyzed by gel electrophoresis. Although many of these enzymes were able to cut the DNA, the analysis did not allow an assignment to a particular cluster of known mycobacteriophages. Venture is currently archived at WKU and the University of Pittsburgh.

Northern, Samuel "Effects of a Curriculum-based PLC on Teachers' Attitudes and Self-efficacy Toward Inquiry-based Science Instruction" (Gary Houchens)
Elementary school students have limited access to standards-supported, inquiry-based STEM learning. Root causes for the lack of three-dimensional science teaching in the early grades were explored through the following topics: accountability, instructional time, historically weak standards, family factors, teacher efficacy, and professional development. The study used mixed methods to investigate teachers' attitudes toward STEM education and inquiry-based learning. General views of certified staff were obtained by using the Teacher Efficacy and Attitudes toward STEM Survey for elementary grades. Semi-structured interviews with the setting's principal, curriculum specialist, and classroom teachers revealed challenges that contributed to the problem of practice: student schema, teacher efficacy, school priorities, and professional development. The study's primary driver for improvement was a curriculum-based professional learning community (PLC). The researcher facilitated an 8-week virtual PLC with six classroom teachers and a curriculum specialist. Data revealed an increase in participants' self-efficacy levels toward science teaching but little change to classroom practice. Iterations to the intervention included personalized instructional coaching strategies based on participants' personality types and sense-making preferences. Revisions to the intervention's theory of action (e.g., SMART goals, coaching, adult learning theory) enriched collaboration among teachers and transformed science education at the elementary level.

Obielodan, Olufunmilola "Monte Carlo Tree Search: How Much Can Be Learned From One Simulation?" (Uta Ziegler)
Dots and Boxes is a zero-sum, two-player game with the objective of being the player to collect the most boxes on the board. As the player is forced to take another move after scoring, the game requires higher strategies to be used in order to win. Monte Carlo Tree Search (MCTS) is a heuristic algorithm used to attempt to find the best given action in a given game for a given player. This machine learning approach creates a tree by running a host of simulations from a given board state to the end of the game, and after the end of the game is reached, data (such as player score) is used to update information throughout the tree. The basic MCTS approach updates the player score by using -1 (loss), 0 (draw), or 1 (win). The question being addressed in this work is how to use other values to update the information in the tree. This will be investigated in the context of a MCTS for the Dots and Boxes game. The possible implementation and preliminary results being weights to update the tree information will be presented.

Okocha, Assumpta "Using Logic Models to Evaluate Educational Practices to Reduce Exclusionary Punishment and Increase Positive Behaviors for Minority Students" (Thomas Gross)
School suspensions are associated with current and future student problems and addressing suspensions could reduce these problems. Short-term impacts of school suspension include missed classroom instruction and falling behind their peers in social and academic skills.Focusing on teachers' implementation of positive behavioral intervention and supports can be used to improve classroom behaviors before resorting to suspensions. This might be especially important when considering underrepresented minority (URM) students. For instance, African-American students are overrepresented regarding disciplinary actions and when compared to their white peers, African-American students experience exclusionary punishment (e.g., suspensions) more often for minor offenses (e.g., talking back to teacher). There are many possible alternative solutions to exclusionary punishment for URM students, e.g., increasing teacher cultural competency or restorative practices. However, few concrete ways for schools to evaluate if their interventions worked are identified. The use of logic models by schools could help gather information about activities, target outcomes, and assess if the interventions have created the anticipated positive outcomes for URM students. Therefore, the purpose of this presentation is to show how logic models can be used to determine program effectiveness to increase positive behaviors and decrease exclusionary punishment of URM students.

Owens, Landon; Aldarawish, Loai; Almarhun, Mustafa; Bedaiwi, Fahad; "Eye, Robot: How Do Robots Perceive and Make Sense of Their Environment" (Farhad Ashrafzadeh)
Many industries are moving towards automation in various tasks to enhance human safety and improve efficiency. For mobile autonomous systems, perception of the surrounding environment is vital. This project explores the application of autonomous system perception for driving. To perform the perception task properly, the vehicle needs to be able to map its environment and detect and identify the objects it sees. For these tasks, we have employed the RPLiDAR 2-D lidar and the ZED Stereo Camera, respectively. After sufficient input is collected from both perception systems, the inputs are integrated, and an algorithm computes the required maneuver that the vehicle needs to perform. This is assisted by machine learning, which permits the vehicle

to identify its lane and drive in it consistently while ensuring passenger safety. Maneuver commands are then sent to instruct the vehicle to move. The perception systems are first designed and integrated with the Robot Operating System (ROS) and simulated in Gazebo. Upon satisfactory results from simulation, the perception systems are implemented on the physical prototype vehicle. The application of environment mapping and object detection can be expanded to encompass the needs of other industries such as manufacturing. These activities were supported under the NSF Cooperative Agreement No. 1849213.

Palmer, Jeffery; Jaybhaye, Amol; "Synthesis Of Nanoparticles Using Functionalized Ionic Liquids To Enhance Catalytic Performance" (Lawrence Hill)
In the usage of nanoparticles as efficient catalysts, such as in CO2 hydrogenation for the purposes of synthesizing fuels, two significant factors determine the effectivity of the nanoparticles used: active surface area and shape. This project will create a set of functionalized ionic liquids that are hypothesized to combine the benefits of the two most viable synthesis methods available: maximizing active surface area with the structural properties of ionic liquids whilst controlling shape for more facets with the Lewis basic sites found in certain organic molecules. Thus far, one of the two functionalized ionic liquids necessary for this nanoparticle synthesis has been produced using viable methods, with the other ionic liquid close to being produced. When both ionic liquids have been synthesized, they will be used to replicate the reaction used to create nanoparticles with the most efficient shape, replacing the insulating organic molecules that would otherwise inhibit surface area. Additionally, a new instrument has been acquired to measure catalytic efficiency (and in turn validate the enhanced effectivity) of the nanoparticles synthesized using the ionic liquids. This project could thereby advance the progress of nanoparticle synthesis to improve activity, creating new opportunities for energy production and electronics.

Panzade, Aarini "The Effect of TIMP-1Levels and MMP-1 Levels on the Wound Surface Area" (Richard Schugart)
Matrix metalloproteinases (MMPs) are enzymes that degrade all kinds of extracellular matrix proteins during the wound-healing process. TIMP-1 is a tissue inhibitor of metalloproteinases (MMPs). In this work, we are investigating how MMPs and TIMPs, and the ratio of MMPs to TIMPs affect the wound surface area and the healing time. The data used for this work was of sixteen patients with diabetic foot ulcers in which measurements were taken of MMPs and TIMPs during a 12-week period. A multilinear regression analysis was performed on the interaction terms of different variables and compared to the wound surface area and compared to the regression analysis done on just the individual variables and other interaction terms. It was concluded that the multilinear regression analysis done by the interaction terms of MMP – 2 Latente and MMP – 9 Latente was the most beneficial to the wound surface area than the one done on other combinations of variables.

Panzade, Aarohi; Wimsatt, Hunter; Shankar, Kaaustaaub; "Using Machine Learning to Interpret Dice Rolls" (Warren Campbell)
Gamers use polyhedral dice that come with 4 sides (D4), 6 sides (D6), 8 sides (D8), 10 sides (D10), 12 sides (D12) and 20 sides (D20). All dice are unfair, some more than others. The goal of this project was to develop a machine learning and computer vision solution for the interpretation of dice rolls. When combined with an automated dice roller it would facilitate the

study of dice unfairness. In the machine learning literature, Convolutional Neural Networks (CNNs) are the preferred method of computer classification of images. The CNN convolves images with different weights and biases through multiple layers to produce an end array with odds of each number on the die. Using CNNs we were able to obtain interpretation accuracies ranging from 99.76% for D6 dice images to 92.47% accuracy for D20s. Thousands of images were used for training, and thousands of separate images used for validation. The accuracy percentages quoted here are for the validation images.

Pare, Zena "Banking on Her: The Effects of Microfinance on Women's Autonomy in Developing Economies" (Susane Leguizamon)
Once applauded as a way to empower the world's poorest, and in particular benefit women, the practice of microfinance is now perceived with a much more cautious and nuanced lens. Some perspectives state that microfinance improves women's lives and uplifts communities, while others claim that it increases over-indebtedness and does not provide a viable path to escape poverty. In order to determine if microfinance is an effective use of resources to empower women, this paper will analyze the relationship between women's autonomy and microfinance to provide further insight into its proposed positive and negative effects. Using ordinary least squares regression analysis, the study will analyze data from 45 different developing countries using data from the World Bank and the United Nations. Autonomy is operationalized in a variety of ways to test for robustness, such as female unemployment and labor force participation, women's decision-making power, the share of women-owned businesses, and female secondary school enrollment. This study will contribute to the body of literature focusing on women's empowerment and microfinance to help determine future policy approaches.

Park, Andrew "An Algorithm to Estimate Lithium-Ion Battery Lifetime" (Sam Park)
Lithium-ion batteries are a crucial component in many applications. Battery lifetime must be estimated accurately to prevent rapid degradation, emission of harmful gases, and fatal explosions. Thus, mathematical models were created to estimate the battery lifetime, ensuring the safety and efficiency of these systems. Once a lithium-ion battery is not able to store at least 75% state-of-health compared to a new battery, the battery has reached its end-of-life, where further use may result in catastrophes. Premature temperature anomaly indicates the start of declining SoH and end-of-life. By gathering data on the properties of the battery cell, equations that generate curves to accurately estimate the battery lifetime were created. One equation estimates lifetime as a function of average discharge voltage while the other as a function of discharge capacity. It was found that based on 75% of the 1st cycle discharge capacity, the maximum projected lifetime of the current lithium-ion battery is ~2100 cycles. Also, discharge capacity will limit the battery lifetime before average voltage, but the average voltage the battery can deliver drops off significantly faster after a temperature failure. Using experimental data, an algorithm was developed that accurately estimates lithium-ion battery lifetime with greater precision than before.

Pedigo, Ariana "Bringing the Dancing Demons Back to Life: Tsam Dances in 21st Century Mongolia" (Ann Ferrell)
Buddhism was the primary form of religious practice in Mongolia until the Soviet Union takeover in the 1930s, during which there was an unsuccessful attempt to eradicate Buddhism. In the 1990s, surviving elders from the Buddhist religion in Mongolia began to resurrect traditions

which had almost died during the extermination process. One of these traditions was the ceremonial Tsam (masked dance) performances. Tsam ceremonial dances merged with the early hunter-gatherer Tengrism (shamanistic) practices. There is a meditative aspect of these performances as well as the embodiment of characters, skeletons (Lords of the Charnel Grounds), the White Old Man, Khashin Khan, and devil characters. To save the Tsam costumes from destruction, a lot of the spiritual elements were removed, and the costumes and masks were labelled as art with no spiritual or religious connotations. Now that the Buddhist religion is being revived within Mongolia, this presentation will be presented using research from academic sources and focused on whether the Millennial monks of Mongolia can breathe life back into the paper mâché masks of the Tsam ceremonies and bring the spirit of the dance to life again.

Pepke, Brenna "The Effectiveness of Translation/Interpretation through the Visual Process" (Yvonne Petkus)
Through a web-based layout, I propose to exhibit 5-6 paintings with written text. This painted work examines large-scale, societal traumas within the United States that have been repeated throughout history. Connections will be made between historical writings, imagery, and the language of both the oppressed and oppressor. The work is a visual thinking through and questioning of race, gender, sexuality, and class. Research conducted through visual/physical processes can directly affect humanitarian unity. Artworks are able to reach the unspoken, conceptual, and emotional through the experience material play can bring. Investing in visual studies is also important because visuals are accessible to all sectors of society, providing a creative critique through which to address the individual with the power to change that society founded upon individuality. My critiques begin as sketches responding to a wide variety of literature and rhetoric, which evolve into specific, symbolic painted language. First-hand accounts and literature —such as writings of James Baldwin, Stephanie E. Jones-Rodgers, and the rhetoric of the BLM, LGBTQ+, and Feminist movements feed off one another to support the works. We cannot move forward—into unison—without healing the traumas we have created. These painted works use tangibility and accessibility toward that goal.

Phillips, Benjamin "Community And Health: The Frosty Squirrel" (Aly Shahnaz)
The new multi-use structure that was just introduced to Bowling Green, Kentucky encompasses all of the social, health, and business aspects that the growing community could ever need to keep up with its rapid population growth. This facility offers the community social opportunities with its state-of-the-art dining facility and event space. The facility also invites businesses to come and commerce by offering conference rooms that can be rented any day of the week. Finally, the facility offers health and physical activity to the city of Bowling Green by engaging in fitness with its multi-court gym that is used for volleyball tournaments and is open to the public. With the open floor concept, people of the community find it very easy to navigate throughout the 60,000 sq.ft building. The structure is based on the concept of community and lifestyle throughout Bowling Green, which has given the community a place to come and be social or physically active any day of the week. The sleek and modern design of the structure is very welcoming and invites anyone from the community to come and enjoy their time at their new favorite hangout spot.

Pimienta, Matthew "Classifying particle tracks in a cloud chamber with deep learning algorithm" (Ivan Novikov)

Recently, the classification of particle tracks using a deep learning (DL) based methods has gained significant interest due to development of GPU based DL methods and availability of NVIDIA GPU graphic cards. A number of deep learning based methods have been developed and implemented for classifying particle tracks, ranging from image classification approaches to graph approaches. These methods are used to identify particles and their properties, such as energy, electric charge and mass, as well as to detect anomalies which could indicate a new particle or event type. In this talk we present a DL based algorithm to identify alpha particle tracks and determine their energy and charge-to-mass ratio based on the data obtained with a cloud chamber. To train and validate the proposed algorithm, the particle tracks in the cloud chamber were obtained via simulation using FLUKA simulation software.

Pinilla, Valentina "Is the Pupil Old/new Effect Influenced By Cognitive Load or Strength of Memory? A Meta-analysis" (Sharon Mutter)
Memory retrieval is influenced by cognitive processes that occur during encoding, some of which can be measured with pupillary responses. For example, during memory retrieval, pupils dilate more to previously-seen old items compared to new items, a phenomenon called the pupil old/new effect. Variables, such as depth-of-processing, that influence the strength of the memory trace for encoded stimuli play a role in successful discrimination of new versus old items. Additionally, the cognitive load during encoding (i.e., the effort needed to encode information), also impacts memory success. In this study, I conducted a meta-analysis to examine whether the pupil old/new effect is stronger after encoding manipulations that influence memory strength or cognitive load. This analysis showed that both memory strength and cognitive load affect the pupil old/new effect. However, the impact was greater for cognitive load, suggesting that the amount of effort required to process information during encoding has a greater impact on the pupil old/new effect than variables that affect the strength of the memory trace. Pupillometry can be a useful measure of memory effects, so future research could use pupil measures to study other types of memory effects, such as explicit versus implicit memory, on the pupil old/new effect.

Pinney, Abbott "Finding the Information Rates of Secret Sharing Schemes Using Decomposition Construction" (Mustafa Atici)
In cryptography, a secret sharing scheme is one that distributes an encryption key as partial keys, or shares, among a group of participants. Specified sets of these participants can combine their shares to get the whole key. An ideal scheme is one in which the share/key ratio is 1 - the lower the share/key ratio, the less ideal a scheme is, because to share a single key K, an authorized individual will have more secret information to secure. In general, we can measure the idealness of a scheme by the information rate. There are many methods and formulas to obtain a scheme's information rate. In this project, we focused solely on the decomposition method, in which we depict the scheme as a connected graph and use its complete multipartite subgraphs to compute the scheme's information rate. Using Wolfram Mathematica, we were able to automate this process in a computer program and approximate the information rates of many secret sharing schemes.

Polen, Reese; Wichman, Aaron; "Zero Sum Thinking Predicts Stronger Covid Conspiracy Beliefs: Admission of Medical Supply Scarcity Eliminates this Relationship for those Higher in Government Trust" (Aaron Wichman)

In the present research, we examined how zero-sum thinking and government trust are related to conspiracy theory endorsement, and if this would change if people felt their ideological basis for conspiracy belief endorsement had been verified. We reasoned that zero-sum beliefs would be associated with enhanced conspiracy theory endorsement, as conspiracies generally posit that one group is benefiting at another's expense. Our method of study was to have the participants randomly assigned to read either that there was adequate personal protective equipment (PPE), or that there were shortages of PPE, which was consistent with zero-sum thinking and should have verified these beliefs. They then answered a survey measuring their conspiracy beliefs and their trust in government. Our study revealed that there was a positive association between zero-sum beliefs and conspiracy endorsement, especially when the participants did not trust the government. This association was reduced if participants read about PPE scarcity, which should have verified their zero-sum thinking. Overall, we found that people who believe in a zero-sum thinking are more likely to endorse conspiracy theories than those that do not. The implications of this in a society with growing income inequality are discussed.

Powell, Lindsey; Thornberry, Timothy; "How Connected is Parenting Stress and Child Adaptability Through Child Prosocial Talk?" (Timothy Thornberry)
Previous research has demonstrated parenting stress can affect mental health outcomes of children who are exposed to a traumatic event, and child adaptability can significantly affect how a child responds to traumatic events. Thus, it is important to identify factors associated with child adaptability, since such factors could serve as important targets in treatment. Interventions (e.g., Parent-Child Interaction Therapy [PCIT]) have been created for families to learn skills to treat children with disruptive behavior problems, a risk factor contributing to child maltreatment and trauma. The current study seeks to examine whether parenting stress predicts child adaptability and if this relationship is mediated by observed child prosocial talk as measured by the Dyadic Parent-Child Interaction Coding System (DPICS), an analog behavior observation used to assess parent and child behaviors during PCIT. Parent-child dyads (n = 49) completed a DPICS observation, the Parenting Stress Index (PSI), and the Behavior Assessment System for Children (BASC-2). Linear regression analyses revealed parenting stress predicted a significant amount of variance in child adaptability, but this relationship was not mediated by child prosocial talk. This finding suggests the quantity of prosocial verbalizations from a child does not relate to the relationship between parenting stress and child adaptability.

Price, Kaitlin "Landscape Analysis and Content Strategy of Team Kentucky Covid-19 Response Website" (Daniel Liddle)
During this global pandemic accessing accurate up to date information is more important than ever. The main resource for current information about the ever-changing regulations and status of COVID-19 for Kentucky is the Team Kentucky website. The current site is overwhelmingly full of information and is confusing to navigate. If a potential user wanted to find specific information, it would most likely take a close inspection of the site to locate it. A landscape analysis is a type of organizational analysis which focus on finding a cohesive and consistent view of the company and initiatives in some analyzed area of operations and chosen key aspects of them and a content strategy manual focuses on planning, creating, delivery, and governance of content, which includes everything from the actual text as well as graphics and multimedia. Utilizing both of these analysis methods, this project will compare and contrast three state COVID-19 response websites and then will create an in-depth guide of successful aspects that

utilize good design elements and crisis communication practices as well as then provide an effective summary of takeaways in general for the Team Kentucky website to potentially use in the future.

Puhakka, Erika "Understanding Public Support for Foreign Aid in the United States" (Timothy Rich)
This paper examines what factors influence public support for foreign aid in the United States. Despite the significant role that the U.S. plays in the international arena and the benefits of aid to both donor and recipient countries, there remains relatively low public support for foreign aid in the U.S. compared to other donor countries. Using an original MTURK survey of 1035 respondents conveniently sampled in the U.S., this paper aims to empirically identify person-level factors that influence Americans' support for foreign aid. Notably, unlike much extant literature on the topic, this paper also examines how distinguishing between types of aid and the regime of a recipient country affects opinion of aid disbursement in the U.S. Generally, this paper finds that support for aid increases when a recipient country is perceived to be democratizing, as opposed to being a non-democracy or full democracy, when controlling for demographic and attitudinal factors.

Quire, Michael "Synoptic and Mesoscale Forcing in the March 2019 North American Cyclone" (Josh Durkee)
Late winter is not a common time for significant winter weather events. This was not the case in March of 2019. Between the 12th and 14th, a major mid-latitude cyclone hit the continental United States. This cyclone developed over the Pacific and worked its way across the country. As the weather system passed over Colorado, it underwent bombogenesis. The bomb-cyclone covered the central US in snow, broke low pressure and non-thunderstorm wind records, and spawned tornadoes across the plains. Understanding the forces driving a mid-latitude cyclone are essential for their forecasting. In this paper, a reanalysis of the storm’s driving forces is conducted from the synoptic scale down to the mesoscale. The analysis begins with synoptic forcing predicted by the omega equation, a derivative of the Quasi-Geostrophic Theory (QG). The equation is broken down and each of its parameters are discussed and analyzed. Then RADAR, soundings, and hodographs are explained and used to analyze the convective mesoscale forcing that affected this cyclone. Studying the data and storm results show that while this cyclone was significantly affected by mesoscale features, it was mainly synoptically driven. Thus, this forcing should be the primary focus of meteorologists forecasting similar future events.

Ragi, Pallavi; Mahmoudi, Faranak; Conte, Eric; "Occurrence of Estrogens and Other Steroids in Anaerobically Digested Cattle Waste" (Eric Conte)
Estrogens are endogenously produced by dairy cattle, especially in high amounts during pregnancy. Cattle excrete estrogens and other steroids in the form of urine and feces, which is applied to agricultural lands as manure. Due to rainfall and other anthropogenic activities, these compounds enter the soil and aquatic environment. Studies show that estrogens cause endocrine disruption in various aquatic species. Fish exposed to estrogens in range of nanograms to picograms-showed high incidence of intersexuality and feminism. The naturally occurring estrogens, 17ß-estradiol and estrone, the main analytes of our research, are of major concern because they exhibit high estrogenic potency at very low concentrations when compared to other

steroid hormones. In this presentation, the extraction and the determination of estrogens using Liquid and Gas chromatography will be discussed. Derivatization is an additional step required in the analysis of samples using gas chromatography. The complex matrix of the cattle waste and low concentration of the analytes makes the analysis challenging; hence a cleanup step using Solid phase extraction or sorptive stir bars is needed. The outcome of this study will help us understand the fate and degradation of these estrogens from stored and anaerobically treated cattle waste to land applications.

Rigney, Kendra "The Role of Protective Factors for Nonsuicidal Self-injury in Sexual Minority Individuals" (Amy Brausch)
Research has shown higher NSSI engagement and fewer protective factors among sexual minority status individuals compared to their heterosexual counterparts, which associates with higher suicide risk (Taliaferro & Muehlenkamp, 2017). The current study used archival data from a longitudinal study conducted with Western Kentucky University students through mass email. A sample of participants with lifetime NSSI and sexual orientation data was used to test the study hypotheses (n = 621). Within the sample, 210 individuals identified as a sexual minority (33.8%; non-heterosexual), and 411 who identified as heterosexual (66.2%). It was hypothesized that within a sample of individuals with NSSI history, those identifying as sexual minorities would report lower levels of protective factors (resilience, life-satisfaction, and subjective happiness) than heterosexual individuals. It was also hypothesized that individuals identifying as sexual minorities would be more likely to have made past-year and lifetime suicide attempts compared to their heterosexual counterparts. The first hypothesis was fully supported (resilience ($F(1,608) = 13.438$, $p < .001$), life satisfaction ($F(1,609) = 22.619$, $p < .001$), and subjective happiness ($F(1,619) = 22.795$, $p < .001$)). The second hypothesis was partially supported (past year ($\chi^2(1) = 1.068$, $p = .301$); lifetime ($\chi^2(1) = 18.568$, $p < .001$)).

Rippy, Madison "Flirting Through the Ages: Changing Social Customs in the Victorian Era and Now" (Ann Ferrell)
This case study seeks to explain how women from 1889 to 1900 helped push against social boundaries and change the social landscape of Victorian rigidity through their behavior and compare that to contemporary social customs in 2021. This study uses the etiquette books, diaries, and private correspondence of Lattie Robertson (Coombs) as well as examples of contemporary women flirting pulled from social media, entertainment, and interviews. These women pushed against their social limitations through flirting, suggesting parallels with modern customs and women's view of flirting. None of these women participated in large-scale social movements, but their participation in these small acts of rebellion against their social limitations demonstrates that a push for social change existed and continues to exist in every facet of society, even flirting.

Roberts, Jennifer "Minnesota's Wild Rice" (Ann Ferrell)
In this paper, wild rice in Minnesota and its impact on the local and state economies and the integral role in the lives of the indigenous people of Minnesota will be discussed. In addition, the impact that naming wild rice, the "Minnesota State Grain" in 1972 played, and the laws that control planting, harvesting, and selling wild rice will be examined. Existing secondary sources will be used for this paper to understand why things are as they are now. Examples throughout the paper will explain why wild rice is essential to the Ojibwe people. This paper will also

discuss how Minnesota law has impacted wild rice. Only indigenous people may harvest wild rice in Minnesota; however, they may allow the licensing of private individuals on a lake-by-lake basis. Examples from each subtopic will present a comprehensive analysis on wild rice and why wild rice is essential to the economy as well as critically important to the indigenous people of Minnesota, enabling them to maintain their culture and traditions.

Roehm, David "The Effect of Parenting Stress on Child Behaviors Mediated by Parental Negative Talk" (Timothy Thornberry)
Disruptive behavior in a child is associated with impaired functioning later in life, and providing support to parents to minimize their parenting stress yields significant improvements in the child's behavioral health outcomes. Interventions such as Parent-Child Interaction Therapy (PCIT) are designed to train parents to implement skills for the effective management of problematic child behavior. Parent and child behaviors in PCIT are coded during behavior observations using the Dyadic Parent-Child Interaction Coding System (DPICS). The current study aims to explore whether parenting stress predicts child disruptive behavior and whether this relationship is mediated by observed parental negative talk. The sample included 50 parent-child dyads from rural, eastern Kentucky. Participants completed a DPICS observation, the Parenting Stress Index (PSI), and the Eyberg Child Behavior Inventory (ECBI) Linear regression analyses showed that parenting stress significantly predicted variance in child disruptive behavior, but this relationship was not mediated by observed parental negative talk.

Rollins, Casandra; Matheson, Kathryn; Burch, Katrina; "Work-to-school Conflict, Stress, and Alcohol Use Among College Students" (Katrina Burch)
The purpose of the proposed study is to examine the relationship between work-to-school conflict (WSC), role stress, and alcohol use among employed, full-time college students, and how this relationship is influenced by student role salience. A within-person, daily diary design will be used in order to measure participants daily WSC, role stress, and alcohol use. Role salience was assessed via a baseline survey. Multilevel Random Coefficient Modeling (MRCM) will be utilized to investigate the relationships of interest. It is hypothesized that stress associated with the demands of work and school will mediate the relationship between WSC and alcohol use. It is also hypothesized that student-based role salience will moderate the relationship between WSC and stress, such that the relationships of interest will be exacerbated for those whose student role is more salient. The proposed results will help researchers understand how college students' employment during the academic year affects consequent drinking behaviors. Generalizations and implications of these findings can also be extrapolated to the larger organizational domain given that students' developed patterns of alcohol misuse during college can result in many potential issues for not only these future workers, but also for the organizations who hire these employees.

Ruben, Stacia "Mammoth Cave Sharks" (Patricia Kambesis)
In late 2020 Shark fossils were found in Mammoth Cave National park. Dating back 250 million years, these sharks can teach us about the ancient environments with which they lived as well as the ecological purpose of these predators. This study explores the roles of modern sharks to draw similarities between modern and specifically St Genevieve era ancient sharks. There are also comparisons drawn between organisms from the flora and fauna of each respective time period, to paint a picture of what the environment may have looked like so long ago.

Russell, Fallon "Typographic Tone in Texting" (Angela Jones)
This paper analyzes how tone is communicated in text messages through punctuation, capitalization, and special character patterns. Specifically, I explain how periods communicate abruptness; how alternating uppercase and lowercase letters communicate a mocking tone; and how tildes are used for positive emphasis in text messages. My research consists of primary and secondary data through existing studies and academic articles as well as several personal examples of text message communication. The research reveals that the notice and use of typographical tone in texting is largely generational, as individuals in their teens and 20s are the primary communicators using these typographical tools to convey tone. As typographic elements take on new meaning, readers are encouraged to consider their audience and tone when sending and receiving text messages.

Ryumae, Mina "Implementing and Comparing Various Dots and Boxes Monte Carlo Tree Search Techniques" (Uta Ziegler)
The high strategy game Dots and Boxes has a large computational burden, which causes difficulty in using brute force to consider all board configurations. Players must take another move after scoring, creating a vast number of move sequences. The Monte Carlo Tree Search (MCTS) algorithm is a machine learning approach that builds a partial game tree of board positions and moves deemed to be important to the game. A large number of simulations is run for each board configuration added to the tree to collect statistical data. Each simulation uses data to select moves and updates the data after collecting results. This work focuses on transpositions, board configurations that can be reached through multiple move sequences. The aim is to improve the win/loss/draw ratio of the MCTS player by affecting the amount and quality of information learned through simulations. The basic MCTS selection process uses the benefit of the move for selection calculations. The proposed process modifies this by using the benefit of resulting board configurations after a move was taken instead. A framework was developed which allows players utilizing various selection processes to play directly against one another. Comparisons between the two selection processes will be presented.

Salifu, Samirah; King, Rodney; "The Discovery and Analysis of Novel Bacteriophage PetiteSangsue" (Rodney King)
There are approximately 10^31 bacteriophages in the world, but fewer than three thousand have been characterized. More progress can be made in phage therapy, the therapeutic use of phages, if we have more information. The goal of this study was to expand our knowledge of the phage population. In this study, a novel bacteriophage, PetiteSangsue, was characterized. PetiteSangsue was isolated from a soil sample using Mycobacterium smegmatis as the host. To ensure a pure and homogeneous phage population, four rounds of plaque purification were performed. PetiteSangsue forms turbid plaques, suggesting it is a temperate bacteriophage. Large numbers of the purified phage were grown to facilitate the isolation of the phage genome. The genomic DNA was digested with restriction enzymes, and the products were analyzed using gel electrophoresis. The entire genome of PetiteSangsue was sequenced using the Illumina Sequencing platform. By comparing the sequence of PetiteSangsue to DNA sequence databases, I concluded it belongs to the A2 subcluster of mycobacteriophages, which consists of 101 phages. Based on Electron Microscope analysis, I concluded that PetiteSangsue is a siphoviridae bacteriophage with icosahedral, sticky heads, and non-contractile tails.

Satish, Diksha; Schugart, Richard; "Calculating Individual And Population Parameter Values in the Healing of Chronic Wounds Through Mixed-effects Modeling" (Richard Schugart)
In previous work, four differential equations were used to model the relationships between matrix metalloproteinases (MMP-1), their inhibitors (TIMP-1), and the extracellular matrix (ECM) using averaged patient data during the diabetic foot ulcer healing process. The patient data was acquired from a study that collected data on the concentration of these three factors from sixteen patients over the course of twelve weeks. The aim of this study is to curve-fit individual patient data using mixed-modeling effects. Mixed-effects modeling splits each parameter into two parameters. The population parameter is the same for each patient representing an average response for all patients, while an individual parameter represents the individual patient response and varies across patients. Mixed-effects modeling is implemented in MONOLIX, where its Stochastic Approximation Expectation-Maximization Algorithm is used to calculate population parameters from the patient data. The generated population parameter values were then used as a starting point to calculate individual parameters specific to each patient's data. Through MONOLIX, all sixteen patients were successfully curve fit using this approach. Future work will include applying the generated parameter values in a local sensitivity analysis to identify the parameters that most affect an individual patient's healing response.

Schmidt, Cole "Safety Investigation of Distracted Driving Behavior in Kentucky Using a Driving Simulator" (Kirolos Haleem)
This study investigates driver's behavior during distracted driving (texting while driving) using the driving simulator hosted at the Transportation Safety & Crash Avoidance Research (TSCAR) Lab at WKU's School of Engineering and Applied Sciences. Fifty participants (students and professionals) were recruited and each participant drove the simulator for approximately 10 minutes. During the experiment, video recordings and behavior observations were documented by the research team. Different roadway configurations ("intersections, segments, freeways, and roundabouts", "urban and rural sections", and "straight and curved road cross-sections") and various lighting conditions (nighttime and daytime) were tested in the simulator. For the analysis, participants were separated into "Young" (18 to 25 years) and "Middle/Old" (26 to 70 years) drivers. Speed/lane position variance, gap distance, and spelling accuracy of pre-determined text messages were measured at various points throughout the simulation. Overall, participants experienced increased difficulty (in terms of missed or misspelled text responses) while texting and driving at rural curved road sections, at the roundabout, and during nighttime interstate driving. While texting, "Middle/Old" participants had lesser speed variance compared to their "Young" counterparts. Additionally, while texting, "Young" participants had lesser lane position variance than "Middle/Old" age groups. Safety recommendations to reduce distracted driving behavior were proposed.

Schmitt, Margaret; Lockwood, Adam; "The Course on Norm-referenced Academic Assessment" (Sarah Ochs)
Special education teachers frequently administer tests of academic achievement. These tests are pertinent to deciding special education eligibility determination, therefore scoring fidelity is important. There is a lack of research that explores the training that special education teachers receive in administering and scoring these tests. This research was exploratory in nature; the goal was to provide a baseline of data that can be used for further studies. To examine the training

provided to special education trainees in academic achievement testing, a group of undergraduate researchers investigated the courses offered to special education students from universities across the United States. The research team coded data from 71 special education programs' syllabi to determine course content, test administration requirements, and demographic information. The findings and implications of this analysis will be discussed.

Schulte, Connor; Ainembabazi, Lovence; Nee, Matthew; "Polydimethylsiloxane Bead and Photocatlysts as a Method for Treating Organic Water Pollution" (Matthew Nee)
Organic water pollutants such as petroleum are difficult to treat using traditional methods like filtration. Photocatalysts have been proposed as a way to facilitate the breakdown of these pollutants into less harmful forms, and have already been shown to be effective in this regard. However, when photocatalysts are added to polluted water, they form a suspension which can be difficult to remove. One possible solution to this issue is the use of buoyant, porous, polymer substrates to prevent the formation of a suspension. Our group tested the ability of Polydimethylsiloxane (PDMS) beads to meet these substrate criteria. The beads were created using dispersion polymerization in order to maximize their surface-area-to-volume (SAV) ratios. Their structure and SAV ratios were observed using Scanning Electron Microscopy, and Brunauer-Emmet-Teller isotherms. Energy dispersive X-ray spectroscopy, X-ray diffraction, and Raman spectroscopy were used to determine that the photocatalysts had been incorporated successfully and that the photocatalysts's structure remained unchanged. UV/vis spectroscopy was then used to measure the rate at which the photocatalytic PDMS beads degraded methylene blue, a sample pollutant. It was found that the rate was within an order of magnitude of the rate measured using a photocatalyst suspension.

Scott, Tracy; Bell, Onya; Tilford, Markkeah; Trowel, Kameron; Washington, Tani; Lokuku, Divine; Braden, Kiria; "WKU, Black Female Co-ed And Code Switching: Personal Reflections and Experiences by the WKU South Central Kentucky Chapter Of The Association For The Study Of African American Life And History" (Dr. Selena Sanderfer Doss)
The research conducted by the WKU South Central Kentucky Chapter of The Association for the Study of African American Life and History (ASALH) will elucidate interpersonal understandings among black women across Western Kentucky University's main campus. This research will investigate ideas of code-switching, a practice that entails how minorities alter their behavior and appearance to adapt to settings that do not accept cultural and ethical differences. This research posits that code-switching deprives the prerogative of African American women's rights to self-expression through their identity including dialect and dress. In addition to secondary literature on code-switching, body image, and communication, research methods include self-reflective diaries of black women at WKU. Authors and organizational members have noted their social experiences of code-switching and offer reflections. Calls for further sociological research using interviews and surveys investigating code-switching and black female students are also made. This research will allow the Western Kentucky University community and other college campuses to understand how microaggressions that facilitate the use of code-switching can affect Black women's behavior, identity, and on-campus experiences.

Searcy, Kaylee "Distinguishing Autism Spectrum Disorder from other Developmental Delays at 24 Months" (Lisa Duffin)
There is startling evidence that suggests 1 in every 54 elementary school children will be

diagnosed with Autism Spectrum Disorder (ASD) before they leave elementary school. Receiving individualized interventions at an early age (before age 3) drastically improves the developmental trajectory of a child with ASD in a more positive direction, as well as improving the child's level of functioning, showing the importance of early intervention for a child with ASD. To receive early interventions, a child must first be diagnosed with ASD. Some research suggests that symptoms of ASD can be seen in children by the time they are 24 months. However, research also shows that most children do not receive a diagnosis of ASD until they are almost four. One large reason for this gap of when symptoms are present and when a diagnosis is made could be due to the overlap in symptoms that is seen at the age of 24 months in children with ASD and children with motor, communication, or social delays. This study conducts a systematic literature review using the PRISMA flow diagram to develop a comprehensive list of symptoms that can differentiate ASD from other developmental delays at 24 months.

Shrestha, Niroj; Gani, Nahid; "Understanding the Tectonic Geomorphology of the Eastern Fold and Thrust Belt of the Bengal Basin" (Nahid Gani)
Bengal Basin is one of the most important foreland basins of the Himalaya, supporting millions of people. The ongoing collision and subduction among the Indian, Eurasian, and Burmese plates have resulted in a series of deformed compressional fold and thrust belts, hence, an increase in seismic hazard risk. Due to sparse datasets and the region's complicated geology, the record of any tectonic deformation caused by the fault or other activity remains enigmatic. Rivers can respond to tectonic activity by altering their channel and geometry. These signals can be quantified by generating geomorphic indices (knickpoints, chi-profile, slope-drainage profile) from analyzing the longitudinal river profile using remote sensing data such as DEM. The main objective of this study is to investigate the response of the rivers to tectonic activity within the study area. Preliminary results of the river longitudinal profile analysis for a part of the Basin show a presence of knickpoints, which will be further classified based on structures, lithology, and tectonic elements. Further integration of river profile data will be done to establish a relation between geology and tectonics. The results could assist in more accurately conducting geotechnical investigations, assessing earthquake hazard risks, and taking effecting actions at the onset of a large earthquake.

Sisler, Julie "“The Communication Of Sexual Consent By College Students in Casual Sexual Encounters”" (Jennifer Mize-Smith)
Consent in sexual situations is a subject that continues to grow in significance in today's society. While certain aspects of consent have been explored over the past few decades, this paper offers additional research while viewing consent from a communicative point of view. Previous research surrounding consent is reviewed, followed by the findings from this qualitative study examining the attitudes and actions of college students in relation to sexual consent. Thirteen college students were interviewed via Zoom regarding their definitions, valuations, and methods for communicating and obtaining consent in casual sexual relationships. Findings indicate that (1) communication about sexual interactions between participants is considered “taboo” and therefore uncomfortable to discuss, (2) consent is primarily given and obtained through informal, implicit methods, and (3) participants hold contradicting attitudes of consent in general and consent when engaging in sexual acts. Key terms: Consent, sexual consent, college students, interpersonal communication, sexual relationships

Sledge, Gabrielle "The Effect of the Pura Vida Lifestyle on Perceptions of Mental Health in Costa Rica" (Tim Thornberry)
Costa Rica's unofficial slogan "Pura Vida" ("Pure Life") encapsulates how its people, Ticos, live. Ticos are known as a peaceful, homogenous people but a lack of mental health research limits assessment of Tico mental health status. The purpose of this study is to evaluate Ticos' personal experiences and opinions to understand better how Costa Rica's "Pura Vida" culture affects Ticos' mental health and wellness compared to the United States. A 33 question survey addressing mental health experiences and perceptions was administered to a Costa Rican sample (n = 56) and a United States sample (n = 331). Additionally, 6 interviews were conducted in San Ramón, Costa Rica to explore how Ticos discuss and view mental health in their lives. Survey responses revealed more frequent interference of mental health in Ticos' personal lives, more difficulty finding mental health treatment, and higher perceptions of stigma around mental health compared to United States participants. Interviews revealed that many Ticos are unaware of mental health resources in their community and that discussions around mental health during childhood were rare. While Costa Rica appears "Pura Vida", this study suggests that mental health problems are equally if not more prevalent than in the United States.

Smith, Claire; Elliott, Brian; "The Unfaithful Bride" (Matthew Herman)
"The Unfaithful Bride" is a piece of western art music written with the intent of acclimating westernized ears to the sonic landscape of Judaism, while simultaneously exploring a difficult and allegorical passage of Scripture that intersects with the composer's religious traditions. The primary objective, however, was to create a beautiful work of art. To create this work, research on Jewish music (specifically on the ancient liturgical modes) was utilized to both inform and inspire. Once the text was selected and analyzed, composition began, and rhythmic values and a prayer mode were assigned to each movement. Melodic materials were written at the piano, and transcribed using Finale notation software. Parts were recorded and overlaid to create a hybrid recording through asynchronous methods. The modal framework led to musical innovation, and to tangential inquiries about ethnomusicology, musicology, and progressive covenantalism.

Srivastava, Arivumani "Legislative Recommendations to Curb Road Traffic Injuries and Improve Patient Outcomes in the Gambia" (Edrisa Sanyang)
In Gambia, road safety is a critical yet under-addressed public health problem. Road-traffic crashes cause significant injuries and long-term sequelae, especially in low-middle income countries like Gambia. Coupled with an ill-equipped trauma system, road-traffic injuries (RTI) pose a significant burden on Gambian society. Utilizing data from trauma registries in Gambia's two definitive-care trauma hospitals, we examined road user type, events leading to crash, body parts injured, nature of injuries, and discharge status. This analysis revealed notable statistics regarding RTI victims as a proportion of all hospital patients. Over the study period, one in every three admitted patients were RTI victims. 50% of admitted RTI patients were pedestrians or motorcyclists. 51% of RTI involved commercial vehicles. Nearly 70% of admitted patients required antibiotics. Speeding was a significant cause of RTI, with it being a contributing factor to nearly 80% of patients' injuries. Using this information, tailored policy can be written to protect vulnerable road users while reducing burden on hospitals. Stricter enforcement of speed limits, addressing intoxicated driving, and licensing can protect these vulnerable groups. Improving the trauma system to ensure timely transfer of RTI victims between healthcare levels,

while maintaining hygiene to prevent infections requiring antibiotics, will improve patient outcomes.

Stinnett, Sylvia "An Analysis of the 3 March 2020 Nashville Ef-3 Tornado" (Joshua Durkee)
On 3 March 2020 an EF-3 tornado affected the Nashville Metro and surrounding area produced by a supercell that developed a total of 10 tornadoes across Tennessee 3 March 2020. Python was utilized for visualization to synoptically analyze the event using the North American Model and the High-Resolution Rapid Refresh model data and Gibson Ridge Software with radar data is used for the mesoscale analysis. A deepening trough was advancing towards Tennessee bringing warm air and vorticity advections into Tennessee. Many supercell ingredients materialized over the area at once including instability, amplification of the low level jet and westerlies creating low level and deep layer shear, and positive differential vorticity advection providing a mode for parcel ascent. The forcings based on the pressure tendency and quasi-geostrophic equations were present in the area aiding in supercell formation. The forecasting beforehand was focused on large hail with strong wind gusts and only an isolated tornado chance. The tornado potential for Tennessee was realized when a tornado watch was issued just over an hour before the EF-3 that affected the Nashville metro. Model differentiation on storm mode and cap erosion was the main factor for this unexpected outbreak.

Summers, Jackson "Isolation and Analysis of Novel Microbacterium Phage Makinzy" (Rodney King)
Bacteriophages are the most numerous and diverse biological entities on Earth yet very few have been characterized. Isolation, characterization, and comparison techniques were utilized on new bacteriophages from the environment to investigate this rich, considerable diversity of the bacteriophage population. Microbacterium phage Makinzy was enriched from a soil sample in Kentucky using Microbacterium foliorum as a bacterial host. The virion particles were observed using a transmission electron microscope, displaying a shared predominance of siphoviridae morphology with other previously characterized and sequenced Microbacterium phages. Genomic DNA of the bacteriophage was then isolated and analyzed through a DNA restriction digest and gel electrophoresis. It was determined that Makinzy possesses a high concentration of GGCC restriction sites due to the high interaction rates with enzyme HaeIII displayed in the gel electrophoresis visualization. This analysis demonstrated that Makinzy’s characteristics are consistent with those of other Microbacterium phages since it was grown on the same host and isolated from homogeneous environments as its counterpart Microbacterium phages, yet still exhibits unique properties and measurements. These results provide necessary insight for bioinformatic characterization to advance Microbacterium and bacteriophage genetics.

Summers, Shelby; Wulff, Andrew; "Mineralogy of Great Onyx Cave, Kentucky" (Andrew Wulff)
This study focusses on the mineralogy of Great Onyx Cave, located within Mammoth Cave National Park, Kentucky. The cave lies within the Joppa member of the Ste. Genevieve Formation, comprising mostly limestone with minor chert and quartz nodules. Although the cave passageways have been mapped, little is known about the minerals within the cave itself. Although the cave is characterized by wet sections and dry sections, this research concerns the minerals found primarily in the dry section of the cave. Passageways were measured first with a pace count which was then calibrated with a tape measure. Initial sampling centered on minerals

which exhibited fluorescence and phosphoresce under both longwave and shortwave UV light. Sample locales were identified and labelled on the map of the cave passages. A WKU staff photographer captured high-resolution digital and long-exposure photographs of aspects of the cave and all sample locales. Instrumental investigations have concentrated on identifying unknown minerals using hand sample properties, Raman microscopy (RM), scanning electron microscopy (SEM), and x-ray diffraction (XRD). The RM provides rapid, non-destructive identification of minerals, which may then be corroborated using SEM with EDS compositional analyses, and by powder XRD to develop a catalog of known minerals.

Survance, Anthony "Professorial Identities: Managing Identity Crises During a Global Pandemic" (Jennifer Mize-Smith)
Building on existing studies of identification, this paper melds crisis research with studies of identity to understand how crises influence work-place identities. To accomplish this, the study addresses the research question of how professors' decisions to teach in person affects professors' efforts to manage their professional identities during the COVID-19 pandemic. Professors provide a unique sample by highlighting workers who chose to work face-to-face rather than a group who is economically coerced into danger. This paper employs qualitative methods to solicit rich descriptions of professorial identities to get to the heart of how in-person instruction influences identification. Overall, this study shows decisions to teach in person forced professors to overcome tensions between their personal and work-place identities. To accomplish this task, professors emphasized their professorial identity over other features of their identity. Additionally, this study shows during prolonged crises, workers augment their professional identities with the ways they help the organization overcome the crisis, increasing identity confidence. This study advances communication literature by including psychoanalysis into identification research and thoroughly evaluating emerging identities during the COVID-19 pandemic.

Taggart, Kaharie "The Seed That Grows" (Shahnaz Aly)
The purpose of this project is to shed light on community involvement in a suburban area. A vast majority of the time a community forgets about the core values that help raise the culture of a community itself. A successful and functional community center is the symbol of a healthy environment. The Saint Charles Community Center houses spaces for adolescents to learn, adults to exercise and the elderly a place to sharpen their mind. The competitive nature that helps breed friendship, character and rivalry is instilled within this facility with the full-size pool, basketball court, and an outdoor area where individuals/groups can host competitive leagues. My design philosophy is based around the idea of achievement. The objective of this project is to keep the mind, body and soul engaged and push people outside of their comfort zone when they encounter this building. The floorplan is open to invite conversation and the rooms are grand to inspire ideas. A seed is planted the moment an individual walks in this facility and throughout time it will began to develop and grow.

Taylor, Molly; Rowe, Megan; "The Effect of Age on Neurological and Peripheral Inflammatory Responses to Sleep Fragmentation in Mice" (Noah Ashley)
Obstructive sleep apnea can be identified by recurring events of airway collapse during sleep, intermittent hypoxia, and perturbations in sleep continuity, known as sleep fragmentation. Long-term obstructive sleep apnea promotes cardiovascular and metabolic diseases and reduces overall

quality of life. Elderly patients are more at risk of developing obstructive sleep apnea, especially if they are male and/or obese. Consequently, aging and obstructive sleep apnea are independent risk factors for both cardiovascular disease and neurocognitive decline. The purpose of this study is to assess whether age affects neurological and peripheral inflammatory responses to sleep fragmentation. This assessment will be made by subjecting young (4-5 months old) and old (10-11 months old) male C57BL/6j mice to automated sleep fragmentation for 24 h, as well as having mice in both age categories as a control with no sleep fragmentation. Immediately after, neurological and peripheral tissues are to be collected and analyzed for the expression of the gene for the pro-inflammatory cytokine, tumor necrosis factor-alpha (TNF) using real time PCR. These findings will give a better understanding of how obstructive sleep apnea progresses and affects patients as they age.

Thaweechok, Taksin "Home for The Arts" (Shahnaz Aly)
The project is a street art and cultural center that serves as an exhibition hall to showcase local artworks made by various no name street artists. The intentions and purposes for the project are to provide a safe environment and opportunity for street artists to showcase their work. It is true that not all architectural designs have a deeper meaning to it. However, for an art gallery where the keys to the success of having beautiful art, are creativity and the opportunity to express it. By creating such platform, historic areas of the cities can be preserved and kept safe from the graffiti artists. The design and ideas for the construction of such building is developed through intensive research and the study of several similar structures. The location for the site of this building was chosen in Los Angeles, CA with flexibility to design an innovative building form. The green biophilic design implemented into the design to improve creativity and provide green sustainability. An art studio was also provided to create opportunities for those who visit the gallery to be educated about street art.

Thomas, Casey; Bendson, Malyra; Dinning, Kelsey; ; Ochs, Sarah; "Academic Screeners and Language Background: Predicting Future Performance" (Sarah Ochs)
In the fall of 2017, there were approximately 5 million students in public schools who identified as English Learners (ELs). These students often have unique learning needs as they acquire the English language. As a result, schools should consider whether the same academic screening measures used to identify need or risk for native English speakers (NESs) predict future performance with the same level of accuracy. Because of the high importance placed on data from screening tools, scores need to be reliable, valid, and accurate, and measures should be efficient to administer and cost effective (Glover & Albers, 2007; Kettler, Glover, Albers & Feeney-Kettler, 2014; Wilson & Jungner, 1968). In this poster presentation we will analyze early literacy, math, and reading screening data from a suburban school district in the Southern United States. Approximately 13% of the sample identified as an EL student. We will examine the relationship of screening scores to state test performance and relative differences in classification accuracy by comparing area under the curve statistics for ELs and NESs. Results will be discussed and implications for both research and practice will be highlighted.

Thomas, Jayden "The My Parents are Rich Scholarship: Exploring The Effects of Expected Family Contribution and University Aid" (Scott Lasley)
Expected family contribution or EFC, is a number used by the Free Application For Federal Student Aid (FAFSA) to determine a student’s eligibility to receive federal aid. I am exploring

the relationship between a student's EFC and various demographics, and the aid they receive (merit scholarships, KEES, etc.). For qualitative analysis, I plan on conducting interviews with various staff members in the WKU Office of Student Financial Assistance. These individuals have a profound understanding of federal and university aid as well as changes to policy over the years. In my thesis, I plan on addressing some of the shortfalls of FAFSA and how an EFC is determined, as well as offer possible solutions on how universities can address some of these shortfalls to benefit students. I anticipate finding a correlation between a student's EFC and the amount of aid they receive from merit scholarships as well as other sources of financial aid. I also believe there will be a correlation between EFC and GPA. I am also interested in finding a relationship between a student's EFC with other demographic factors such as gender or race. During my presentation, I will also discuss other relevant literature on the topic.

Thompson, Kristen; Jackson, Cameron;Palmquist, Shane; "Engineering Numbers: Innovation of Quantification" (Shane Palmquist)
Numbers are foundational concepts and principles in mathematics. They allow us to measure, compare, quantify, and analyze phenomenon in engineering, applied sciences, business and more. This paper examines the work of two undergraduate civil engineering students who explore what a number is in mathematics, examining the meaning and application. Number types and groups of known finite numbers are explored. Based on this investigation, potentially new numbers are engineered and presented to fill the gap in understanding that exists within our number line system. The results are surprising and serve as a means of helping to unify and clarify numerical mathematics in the wake of the work by Kurt Gödel and his incompleteness theorems. In addition, this work serves as a beacon to help illuminate new possibilities for future developments in applied mathematics. A student assessment of this research project presented.

Troxell, James; Polk, Jason; "An Adaptive Incident Response Framework for Urban Karst Groundwater Hazards" (Jason Polk)
Environmental spills in karst regions are damaging and often go unnoticed until the issue has escalated to a point of affecting life or property. The field of emergency and environmental spill response lacks planning or preparedness focused on remediating groundwater contamination in karst systems. A lack of preplanning before an incident can lead to confusion, delayed response, and the inability to recover the contaminant. Due to the rapid movement of contaminants through urban karst groundwater aquifers, an efficient response plan that leverages localized data in a GIS must be developed and maintained in order to adequately respond. The objective of this study was to develop an adaptive response framework that includes data-driven preparedness and planning, a response plan template, and example mock drills for use by communities and emergency responders to assist in the response to urban groundwater contamination. Using the City of Bowling Green, Kentucky as a case study, where historical and modern gasoline leaks are prevalent, surveys and semi-structured interviews were conducted, along with participant workshop analysis, to inform the framework's development and integration of GIS into the emergency response planning for urban karst groundwater hazardous contamination events

Turner, Grant "Simplification of Robotics Through Autonomous Navigation" (Mark Cambron)
Electronics, programming, robotics, leave those complicated ideas for the nerds, or so many may think. The real question is if these topics truly are as complex as society makes them seem or if the common perspective of robotics is just too broad, causing the easily understandable aspects

to be overlooked. This negative viewpoint on robotics trickles down to cause a few overarching issues: selling short of one's abilities, potential loss in implementation of society-changing ideas, and potential loss in contribution to STEM fields. Through presenting a self-developed curriculum within robotics workshops where participants are able to attempt developing a code/program to make a robot autonomously navigate a unidirectional hallway system, my project is aimed at reducing perceived complexity in robotics as well as stimulating a logical thought process when evaluating complex topics. The project also targets individuals who have little to no prior experience with programming or robotics. This presentation will discuss similarities between robotics and the human body as seen in my developed curriculum and it will also present a qualitative analysis of results from the robotics workshops.

Turner, Grant; Sellers, Emma; Estes, Joshua; Hardesty, Logan; Alshaiki, Abdullah; Almajed, Mahmoud; Alrefaei, Mohammed; Maners, Nolan; Alanzi, Saud; "IEEE Student Robot Team" (Mark Cambron)
Each year the Institute of Electrical and Electronics Engineers (IEEE) challenges students with a new robotic design competition to allow different universities to test their problem solving and technical skills. WKU electrical and mechanical students have joined to represent the university with a robot built with the objectives of autonomously navigating a randomized playing space to avoid specified obstacles, locating and retrieving a specific wooden object, and returning to the starting point. This project is broken into three main sub-system designs: voice recognition, autonomous navigation, and a mechanical arm. Initial voice commands, instruct the robot of specific positions of objects within the randomized competition space. Based on vocal commands, the best route of navigation is chosen from a comprehensive list. Each navigational route is a combination of simple movements utilizing input components to determine directional movement and orientation. Once the robot arrives at a user-specified location in the playing space, a mechanical arm will extract out and over a wall to retrieve the wooden object, then instruct the robot to return home. In this presentation, each of these main sub-systems will be introduced and explained to show how electrical and mechanical design work together to develop our robotic system.

Turner, James; Griffiths, Austin; Murphy, April; "The Development and Utility of The Child Welfare Employee Feedback Scale (CWEFS-R)" (Austin Griffiths)
Child maltreatment in the United States is considered a public health crisis. Frontline child welfare workers are tasked with responding to the increased number of allegations of abuse and neglect of children and face significant job stress. This continues to result in high rates of workforce turnover, and the average length of tenure for child welfare workers is less than two years. Job satisfaction remains a key factor in workforce stability, and proactive data collection is vital when seeking avenues to address this dilemma. This presentation will describe the development and utility of the Child Welfare Employee Feedback Scale (CWEFS-R). Based on data collected from a sample of public child welfare workers (n=628), an exploratory factor analysis identified five prominent underlying structures that contribute unique feedback across vital domains that are known to influence the satisfaction and longevity of child welfare workers (e.g., workload impact, supervision, peer support, organizational climate, and accomplishment). This presentation will highlight aspects of the literature that support the integration and relevance of these key domains, the psychometric development of the instrument, and its current utilization in research.

VanHoose, Kathryn "Western Kentucky's University's Agriculture Student's Behaviors and Attitudes Toward Class Adjustments Due to the COVID-19 Outbreak" (Thomas Kingery)
The college experience was drastically challenged in March 2020 with the COVID-19 pandemic. Institutions scrambled to change educational delivery systems while faculty and students were forced to change the way they interpret and share knowledge. The purpose of the study was to determine if the students in the Agriculture Department at WKU were comfortable with the transition from regular classes to online courses. To assess student opinions, a Qualtrics survey was distributed to students on the WKU Agriculture email list with a goal of determining their behaviors and opinions in relation to the online learning during COVID. Out of the responses received, 47% showed an unpleasant transition from a variety of issues such as technology, professor ability to work over the internet, and loss of hands-on training for labs and active methodology classrooms. They believed that their education was different and not as effective as traditional classes. Many students also faced non-educational challenges due to COVID including postponed family visits, loss of work, and increased stress levels. The goal of this study is to determine a level of transitional awareness and acceptance and to understand how the COVID-19 adjustments affected WKU agriculture students' learning experiences.

Wade, Mason; Brosky, Maggie; ; Gani, Nahid; Gani, Royhan; "Geologic Mapping Methods of the McDaniels Quadrangle, Kentucky" (Nahid Gani)
Abstract: A 1:10,000 geologic map of the McDaniels Quadrangle is being created using fieldworks and lab analysis. Standard geologic field methods were utilized in the study area to map faults, lithology and stratigraphic contacts. Samples of various units were also collected from the Reelsville Limestone, Beech Creek Limestone, Haney Limestone, Big Clifty Sandstone, and Hardinsburg Sandstone for petrographic studies. ASTER and DEM datasets from the United States Geological Survey were used to guide field mapping and conduct river profile analyses using MATLAB codes. Using the collected data, an interactive digital geologic map is being created at a higher resolution than what is published currently, with additional information such as: lithologic descriptions, paleontological data, structural data, and depositional environment interpretation. Our geologic map of the McDaniels Quadrangle represents the most recent field investigation and geologic data pertaining to the area. An updated geological map will provide more detailed insight of the area and help local authorities anticipate potential hazards, plan construction projects, and gain a deeper knowledge of both the surface and subsurface geology of the area.

Wasson, Fiona; Yusuf, Augustine; Nguyen, Ngoc; "Optimizing the Synthesis of a Degradable Initiator Towards Novel Degradable Polymers for Drug Delivery" (Lawrence Hill)
Work to optimize yield on a novel drug delivery polymer was conducted on an initiator capable of degrading in certain biological conditions. This polymer can be degraded by the triggering of the initiator at low concentrations of hydrogen peroxide. The final step of the initiator synthesis has shown low yields of recovery ~22% of the theoretical yield. To best optimize the final reaction, a series of micro reactions tested the base/catalyst, solvent, and temperature conditions. The techniques learned included using NMR peaks to analyze the percent conversion for the reaction. This analysis uses the integration values of changing hydrogen bonds at the reaction center to an unchanging hydrogen peak. This technique was used to analyze each micro reaction, providing evidence of the best condition. The best condition showed 85.75% conversion using

the selected base/catalyst mixture in the solvent chloroform at room temperature, as opposed to 72.96% conversion using the original conditions of the reaction. Optimizing the purification proved difficult with trials of recrystallization, sonication, and columns. Other techniques learned and utilized include NMR for characterization, TLC, and purification using liquid extraction and rotary evaporation. Current work is focused on a monomer that will delay degradation until the optimal biological condition.

Weafer, David "Leadership, Emotional Intelligence, and the Enneagram: A Study of the Effects of Enneagram Training on College Student Leaders" (Steven Wininger)
This thesis investigates the impact Enneagram training has on empathy and self-awareness in college student leaders. The EQ-i 2.0 was used to gather and analyze data on 16 student leaders' emotional intelligence, before and after the intervention. Qualitative methods, specifically open-ended journal prompts and semi-structured interviews, added a rich description of the participants' perceptions of the Enneagram's usefulness. Preliminary findings show that the participants have made connections between what they are learning in the experiment and how they interact with others through their leadership roles. Though data is still being collected, the results should provide answers to research questions about the Enneagram's effect on the participants' emotional intelligence and how they perceived its impact on their leadership abilities.

Weiler, Austin; Mallinger, Gayle; "Psychosocial Risk and Body Dysmorphic Disorder: A Systematic Review" (Gayle Mallinger)
Body Dysmorphic Disorder (BDD) is a psychiatric illness affecting 1 in 50 individuals throughout the United States (International OCD Foundation, 2020). Research supports the importance of early treatment in symptom reduction across the lifespan; therefore, it is imperative mental health providers recognize individual, interpersonal, and environmental influences placing individuals in danger of developing this disorder. This proposed presentation will discuss the process of conducting a PRISMA-P systematic review of studies examining risk factors for BDD, our findings, and implications for practice, education, and further research.

Wheeler, Lindsey; Wininger, Steven R.; "The Effects Of Outdoor Therapy on Depression and Anxiety: A Quantitative Review" (Steven R. Wininger)
The goal of this research was to assess the effectiveness of outdoor therapy on depression and anxiety across different moderators via a quantitative review. While there are studies that look at the effectiveness of outdoor therapy on psychological outcomes, there is a lack of synthesis of the research investigating moderators such as age, intervention type, and intervention duration. The present study sought to examine such moderators via a quantitative review. A literature review was conducted and studies were excluded for not pertaining to outdoor therapy and/or not including relevant data. This left six studies to be included in the analysis, with a total of 1294 participants. Cohen's d was calculated for each study. We included the following moderators: intervention type (immersion vs part-time treatment), intervention duration (0-2 months vs 2-4 months), age (adult vs adolescent), and measurement type (direct vs indirect). The effects of outdoor therapy were greater for anxiety (d=0.65, n= 1215) than depression (d=0.43, n=115). Within the anxiety results, the average effect size for adolescents (d=0.75, n=979) was greater than the adult effect size (d=0.27, n=236).

Wilhelm, Garrett "Warren County Career & Technical Center" (Shahnaz Aly)
Within the Senior Capstone Project here at WKU I have designed a vocational school for students of the various Warren County High Schools. The goal for this project was to create a facility that is an efficient and enjoyable environment for students to learn various vocational topics. Taking vocational courses and learning the value of where they can take a student in life has been the inspiration behind this. It is important for all students to have the chance to take these types of classes if they're interested due to how much opportunity it can provide for each and every student. During this project there have been phases of schematic design aiming to develop the most efficient layout along with creating an enjoyable work environment for instructors and students. Along with this it has included tasks such as site visits, code research, drafting and modeling, meetings with classmates/instructor, and various other things.

Williams, Abigail "Improving Best Management Practices For Siting, Maintenance, And Design Of Urban Karst Groundwater Injection Wells" (Jason Polk)
Class V injection wells in urban karst areas generally lack effective regulation and guidance to prevent sediment and pollutants from entering surface and groundwater supplies. Bowling Green, Kentucky, is home to over 1,500 mapped Class V wells; pollutants can flow unimpeded through these wells, impairing water quality and causing well obstruction. The objective of this study is to determine proper management practices for drilling new wells, maintaining existing wells, and closing non-viable wells. Ultimately, this research aims to improve the viability and longevity of Class V injection wells as flood control measures. These data should lead to science-based policy recommendations on Class V injection well implementation and maintenance, which could result in improvements in flood control and stormwater runoff quality.

Williams, Baron; Smith, James; Anastasio, Israel; Hosseinpour, Mehdi; "Comparative Analysis of Aggressive-driving And Distracted-driving Crashes Involving Commercial Motor Vehicles in Kentucky" (Kirolos Haleem)
In Kentucky, for the years 2015-2019, crashes affected by driver aggressive violations and distraction activities accounted for 31% and 41% of total severe commercial motor vehicle (CMV) crashes, respectively. This study compares the injury severity outcomes (severe vs. non-severe) concerning aggressive-driving and distracted-driving crashes. Recent five years of CMV-related crashes (2015-2019) in Kentucky were used. Separate Z-tests of proportions and chi-square tests of independence were applied to identify the factors affecting the severity of crashes for each of aggressive-driving and distracted-driving CMV-involved crashes. The Z-test showed that, overall, the proportion of severe injuries in aggressive-driving crashes was higher than that in distraction-related crashes. Interestingly, road segments with lanes equal to or less than 11 feet increased the risk of severe aggressive-related CMV crashes (odds ratio = 1.30), but reduced the risk of severe injuries in distraction-related CMV crashes (odds ratio = 0.77). Head-on crashes, use of alcohol or drugs, angle collisions were the top three factors increasing the risk of severe CMV crashes from aggressive-driving and distraction behaviors. The study findings suggest that removal of road distracting elements (e.g., billboards) at high crash risk spots and intensifying traffic enforcement can reduce the severity of aggressive-driving and driver-distraction CMV-related crashes.

Williams, Jessica "Mapping Out the Natural Underground "plumbing System" of the Great Onyx Groundwater Basin, Mammoth Cave National Park, Kentucky" (Chris Groves)

Mammoth Cave National Park lies on a spectacularly developed karst landscape formed within limestone bedrock and the Mammoth Cave System here is the longest known cave on Earth. Great Onyx Spring drains a small (~5 km2) forested area of the Park relatively free from human contamination sources. More than 10 kilometers of cave passages provide excellent accessibility to the subsurface drainage system. The purpose of this project is to contribute to a larger, ongoing study by WKU and Mammoth Cave scientists to better understand the natural underground "plumbing system" of the aquifer here by utilizing fluorescent dyes to trace the pathways of surface and underground streams. Partnering with these scientists we have successfully connected a sinking surface stream in Three Sisters Hollow to the Lucykovah River underground stream in Great Onyx Cave and shown that Biz Falls in the cave is also a tributary to Lucykovah River. Work is currently underway to study the section between Biz Falls and Lucykovah River using discharge measurements that include salt dilution tracing tests and direct volume-time measurement. Early results suggest that some flow is lost between the two points, but we continue to refine our measurements—each experiment informs planning for the next.

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Willis, Victoria; Gunter, Dr. Phillip; "Effect of Supplemental Garlic on the Incidence of Heinz Body Anemia in Horses" (Phillip Gunter)

Garlic (Allium sativum L.) is a spice that has been used for centuries for medicinal purposes or flavoring in food. Garlic has also been commonly used as a fly and pest control for horses and is still commonly used for that purpose today. Recent research has shown garlic may cause Heinz body anemia in horses. The purpose of this study was to evaluate the incidence of Heinz body anemia in horses supplemented with varying rates of garlic. This study included 12 horses divided into 4 groups (control and 3 supplement rates: low (0.0625 g/kg), medium (0.125 g/kg), high (0.1875 g/kg)) that were provided garlic for 74 days. Blood samples and weights were taken on day 0, 25, 50, and 74. Data were analyzed using Proc Mixed of SAS as a completely randomized design, pα = 0.05. Garlic affected red blood cells (P = 0.0278) and platelets (P = 0.0058). Hemoglobin (P = 0.0740) and Heinz bodies (P = 0.4055) were not affected by garlic. Overall red blood cell counts and platelets were affected by garlic supplementation, but hemoglobin and Heinz body counts were not. Our results indicate that garlic supplementation

may be safe for horses, but further research is needed.

Willoughby, Ginny "Hanoks: Subsidization, tourism, and space" (Tim Frandy)
This paper examines the reconceptualization of space in traditional vernacular architecture (hanoks) and modern apartments in South Korea. Through analysis of existing scholarly research, traditional and modern spaces were identified to be both products and sources of shifting cultural values within the South Korean cultural narrative. State subsidized initiatives denote the importance of preservation of traditional culture while still sanctioning considerable progress in the development of a national identity. This paper addresses relevant issues regarding the growing concern of westernization's impending detrimental impacts to traditional culture by calling for a more complex understanding of heritage production in South Korea's cultural and built environment.

Wilson, Nathan; Nee, Matthew; "Monitoring Paraquat Degradation In Real Time Using Colloidal Gold Surface-enhanced Raman Spectroscopy" (Matthew Nee)
Monitoring fast chemical reactions in aqueous solution is a challenge because most instrumental techniques are not suited for the rapid timescales or are not sensitive enough to detect small structural changes. Raman spectroscopy is a promising method to monitor reactions, as it is fast and dependent on structure but without a strong signal from water; however, Raman scattering is generally very weak. Surface-enhanced Raman spectroscopy (SERS) improves the signal strength of Raman spectroscopy by creating a plasmon, or oscillation of the surface's electrons, to allow for highly-selective and sensitive detection and characterization of molecules in solution. An aqueous colloid of partially aggregated gold nanoparticles is an accessible substrate to generate plasmons necessary for SERS. Analyte is adsorbed to the nanoparticles, and structural changes can be detected over time as photons are scattered by the molecules. Paraquat a common yet dangerous herbicide banned in the EU, was monitored with SERS in real time as it degrades into methylpyridinium when exposed to intense light, analogous to sunlight. A reaction mechanism and kinetics were determined. Gathering better data about this harmful chemical can help guide users and policymakers to apply paraquat only when there will be minimal harm to the wider environment.

Wriedt, Zachary "Acute Sleep Fragmentation Increases Inflammation in White, But Not Brown, Adipose Tissue" (Noah Ashley)
Sleep is an important process required for vertebrates, including humans, to function. When sleep is disrupted, it leads to deleterious effects such as inflammatory responses throughout the body. In past studies, acute (24 h) sleep fragmentation (SF) leads to an inflammatory response in white adipose tissue. However, whether brown adipose tissue responds in a similar fashion is unknown. Male adult (>8 weeks of age) C57BL/6j mice were subjected to SF for 24 h using a cage outfitted with a bar that moves horizontally across the cage every 2 min to periodically awaken mice (N =10). Controls were housed in a similar cage but experienced no bar movement (N=10). After SF, inguinal and epididymal white adipose tissue, as well as brown adipose tissue, were collected. Next, RNA was extracted from samples, reverse transcribed into cDNA, and then pro-inflammatory gene expression (IL-1-beta and TNF-alpha) was assessed using real-time PCR. For both cytokines, there was differential expression in the different types of adipose tissue. Specifically, pro-inflammatory gene expression was elevated in white, but not brown, adipose tissue among SF mice. Since the functions of brown versus white adipose tissue are different,

these tissues respond differently to a stressor, such as sleep loss.

Wright, Emily "Geologic Mapping of the “incrop” in the Mammoth Cave System, Kentucky" (Patricia Kambesis)
Geologists typically use surface rock exposures (outcrops) or remote sensing techniques such as aerial photography to document and record the geological units of an area of interest. Well-log analysis is another remote sensing technique to map geological units that are not accessible at the ground surface. Mapping of Incrops (rock exposures within cave passages) is an underutilized technique to document the geology of a karst area. Unlike well-log analysis, which is costly and requires specialized equipment, mapping geological incrops in caves is an accurate and efficient method of mapping a geological unit from the “inside”. This study uses geological mapping of incrops along with cave survey data to produce georeferenced 3-dimensional maps particular areas of the Roppel Section of the Mammoth Cave System. Newly mapped geologic data is used to produce 3-dimensional profiles that illustrate the geology and the geography of the Roppel Section of the Mammoth Cave System. This extends geological data to areas outside of the National Park Georeferenced cave.

Yarberry, Ashley "Sustainability in Architecture: Royal Oak Transit Center" (Shahnaz Aly)
This senior research project captures the need for sustainability, community, and togetherness through the advancements of a former transportation spot into a full-blown transit center for gathering and traveling. Through research I have found that architecture can boost sustainability within transportation and sustain the building as well. The new transit center brings together Amtrak travel, Greyhound, Mega bus, Metro Bus, and ride sharing app transportation at a downtown location. As well as the sustainable aspect of travel, the building itself is equipped with solar panels, environmentally friendly windows, and a green roof. Therefore, the building can maintain itself longer and create some of its own energy. This project was approached with a need to solve America’s growing problem with personal transportation. By offering a place to catch transportation, it has opened the eyes to new ways to travel and save on gas emissions. The Transit Center project is in Royal Oak, Michigan that sits right outside Detroit. Due to the area being known for motor vehicles, public transportation has never been a concern for the area. Therefore, making sustainable moves towards safe and available transportation is so important within a metropolitan area that is so spread out.

Yusuf, Augustine; Hill, Lawrence; Wasson, Fiona; Palmer, Jeff; "Design of a Novel Class of Degradable Antioxidant Polymers" (Lawrence Hill)
Hydrogen peroxide is present at sites of inflammation in the body and degradable polymers can be used to create drug delivery containers that preferentially release therapeutics at these locations. We are working towards a new class of materials expected to have tunable degradation rates in the presence of hydrogen peroxide. These new materials consist of three parts: degradable linkages, antioxidant groups, and unreactive filler monomers such as methyl methacrylate. We have synthesized a polymerization initiator with a degradable linkage and we have shown that using this initiator to synthesize an otherwise inert polymer, poly(methyl methacrylate), results in a material that is degradable in the presence of hydrogen peroxide. Based on the known antioxidant activity of ascorbic acid, we are currently working to synthesize an ascorbic acid containing monomer to incorporate antioxidant groups into the degradable poly(methyl methacrylate). These antioxidant groups are expected to afford some protection to

the degradable linkage and allow us tune the rate at which containers made from this polymer release their cargo in the presence of hydrogen peroxide.