Participant Abstracts - Posters & Projects
EMU Academic and Creative Excellence Festival 2026

Listings are in alphabetical order by the last name of the presenter. In the case of group projects, the entry is alphabetized under the name of the student who submitted the entry.

How station location shapes metro ridership in Washington D.C.
Ankita Adhikari
Faculty Mentor: Doug Graber Neufeld

This project looks at how the location of metro stations affects how many riders use them across Washington D.C. Ridership data from WMATA and station locations from the DC Open Data Portal will be mapped in ArcGIS to find patterns between busy stations and what surrounds them. The goal is to show that stations located near popular areas, job centers, and dense neighborhoods tend to attract the most riders.

Battle of Advils: Gel V. Solid Dissolution
Rin Akinotcho, Donovan Glymph, Trinity Washington
Faculty Mentor: Laurie Yoder

Advil is an over the counter medication used for pain relief. In our experiment, we will aim to determine if the coating of Advil (Solid or Gel) has an effect on the dissolution rate. In five minute intervals, we will take a sample of our solution and the absorbance will be measured using a spectrophotometer. Hydrochloric acid will be used to simulate stomach acid for more accurate results. Our simulated solution will be stored at body temperature for a closer representation of stomach acid. We expect the solid tablet of Advil to dissolve more quickly compared to the gel tablets in the solution.

Spice to Science: Extracting Cinnamic Acid from Cinnamon Bark
Kristen Andersen, Ephrata Amare, Jade Davis
Faculty Mentor: Steve Cessna

Cinnamic acid is known to be a potent antioxidant, but just how potent can it be? We decided to investigate this by comparing the anti-oxidant concentrations between cinnamon bark from a farmers market and from a large chain grocery store. We will determine the antioxidant concentration using the Ferric-Reducing Ability of Plasma (FRAP) test. We plan to use 13C NMR, 1H NMR, and UV-vis spectroscopy to determine the concentration and purity of the cinnamic acid that we extract from the cinnamon bark.

Mechanical Cuckoo Clock

Nick Arnold, Ben Huyard
Faculty Mentor: Danny King

In this project, the problem was to create a clock that displays hours, minutes, and seconds accurately. Our solution to this problem consists of a pendulum swinging at a specific frequency, which is transferred to rotational motion through an escapement mechanism and a gear train connected to the escapement directs the motion to the clock hands. A mass pulling down on one of the gears is the energy source for the system. The clock was built out of primarily 3D printed parts, with some critical components such as ball bearings and axles needing to be ordered. The major constraints in this project are time and money. The solution ended up being successful, however, more testing needs to be done to determine exactly how accurate the clock is. To improve upon this design, a cuckoo could be implemented, making sounds indicating what time it is. Another improvement could be the overall efficiency, making the clock run for longer before being rewound.

Foster Care and Mental Health: Understanding Risk for Anxiety and Depression

Meredith Atkinson
Faculty Mentor: Bryce Van Vleet

The foster care and child welfare system is essential for ensuring safety and well-being for children who have experienced abuse, neglect, or other adverse childhood circumstances. As of right now, there are approximately 400,000 children in foster care in the United States (Department of Education, 2025). Despite its protective intent, many youth involved in the system remain at elevated risk for emotional and psychological difficulties, particularly anxiety and depression during adolescence. With these being among the most common mental illnesses globally, understanding how specific foster care experiences shape mental health outcomes is essential for improving services and long-term well-being. Using longitudinal secondary data from the National Survey on Child and Adolescent Well-Being III (NSCAW III), this project analyzes placement history, maltreatment exposure, and emotional functioning among youth involved in the child welfare system. The sample includes approximately 3,298 children ages 0 to 17.5 from 61 counties across 17 states who entered the child welfare system between 2017 and 2021. It is expected that greater placement instability and adverse childhood experiences will be associated with higher levels of anxiety and depression. Identifying the aspects that are most strongly associated with these mental illnesses will help inform future interventions, policies, and support services for youth in foster care.

Flood Risk and Income Inequality in Rural and Urban Areas

Ezekiel Awkward
Faculty Mentor: Doug Graber Neufeld

Flooding is a very common hazard in the U.S. However, more areas are at a higher risk than others. This project analyzes the relationship between income levels and flood risk by combining flood hazard data with census income data. The goal is to determine whether low-income communities experience greater vulnerability to flooding compared to higher-income areas.

Environmental Degradation of Plastics Under Different Chemical and Natural Conditions

Lemi Bekele, Seungmin Cha
Faculty Mentor: Steve Cessna

Plastic degradation is a significant environmental concern because many synthetic plastics persist for long periods in natural environments, leading to accumulation in soil and water systems. This project investigated how different plastic and natural materials degraded under various environmental conditions. Six materials LDPE, HDPE,polycarbonate, polyester cloth, and cotton cloth were cut into small squares, arranged in a consistent pattern on wooden blocks with duplicate samples, and exposed to six environments, a dark air cabinet, high-UV sunlight in a greenhouse, a saltwater bath, compost rich soil, H2O2 and Fe2+ solution, and a bleach bath. After approximately five weeks of exposure, the samples were analyzed using infrared (IR) spectroscopy and microscopy, along with physical observations such as changes in flexibility and surface appearance. The IR spectra were examined to identify characteristic peaks and determine how the chemical composition of each material changed in different environments, while microscopy was used to observe surface degradation and structural damage. Overall, the study compared the stability of the materials under different environmental conditions and provided insight into how environmental factors influence plastic degradation and potential breakdown pathways.

In Black & White - The Effects Of Low Dose Muscarinic Cholinergic Antagonists Extracted From D. Stramonium On Zebra Fish Neuro Systems

Marlowe Brin, Sharon Tamon
Faculty Mentor: Steve Cessna

Muscarinic cholinergic signaling plays a central role in attention, sensory processing, and behavioral responsiveness. This study investigates the behavioral effects of low-dose muscarinic cholinergic antagonists extracted from the plant Datura stramonium on the neural systems of zebrafish. Alkaloids that we will be using will be isolated through acid-base extraction and centrifugation & analyzed using gas chromatography mass spectrometry (GC/MS), with activity levels compared to a known muscarinic antagonist such as Atropine. Behavioral responses in zebrafish will be

recorded at baseline and following exposure to low-dose extracts. We will be focusing on attentional persistence, sensory responsiveness, and locomotor activity. We hypothesize that partial suppression of muscarinic cholinergic signaling will increase attentional persistence while reducing sensory responsiveness. By correlating cholinergic antagonism with measurable behavioral changes, this study aims to clarify how mild disruptions in muscarinic signaling influence attentional and sensory processing in a vertebrate model.

Effect of Sulfuric Acid Concentration on the Synthesis and Antibacterial Activity of Methyl Cinnamate

Emily Buck, Malya Garland

Faculty Mentor: Steve Cessna

We will synthesize methyl cinnamate from trans-cinnamic acid using an acid-catalyzed esterification with sulfuric acid at concentrations of 3 M, 4.5 M, and 6 M. We utilize GC/MS, TLC, and disc diffusion plate assay techniques to ensure synthesis of methyl cinnamate and measure antibacterial properties. The purpose of this experiment is to determine whether lower sulfuric acid concentrations could produce the ester while retaining antibacterial properties. Comparing results across the three conditions will allow assessment of whether reduced acid concentration could maintain product formation and biological activity.

Antioxidant Concentration in Fresh versus Frozen Strawberries

Noah Buckwalter, Zoe Clymer, Lisa Zimmerman

Faculty Mentor: Laurie Yoder

Antioxidants are important for protecting the body from oxidative stress, a contributor to many diseases. Strawberries, a fruit frequently used in smoothies, contain antioxidants. We expect that the freezing process will have an effect on antioxidant concentrations in strawberries. We will use the FRAP (Ferric Reducing Antioxidant Power) assay to determine whether there is a significant difference in antioxidant concentration between fresh strawberries, strawberries frozen for one day, and strawberries frozen for one week.

The Relationship Between Class Sizes and Student Value

Grace Burke

Faculty Mentor: Bryce Van Vleet

This study focuses on students feeling “seen” which has been identified as a sense of belonging and being heard. Smaller class sizes are related to more focused attention and stronger relationships between peers and teachers. Past research analyzed school sizes and class sizes and found students in larger schools reported feeling less acknowledged and heard rather than small school sizes. The purpose of this study was to examine if a smaller class size was assoicated with students' mental

health. Data was collected via an in-person questionnaire that was filled out by students in various sized classes. This project focused on college level students where 64 participants responded. Students responded based on that specific course teacher for the class they were surveyed in. Results are forthcoming and will be impactful to educate future administrators on how to teach college students successfully.

Comparing Water Qualities in the Shenandoah

Tara Cahill, Jade Davis

Faculty Mentor: Steve Cessna

Comparing water quality measurements (pH, alkalinity, Ca, phosphate, and electrical conductivity) between Dry River and Blacks Run. We can then assess stream health between each location.

EMU Athletic Attendance

Isaiah Carr, Kai Johnson, Treshawn Oliver

Faculty Mentor: Cherelle Johnsom

For this project, the goal is to research and find out why EMU students choose not to attend any varsity sport home events. This idea for research got brought up because statistically, EMU home attendance is just in the ODAC for sports Men's and Women's basketball and Volleyball is 9th and 10th out of 12. Which can probably be said for other sports here at EMU too. Which one sparked us to question, if EMU promotes togetherness and camaraderie, why can't we as a community bring people to support student athletes and one another? So with that in mind we tend to send out a survey and get hopefully 20 plus responses to then put research to the test, these questions match to the hypothesis that athletes aren't connected to one another which then leads to lack of interest to attend other sporting events. We don't only think that bringing teams together will show support but boost morale, as other schools that have done this research have shown the more people in attendance, the higher the campus atmosphere is as well as the increase in other sporting events. It is almost a chain reaction, so the main goal of the research is to find out why attendance is low compared to other schools and hope to boost it to form a school community whose core values are even more built on togetherness.

Promoting Inclusive Outdoor Recreation at EMU Through Student Organization Partnerships

Mara Carlson

Faculty Mentor: Steve Johnson

This project focuses on a collaboration between EMU Outdoor and the Black Student Alliance (BSA), meant to increase access for students who have historically not always had the resources to participate in outdoor recreational activities. The broad goal of this project is to create a welcoming and accessible outdoor experience for Black

students and others at Eastern Mennonite University while fostering community, leadership, and environmental engagement. Access and participation in activities oriented around nature and green spaces has historically varied among different groups, often reflecting disparities related to race and socioeconomic status. In response to this issue, EMU Outdoor Programs partnered with BSA to organize a day trip involving hiking and rock climbing at Hone Quarry Recreation Area in the George Washington National Forest.

This event creates an opportunity for a reflective, community-engaged approach to examine how collaborations between student organizations and outdoor programs can support more inclusive access to the outdoors. The project also connects the event to broader efforts to promote inclusion, community, and diversity in outdoor recreation and environmental engagement. Planning involved collaboration between student leaders, logistical coordination for transportation, food, and equipment, and the development of inclusive programming designed to reduce barriers to participation. Funding for the event was provided by a Diversity, Equity, and Inclusion (DEI) grant, which helped cover transportation, training, food, and other necessary resources to ensure that cost was not a barrier to participation.

Solar-powered electric car with integrated wall charging.
Carter Cashin, Zander Armstrong, Dylan Diener, Noah Sanderson
Faculty Mentor: Shravan Akula

The intention of this project was to create a cost-effective, environmentally friendly electric vehicle with solar energy as its primary source within three months for less than $300. Upon finalising the design, the results demonstrate how we recycled the existing super mileage car and constructed it using five solar panels, a dual battery configuration and a motor powered through a unique relay circuit that protects the vehicle by providing a safe means of operation.

Detection of Salmonella-Specific IgY Antibodies in Chicken Egg Yolks from Different Egg Sources
Seungmin Cha, Lemi Bekele
Faculty Mentor: Jeffrey Copeland

Salmonella enterica is one of the major pathogens causing food poisoning worldwide, and poultry products are known to be important carriers of infection transmission in humans. Chickens exposed to Salmonella produce specific IgY antibodies that can accumulate in the egg yolk. The objective of this study is to determine whether the origin of eggs influences the detection of IgY antibodies against different serotypes of Salmonella enterica in egg yolks. To address this question, eggs collected from different sources, including commercial eggs sold in supermarkets and eggs produced on local farms, will be compared to evaluate whether differences in production environments influence the likelihood of Salmonella exposure.

Experimentally, egg yolks are extracted and immunoblot-based assay methods are used to confirm the presence of IgY antibodies against Salmonella. The antibody response to Salmonella enterica serovars Enteritidis, Typhimurium, and Minnesota, common variants associated with poultry-related Salmonella infections, will be evaluated during the analysis. When antibodies are present, the presence and intensity of signals appearing in the immunoblot can indirectly estimate the previous Salmonella exposure. In this study, we intend to increase the reliability of these observations by expanding the scope of analysis to include more egg samples and various sources. Ultimately, this study shows that immunological analysis with eggs can be used as a tool to indirectly assess Salmonella exposure in poultry populations, suggesting the possibility of contributing to food safety monitoring and public health research.

Access to Green Space and Its Effect on Public Health Outcomes in Virginia
Joel Chamberlain
Faculty Mentor: Doug Graber Neufeld

Access to green space is widely believed to influence mental and physical health, making it an important and timely topic as communities address environmental inequality and public well being. This study employs GIS to analyze the correlation between access to green space, quantified by tree cover, and public health outcomes, particularly alcohol abuse and self-reported mental health, across Virginia at the census tract level. Scatterplot analyses indicated negligible correlations ($R^2 = 0.06$) for alcohol abuse and ($R^2 = 0.00$) for self-reported mental health variables, implying an insignificant direct relationship. While the results show that green space alone does not significantly explain these health outcomes, they do show how complicated mental health is and how important it is to look at other social and economic factors. Subsequent research that includes supplementary variables and more comprehensive assessments of green space may yield enhanced understanding of these relationships.

What Changed Electoral Politics in Appalachian Virginia? An Analysis of the Voting Trends and Cultural Change between Buchanan County and Rockingham County
Chase Comer
Faculty Mentor: Mary Sprunger

Rockingham and Buchanan Counties, both located in Appalachian Virginia, have seen differing election trends since the 1970s. While the mountains and valleys of Appalachia have their own unique characteristics, their political trends are said to be in sync, meaning that all counties in Appalachia have generally followed a similar election trend and have shifted in tandem. However, close examination of these two counties shows that there is a variation in Appalachia voting shifts. Based on election data and political trends, this paper will demonstrate how these counties have voted at the presidential level and how their voting patterns have evolved and continue to differ in

the modern era. After this examination, it will be clear that Buchanan County has gradually shifted to the right since the 1970s, but has been significantly pushed to the right during the 21st century and more so since 2016. Rockingham County has reliably voted for the Republican candidate for president since the 1970s and has held this streak up to the modern day. However, since the 21st century, Rockingham has seen a slight shift to the left overall, with this being furthered since 2016. Both these counties vote Republican, but both by drastically different margins, and are both shifting in two different ways based on many factors.

Peek-a-boo Whales - Toy Project

Rebekah Compagnari
Faculty Mentor: Holly Herr Stravers

Peekaboo Place House is an interactive, developmentally appropriate toy designed for children aged two years, aligning with milestones identified by the Centers for Disease Control and Prevention and supported by early childhood guidance from Bright Futures. This toy-sized house promotes cognitive, motor, and social-emotional growth through hands-on exploration. The structure features four fabric curtains—one on each side—that toddlers must lift to locate the correctly shaped opening for matching blocks. This activity supports object permanence, problem-solving, shape recognition, and early critical thinking skills.The colorful blocks, each decorated with friendly faces resembling people entering the home, encourage imaginative play and symbolic thinking. Manipulating the curtains and inserting blocks into matching holes strengthens fine motor development, hand–eye coordination, bilateral coordination, and wrist rotation. The twist knob on one side of the roof allows children to practice rotational movements while retrieving the blocks, further refining fine motor control. Bright painted elements such as bees, butterflies, and flowers enhance visual stimulation and language development as caregivers label and discuss these features. Safety considerations include ensuring all blocks are larger than 1.25 inches in diameter to prevent choking hazards, securely fastening curtains to avoid detachment, using non-toxic paint, smoothing all edges to prevent injury, and reinforcing the cardboard structure with sturdy tape to maintain durability. Adult supervision is recommended. Overall, Peekaboo Place House fosters developmentally appropriate learning through play while prioritizing safety and engagement for two-year-old children.

Language Education, Cultural Integration, Student Development, Academic Preparation

Anne Marie Cornelius, Gisele Kuate Mogouong, Sarah Prroj
Faculty Mentor: Cherelle Johnson

International students who come to the United States in pursuit of higher education face significant financial challenges that go beyond tuition cost. International students typically incur higher tuition fees than domestic students, as they are subject to

non-resident tuition rates. In addition to unanticipated costs such as health insurance requirements, student activity fees, and other academic charges, international students frequently encounter restricted employment opportunities due to visa limitations. They must also navigate fluctuating currency exchange rates, economic instability in their home countries, political tensions, and evolving immigration policies, all of which contribute to financial uncertainty. In addition, Olson and Banjong (2016) observed that sponsoring students to study abroad usually incurs higher costs due to economic differences between the home country and the foreign country. This research uses structured questionnaires for data collection to examine the financial challenges faced by international students and how they pay tuition and miscellaneous fees. It further analyses the impact of F-1 visa restrictions, geopolitical tensions, and immigration policies on their financial stability, while also identifying gaps in existing financial support systems available to international students. According to Bilas (2016), in addition to not being eligible for certain scholarships and financial aid funding options, international students often do not receive valuable information regarding funding options available at their institutions, which this fact was found to be lacking in previous research study and suggested to be a possible reason why international students have a hard time finding information related to funding opportunities.

Effects of pH on the dissolution of naproxen using beverages

Connor Cubbage, Andrew Arledge
Faculty Mentor: Laurie Yoder

Medicine is often prescribed to take with water, however many often take medicine with varying beverages. This study aims to examine how different store bought beverages affect the dissolution rates of Naproxen (Aleve). We will measure the pH of each beverage, as well as create a buffer to simulate gastric fluid. The time it takes for the tablet to fully dissolve in the beverage will be measured to find the dissolution rate. We expect to find a difference in the dissolution rate of naproxen dissolution depending on the PH of the drinks.

Extraction of Sulfur based products from Asparagus

Bennett de Tenley, Ricardo Fernandez
Faculty Mentor: Steve Cessna

The objective of the experiment is to obtain asparagusic acid from raw asparagus and then transform it into sulfur compounds. Asparagusic acid is a naturally occurring acid found in asparagus, and it is well known for producing sulfur compounds. This experiment involves the extraction of the acid from the asparagus and then chemically converting the acid so that it produces different sulfur compounds. By performing the experiment, we can see how a naturally occurring molecule from a living source can be chemically converted. This experiment helps us understand the basic techniques of extraction and chemical conversion of a naturally occurring molecule. This experiment

also helps us understand the importance of sulfur compounds, which occur naturally. By studying the experiment, we can see how naturally occurring compounds, as found in different foods, can be extracted and converted chemically.

The Relationship Between Social Media Use and Attention Among Adolescents?
Sophia Denby
Faculty Mentor: Brace Van Vleet

The rapid rise of social media platforms, particularly short-form video applications such as TikTok, has raised concerns about their potential influence on attention and cognitive functioning among young people. These platforms present highly stimulating content in brief, rapidly changing segments that may encourage constant engagement while reducing the ability to sustain attention for extended periods. Previous research has found associations between heavy short-form video consumption and reduced attentional control, increased distraction, and poorer academic behaviors (Haliti-Sylaj & Sadiku, 2024; Xie et al., 2023; Yan et al., 2024). The purpose of this study is to examine the relationship between social media use and attention using a secondary data analysis approach. Data will be drawn from a large publicly available dataset that includes measures of social media engagement and attention-related outcomes among adolescents. Variables representing time spent on social media will be analyzed alongside measures of attention or concentration difficulties. Pearson correlation analyses will be conducted to examine relationships between social media use and attention outcomes, and linear regression analyses will assess whether social media use predicts attention difficulties. By examining naturally occurring patterns of digital media use, this study aims to contribute additional evidence to ongoing discussions about how modern media environments may influence attentional functioning among young people.

Short-Term TikTok Use and Its Effects on College Students' Attention During a Focused Study Task
Sophia Denby
Faculty Mentor: Brace Van Vleet

Short-form video platforms such as TikTok deliver rapid, highly stimulating content that may disrupt attentional control, particularly among young adults who are frequent users. While prior research has demonstrated associations between heavy short-form media consumption and reduced attention span, lower executive functioning, and poorer academic performance, most existing findings are correlational and cannot establish causality. As a result, the short-term, immediate effects of brief TikTok exposure on sustained attention remain unclear.

The present study employs an experimental design to examine whether short-term TikTok use negatively impacts college students' ability to maintain attention during a focused academic task. Thirty undergraduate students between the ages of 18 and 25 will be randomly assigned to one of two conditions: a TikTok exposure group, which will view 10 minutes of trending TikTok videos, or a control group, which will view 10 minutes of calm nature imagery. Following the exposure period, all participants will complete the Sustained Attention to Response Task (SART), a validated cognitive measure of sustained attention and response inhibition, as well as a brief self-report questionnaire assessing perceived focus, distraction, and mood.

It is hypothesized that participants exposed to TikTok content will demonstrate lower sustained attention and higher levels of perceived distraction compared to those in the control condition. Findings from this study aim to provide insight into the immediate cognitive effects of brief digital media exposure and contribute to a growing body of research on media multitasking and academic performance. Results may help college students better understand how short-term engagement with social media platforms influences their ability to concentrate during study tasks and may inform strategies for reducing digital distractions in academic settings.

Structure–Activity Relationships of Cinnamic Acid and Vanillin Derivatives

Chidubem Ekoh, Adamah Ekoue-Gomido
Faculty Mentor: Steve Cessna

Cinnamic acid and vanillin are naturally occurring phenolic compounds found in plants and food products and are known to exhibit antimicrobial and antioxidant properties. In this project, several derivatives of these compounds—including methyl cinnamate, truxillic acid, 5-iodovanillin, and divanillin—are analyzed to investigate how structural modifications influence their physicochemical properties and biological activity. Physical and chemical data such as lipophilicity (logP) are obtained from PubChem to evaluate how structural changes may affect membrane permeability and potential topical or oral use. Computational target prediction using SwissTargetPrediction is used to identify potential protein targets based on structural similarity to known bioactive compounds. In addition, molecular docking simulations with the inflammatory receptor TLR4 are performed using Webina to estimate binding affinity and potential anti-inflammatory activity. These computational predictions are then complemented by experimental assays, including antibacterial and antifungal disk diffusion tests and UV-visible spectroscopy to evaluate UV absorbance properties. By comparing cinnamic acid and vanillin with their synthesized derivatives, this study explores how chemical modifications influence potential biological and pharmaceutical applications of small aromatic compounds.

Sankofa Circles

LaToya Fernandez
Faculty Mentor: Joe Cole

The Sankofa Reconciliation Weekend Retreat was a two-day restorative experience that invited EMU students, staff, and faculty to explore belonging, reconciliation, and healing through storytelling, embodiment, and restorative dialogue. Rooted in African principles of Sankofa—“to go back and fetch what was lost”—this project honors ancestral wisdom while fostering modern inclusion.

Participants journeyed through three phases: Remembering (acknowledging shared and personal histories), Reckoning (honest dialogue around identity, privilege, and harm), and Reconciliation (co-creating a shared vision of belonging at EMU). The weekend included restorative circles, movement, music, story telling, poetry and guided reflection led by trained restorative justice practitioners.

This retreat was designed to strengthen community bonds, increase empathy across differences, and create a model for continued restorative dialogue on campus. The project aligns with EMU’s Inclusive Excellence priorities by cultivating belonging, encouraging open dialogue, and celebrating the diversity that enriches EMU’s identity.

Teaching for Social Justice: The Power in Student Voices

Julia Fisher, Marianna Kinnison
Faculty Mentor: Aundrea Smiley

"The real goal is to use content as a method of teaching them how to think and learn on their own feet for themselves (Rose, 2024 p. 36)."

Based on the texts, Woven Together and The Little Book of Restorative Justice in Education, required for ED 101, as well as field experience; it feels important to highlight teacher identity along side student ability to think critically and use their voice in both school and education settings. We will also discuss how teaching students in this way empowers them to advocate for social justice.

"Beliefs and values are often assumed, varied, interconnected, and influenced by our sociocultural contexts. Identifying and assessing thee beliefs and values can be difficult, et positive social change requires that this be done (Evans, Vaandering, 2022 p. 34)."

Comparing athletes and non-athletes GPAs

Ben Florkowski, Jack Hinton, Zach Danielczyk
Faculty Mentor: Cherelle Johnson

Differences in academic performance between student athletes and non-athletes may show whether one group needs extra support in college. Research on adolescents has found that students who play sports often do better academically and behaviorally than their peers who do not participate in sports. For example, a large study of middle and high school students found that athletes had higher standardized test passing rates,

lower risk of dropping out, and fewer disciplinary actions compared to non-athletes, which suggests that organized physical activity and sports participation relate to stronger academic outcomes and school engagement in youth populations. In quantitative studies, it is important to examine data quality and ensure that unusual values do not distort results. Methods for detecting outliers in data have been developed in research on statistical design, such as exploratory techniques and principal component analysis, which help to identify unreliable data before analysis. This study will compare cumulative GPAs of college student athletes and non-athletes by collecting university records and survey data. It will include statistical screening for outlier GPA scores to maintain valid comparisons. Findings aim to inform academic support services about potential needs of each group.

Fragrance to Function: Exploring Cinnamate-Based Anti-inflammatory Activity
Dante Flowe, Skylar Stevens
Faculty Mentor: Steve Cessna

The goal of this project is to test the anti-inflammatory affinity of Methyl cinnamate and Cinnamic acid. We will do this by yeast fermentation and comparing the target binding sites of each of these products. By using Webina we can obtain the affinity to bid to TLR4, a receptor on immune and other cells that responds to infection and activates the inflammation pathways.

How Adverse Childhood Experiences and Tolerance for Uncertainty Relates to Spiritual Engagement in Undergraduate Students
Leah Frankenfield, Daisy Buller, Lauren Kauffman, Hollyn Miller
Faculty Mentor: Bryce Van Vleet

Religion shapes many people's belief systems and moral compasses, and by extension, how they engage with the world around them. College students often grapple with their beliefs and explore where their ideas come from: a process that can look very different from one peer to another depending on their backgrounds, experiences, and influences. Previous findings found that attachment styles, adverse childhood experiences (ACE's), and religiosity are interconnected, as young adults with higher ACEs often show lower religious involvement, yet religion can also serve as a supportive tool to help them cope with these early adversities.We aim to build upon this research by investigating the variables tolerance for uncertainty and ACEs, and how that impacts religiosity. We expect to find a stronger correlation between tolerance for uncertainty and religiosity than between ACEs and religiosity. This study investigates how adverse childhood experiences (ACEs) and tolerance for uncertainty relate to self-identified levels of spiritual engagement among undergraduate students at Eastern Mennonite University. A self-report questionnaire was distributed to undergraduate

students at EMU. The questionnaire was a compilation of the ACE's questionnaire, the Centrality of Religiosity Questionnaire, and the Need for Closure Scale.

Design and Implementation of a Greenhouse Misting System

Maxim Fritts, Barry Muluneh
Faculty Mentor: Anushika Athauda

To maintain optimal conditions for growing plants in a greenhouse, it is important to keep the temperature and humidity at a constant level. Changes in external weather conditions can have a dramatic effect on the microclimate within a greenhouse, which, in turn, can adversely affect plant growth and development [1]. The objective of this project is to build a misting system to maintain the humidity level inside an on-campus greenhouse. This project will include designing the mechanical layout of the misting system [2], selecting appropriate materials and components, constructing the support structure, and assembling the water distribution system. The proposed design for the misting system consists of a 32-gallon water storage tank connected to a pump that supplies pressurized water to a misting line inside the greenhouse. The tank will supply water to the misting line via vinyl tubing, which then feeds into a polyvinyl chloride misting line with evenly spaced nozzles that will create very small water droplets. The tank will be mounted on a wooden stand made of treated wood that will hold the pump and provide space for the electrical components necessary to operate the system. The system performance will be evaluated by testing the misting system inside the greenhouse and monitoring humidity levels. The completed system will be a low-maintenance misting system specifically integrated for the greenhouse dimensions and can be configured to meet the misting needs inside the greenhouse, effectively controlling the microclimate.

How Coach Characteristics Relate to Student Athletes' Commitment To Their Sport and Team

Julian Gonzalez, Keenan Fulwood, Trevor Selph
Faculty Mentor: Bryce Van Vleet

What communication practices and characteristics from their coach do student-athletes perceive as motivating or demotivating within both academic and athletic contexts? This question addresses how coach–athlete communication influences both athletic performance and academic motivation, two central aspects of the student-athlete experience. Coaches are often primary authority figures in athletes' daily environments, so their communication style such as feedback, support, criticism, or expectations can significantly shape athletes' motivation, confidence, academic engagement, and overall well-being. By examining which communication practices athletes perceive as motivating or demotivating, from a secondary dataset, the research can help identify strategies that foster positive developmental outcomes, stronger coach athlete relationships, and better balance between sports and academics.

Big Burger - Toy Project

Juliana Greaver
Faculty Mentor: Holly Herr Stravers

"Big Burger" is a sensory based toy that is created for children 12 months and older. I made this toy out of clay, cardboard, tool fabric, styrofoam, and wood so it is a light weight toy. All the pieces have velcro circles to connect them together. All the pieces are unbendled and large, making it difficult for a child to choke.The toy is made to engage both fine and gross motor skills. The fine motor includes pinching, grasping, improving hand eye coordination and placing individual pieces together. The gross motor skills the toy promotes are lifting, reaching, coordination, encouraging arm movement and overall physical interaction.

Comparative Extraction and Purity Analysis of Caffeine From Energy Drink and Natural Sources

Sarkawt Hamad, Farah Mohammed
Faculty Mentor: Steve Cessna

Caffeine is one of the most widely consumed stimulant compounds and occurs naturally in various plants like coffee and tea, while also still being added to energy drinks. The purpose of this project is to extract caffeine from common beverages and compare the yield and purity of caffeine from natural sources to energy drinks, the samples will include coffee, tea, Redbull, and Celsius. Each beverage sample will first be prepared by removing carbonation if necessary and adjusting the solution to basic conditions to promote extracting of caffeine into an organic phase. The caffeine will then be isolated using liquid-liquid extractions with an organic solvent.The solvent will be evaporated to obtain crude caffeine; the mass of the crude caffeine will be measured to determine the extraction yield. The purity will be analyzed using melting point, TLC, and the results will be compared with literature values for pure caffeine. Understanding caffeine sources and purity will become more and more important as everyday more energy drinks are created and consumed yet we have less transparency on what we are consuming.

Low-cost Ventilation System for Improving Humidity and Temperature Control

Alondra Hernandez-Gonzalez, Dianne Meli
Faculty Mentor: Anushika Athauda

Greenhouses are designed to retain heat and moisture for plant growth, but stagnant air can cause excess moisture and promote fungal and mold development which may negatively affect plant development and productivity [1]. The goal of this project is to design and build a small solar-powered system [2] that monitors and controls the temperature and humidity inside an on-campus greenhouse. The system uses an Arduino-based control unit connected to a DHT22 temperature and humidity

sensor to continuously measure environmental conditions. When the temperature exceeds 75°F or when humidity levels become too high, the Arduino automatically activates a ventilation fan to improve airflow and reduce heat and moisture inside the greenhouse. This project includes designing the electrical and control system, programming the Arduino microcontroller to read sensor data and operate the fan, and constructing the solar-powered energy system that includes a solar panel and a 12 V battery for off-grid operation. The system will be tested inside the greenhouse environment to evaluate its ability to monitor conditions and automatically regulate temperature and humidity. The completed system is intended to provide a low-cost and low-maintenance solution for improving the greenhouse climate control.

Assessment of climate preparation and climate perceptions across U.S. cities
Claire Hurst
Faculty Mentor: Doug Graber Neufeld

As climate change intensifies, research on the intersection between climate vulnerability and climate perceptions is becoming increasingly relevant. It is well known that intensifying global temperatures will increase the demand for health care accessibility, placing certain communities at a greater risk than others. It is also well known that beliefs and perceptions around climate change vary greatly among communities in the U.S. This project aims to contribute to the field of environmental applications of public health to bring attention to the intersection between health-based climate vulnerability and societal perceptions surrounding environmental concerns. Data from a climate vulnerability assessment is compared with a nation-wide climate opinions survey to examine how at risk cities actually are, and how vulnerable they believe themselves to be.

The purpose of this project is to use ArcGIS to create a spatial distribution model of U.S. cities to compare climate vulnerability with perceived risk and attitudes surrounding climate change. The map includes a graduated symbols spatial comparison of health-based climate vulnerability and climate opinions data.

The Impact of Sea-level Rise Across the Central East Coast
Augy Ives
Faculty Mentor: Doug Graber Neufeld

This study looks at what sea level rise will look like in the Chesapeake Bay and the North Carolina Coast. Geographic Information System (GIS) is used, via ArcGISpro, to map different areas in the Central East Coast with a combination of city and county data, state data, NOAA and other federal agency data, among other data sources. The National Oceanic and Atmospheric Administration, otherwise known as NOAA, has a sea level rise dataset that shows what the coast could look like with rising sea level in increments of half a foot, and is the primary source of data. This project is done through Environmental GIS.

A Pilot Study Comparing the Effectiveness of Virtual and In-Person Qigong

Madison Jordan, Taylor Davis, Ethan Neufeld, Simeon Mussie , Kaitlyn Upshaw, Jane Baker

Faculty Mentor: Hongtao Li

Eight Pieces of Brocade (EPB) is a classical Qigong form practiced for over a millennium and has been associated with modulating stress-related biomarkers, including cortisol. As virtual platforms increasingly expand access to mind–body practices, this study examined whether virtual delivery of EPB produces effects comparable to in-person practice on physiological stress markers and psychological outcomes. Twenty-four participants from Eastern Mennonite University were randomized to virtual or in-person EPB groups during Spring 2025, with additional recruitment in Spring 2026 to increase sample size. Both groups completed four Saturday sessions over three weeks, practicing EPB for one hour per session. Saliva samples and self-report surveys were collected at baseline and post-intervention. Participants also completed self-practice journals documenting practice duration and subjective experiences. Saliva was analyzed for cortisol and secretory immunoglobulin A (s-IgA) using ELISA. No significant differences were observed between the virtual and in-person groups for salivary cortisol or secretory IgA (s-IgA), nor were significant pre- and post-changes detected in these biomarkers. In contrast, self-reported anxiety significantly decreased across all participants following EPB practice ($p = 0.0067$). Marginal improvements were observed in depressive symptoms ($p = 0.078$), attitudes toward Qigong ($p = 0.0827$), and life satisfaction ($p = 0.0802$). Notably, total practice time emerged as a significant predictor of stress reduction ($p = 0.0264$). Data collected during Spring 2026 are currently being analyzed and will be incorporated into the final results. A short-term EPB intervention reduced anxiety among participants regardless of delivery modality. While no significant physiological biomarker changes were detected over the intervention period, virtual Qigong demonstrated psychological benefits comparable to in-person practice. These findings support the feasibility of virtual Qigong as an accessible modality for mind–body health, while highlighting the importance of practice dosage in stress regulation.

Does silence or background music improve or impair working memory

Hannah Kepler

Faculty Mentor: Bryce Van Vleet

This study examined the relationship between working memory performance and study environment, specifically whether listening to music or studying in silence leads to better memory performance. Many students choose to study while listening to music, while others prefer a quiet environment. The purpose of this study was to explore whether individual study preferences influence working memory performance when music is present or absent. Participants first completed a short survey about their typical

study habits. The survey asked whether they usually study while listening to music or in silence and what types of music they prefer to listen to while studying. This information was used to understand participants' usual study environments better and whether silence or music tends to distract them. After completing the survey, participants completed two separate two-tiered tests designed to measure working memory performance. One test was conducted in a silent environment, whereas the other was conducted with participants listening to instrumental music. Instrumental music was selected to minimize potential distractions from lyrics. The purpose of this design was to compare participants' performance in both conditions and determine whether music improved or reduced their ability to recall and process information. The results indicated that study environment preferences played an important role in performance. Participants who reported that silence tends to distract them performed better when they listened to music during the test. In contrast, participants who reported preferring silence or background noise when studying tended to perform worse when music was played. These findings suggest that the effectiveness of music while studying may depend on individual preferences and personal study habits. Overall, the results highlight the importance of identifying study environments that best support individual learning and concentration.

Antioxidant levels in differently prepared orange juices.

Ani Koontz, Alex Jantzen, Nick Porcaro
Faculty Mentor: Laurie Yoder

Orange juice is an American dietary staple and often noted as a great source of vitamin C. Vitamin C is an antioxidant that protects cells from oxidative stress. Some people choose to hand-squeeze oranges, and others choose to purchase orange juice from the store. We aim to compare the antioxidant concentrations between hand-squeezed and store-bought orange juice using the FRAP assay to better understand how orange juice preparation can impact our diets.

Acid–Base Extraction and Isolation of Aspirin, Acetaminophen, and Caffeine from Excedrin Tablets

Ramata Lam, Kaitlyn Upshaw
Faculty Mentor: Steve Cessna

Most over-the-counter medications contain a numerous amount of ingredients that work together to relieve symptoms. Excedrin is a common pain reliever that is taken in the case of a headaches, migraines, muscle aches, menstrual cramps etc. This tablet contains three active compounds: Aspirin, Acetaminophen, and Caffeine. Excedrin tablets will be broken up and dissolved in an organic solvent for this project. After that, the mixture will go through many liquid-liquid extractions with basic and acidic aqueous solutions. These steps will allow us to be able to separate the different compounds. In general, this study will demonstrate how individual components within a complex drug

can be separated and characterized by taking advantage of differences in functional groups and acid-base behavior.

Measure water samples along the Eastern Shore for indicators for chemicals
Mathew Lawson, Camden Jefferson
Faculty Mentor: Steve Cessna

We have about 12 water samples from four different spots along Virginia's eastern shore. We will be looking at the pH, alkalinity, and more chemical measures of the water samples. Some of the spots are near major industrial developments causing a large amount of chemical pollution, not only from runoff but also from dumping. We plan to see if we can use our different tests to identify the main pollutants being introduced into this environment by industries along this strip.

ATPsynβL knockdown in glutamate neurons extends lifespan and preserves gut integrity in Drosophila melanogaster
Maria Longenecker, Zoe Clymer
Faculty Mentor: Jeff Copeland

Aging is influenced by a variety of molecular mechanisms, including mitochondrial function. Inhibition of the electron transport chain (ETC) has been shown to increase lifespan in many species. Previous research established that RNAi knockdown of ATPsynβL gene in glutamate neurons alone significantly extends lifespan in Drosophila melanogaster. When we investigated their behavior, we found they exhibit increased daytime sleep that persists throughout the lifespan, supporting a strong correlation between sleep behavior and aging. Because aging is also associated with a loss of intestinal integrity, we investigated whether the long-lived ETC RNAi flies display differences in gut health. The intestinal permeability was assessed using a Smurf assay, which measures gut “leakiness” by tracking the spread of the ingested dye throughout the fly body.

We found that the long-lived flies show increased intestinal integrity compared with controls. These results suggest that the ATPsynβL knockdown in glutamate neurons associated with lifespan extension and changes in sleep behavior may also delay the decline in the intestinal barrier. As the loss of intestinal barrier during aging is associated with increased gut microbiota, reactive oxygen species production, and inflammation, we have begun investigating whether these factors are also altered in the long-lived ETC RNAi flies. Together, this work contributes to our growing story of the broader mechanisms by which an organism ages.

Analyzing the Spatial Relationship Between Data Centers and Various Infrastructures in Virginia
Jose Lopez Vasquez
Faculty Mentor: Doug Graber Neufeld

The cloud is often seen as an invisible digital service, yet it relies heavily on a vast network of physical infrastructure in the form of data centers. Northern Virginia has become one of the largest hubs for data centers in the world due to its proximity to internet exchange points, fiber networks, and reliable power infrastructure. While these centers support the global digital economy, their rapid expansion raises some important questions about land use, electricity demand, water consumption, and the visual transformation of local landscapes.

Using Geographic Information Systems (GIS), this project examines the spatial distribution of data centers across Virginia and analyzes how their locations relate to surrounding infrastructure and environmental resources. Spatial datasets including data center locations, electrical transmission infrastructure, land use classifications, and water resources are used to evaluate patterns in data center development. The analysis focuses on recent data from the past decade in order to better understand how the rapid growth of data centers has influenced regional land use and infrastructure demand.

Urban and Rural Comparison of Blacks Run Soil Health

Esme Martin, Joel Chamberlain, Kate Stutzman

Faculty Mentor: Steve Cessna

Understanding soil health is crucial in understanding the ability of our ecosystems to perform their necessary functions, which is inevitably altered by human industry and activity. This project seeks to compare soil samples along Blacks Run, a local waterway, in both rural-agricultural and urban environments. In order to best understand soil health, measurements including phosphate concentration, textural class, pH, electrical conductivity, water and organic matter content, and soil moisture, among others, will be collected from sites in Rockingham County and Harrisonburg City. This project will analyze the impacts of human activity, both urban and rural, on soil health near our crucial local waterway.

Action in Electrolytes: Dissolution in Sports Drinks

Arleigh Mason, Jocelyn Allanson

Faculty Mentor: Laurie Yoder

Many athletes drink sports drinks to help replenish the electrolytes in their bodies. Athletes also use certain medicines, such as ibuprofen, to help with aches and pains. This study aims to test how ibuprofen dissolves in different sports drinks with differing amounts of electrolytes. We will test both water that contains NaCl as our sports drink with electrolytes and Pure Water. The controls of the experiment would consist of the stirring speed, temperature of the drinks, and the time intervals. Our results will be based on the rate in which the ibuprofen dissolved in the Pure Water and the water containing NaCl. The dissolution rate will be able to determine if electrolytes play a role in the dissolution of medicine like Ibuprofen.

MakerBot Replicator revitalization

Micah Mast
Faculty Mentor: Shravan Akula

This project is intended to revive a MakerBot Replicator+ by replacing its proprietary control system with modern, open-source electronics. The original printer, while capable in its time, had been put out of service in part due to its discontinued parts and incompatibility with modern slicers. By installing a BTT Pi, SKR Mini E3, and open-source Klipper software, the printer was brought up to current standards while retaining its original mechanical frame and gantry system. Every part of the machine, except for the frame and gantry, can now be sourced from online retailers or 3d printed. Throughout the build, several unexpected issues arose, including failures in the Pi's stock 24V buck converter and incompatibility with the first purchased touchscreen, but these were resolved with alternative hardware. The result is a fully functional, easily maintainable printer that offers improved print quality, faster workflow, and long-term serviceability using only open-source tools and components.

The Human Tendency to Self-disclose

Kiyah Mata
Faculty Mentor: Bryce Van Vleet

Self-disclosure plays an important role in interpersonal communication and psychological research. The present study examined whether individuals tend to share more information when responding to self-related questions compared to general-topic questions. Participants (N=10) between the ages of 18 and 35 completed a brief interview consisting of ten open-ended questions, including five self-related prompts and five general-topic prompts. Questions were presented in randomized order to control for order effects. Response length was measured using both word count and response duration (seconds) to evaluate the extent of disclosure across question types. Statistical analyses compared whether responses to self-related questions were greater than responses to general-topic questions on both measures. Results indicated no statistically significant difference between the two question types. The comparison of word count between self-related and general-topic responses produced a non-significant result ($p = .174$), suggesting that participants did not provide significantly more words when responding to self-related questions. Similarly, the comparison of response duration between the two conditions was also not statistically significant ($p = .104$). These findings suggest that self-related prompts may not necessarily elicit greater disclosure than general-topic prompts in conversational interview settings. Further research with larger sample sizes, varied question structures, and added linguistics tests may help clarify the relationship between question type and the tendency to self-disclose.

Cinnamon Bark-Derived Cinnamic Acid as an Antioxidant

Maggie Mayhew, Payton Keesee
Faculty Mentor: Steve Cessna

Cinnamic acid is a naturally occurring phenylpropanoid found in cinnamon bark and is known for its antioxidant and antimicrobial properties. In this project, cinnamic acid will be extracted from cinnamon bark using organic solvent extraction techniques and purified for further analysis. The isolated compound will be characterized using spectroscopic methods like 1H NMR to determine the structure/purity with UV-visible and Anti-oxidant to figure out what the compound can be used for. By combining natural product extraction with spectroscopic characterization and functional testing, this project aims to demonstrate the presence and chemical properties of cinnamic acid in cinnamon bark and explore it's potential biological activity.

Run to Rise

Kassidy Meadows
Faculty Mentor: Annalise Livingston

Mental health is a critical part of well-being, yet many individuals continue to struggle in silence. The mental health awareness walk, Run to Rise, is a campus-wide event designed to bring students, faculty/staff, and the entire EMU community together to promote awareness, reduce stigma, and encourage open conversations about their mental health and well-being. This event will highlight the importance of community and will remind students that they are not alone in their experiences.

Hosted in collaboration with Royals RISE, SAAC, Green Bandanna Project, and Student Life, the walk aims to create a supportive and visible space where all the participants can come together for mental health and social connection. Each organization brings a unique perspective and commitment to student wellness, emphasizing leadership, peer support, advocacy, and education.

The Run to Rise event will provide an opportunity for community members to reflect on the importance of mental health while actively showing support for those who may be struggling. By walking together, participants will embody the journey which many individuals face with mental health and the power of community and supporting in navigating it all. The event will also encourage students to engage with available resources, learn about peer support initiatives such as the Green Bandanna Project, and emphasize the role that they can play in supporting friends, teammates, classmates, and themselves.

Ultimately, Run to Rise seeks to foster a campus environment where mental health and well-being is openly acknowledged, conversation is encouraged, and students feel safe and empowered to seek help and support when they need it.

Dissolution of Nyquil at Various Temperatures

Emerson Moats, Reese Allen
James Powell
Faculty Mentor: Laurie Yoder

Living in close quarters as college students; illness spreads rapidly. Many rely on Nyquil for comfortable sleep. The aim of this project is to compare the dissolution of Nyquil liquid gel capsules at 36 degrees celsius or normal body temperature versus room temperature of 22 degrees Celsius. We performed dissolution in a buffer with a PH of 3.5 to mimic the acidity of stomach acid. We extracted 5 mL from the dissolution every 5 minutes and replaced it with the buffer in intervals of 5 minutes to ensure precision and accurate results. We will compare the dissolution rates of Nyquil in two different temperatures in a stomach acid-like environment.

Predicting the Effects of CRISPR-Cas9 Editing Using AlphaFold3

Ethan Neufeld, Tara Cahill, Dante Flowe
Faculty Mentor: Jeffrey Copeland

Precision genetic editing with the CRISPR-Cas9 system is a relatively new advancement in biotechnology, with numerous applications for basic research and applied science alike. Additionally, advances in protein folding algorithms have improved our ability to predict the physical changes that mutations will have on protein structure and function. The purpose of this project is to explore the predictive utility of AlphaFold3 in making precise loss of function and functional recovery missense mutations in the ADE2 gene in Saccharomyces cerevisiae. AlphaFold3 will be used to identify structurally important amino acid residues in the ADE2 substrate binding site, which we hope mimics the loss of function similar to a start codon or promoter mutation.

Three independent mutations will be generated in the ADE2 promoter, start codon, and ATP-binding site, respectively. Mutations will be introduced using a CRISPR-Cas9 system carried on the pML 104 plasmid. For each of the three separate target sites, custom single-guide RNAs will direct Cas9 to the desired locus, and donor DNA repair templates containing the desired nucleotide substitutions will be provided to incorporate the desired mutations into the host genome by homology-directed repair. Successful ADE2 loss of function will be characterized by red colored colonies. We will confirm that mutant ADE2 is the source of the red phenotype through functional recovery with wild type ADE2 on new introduced plasmids.

The Modulatory Effect of Cold and Heat Exposure on Exercise Recovery

Ethan Neufeld, Rin Akinotcho, Claire Hurst
Faculty Mentor: Kristopher Schmidt

The parasympathetic and sympathetic nervous system are two important physiological processes in the human body, which may be modulated by extreme changes in environmental temperature. Sympathetic nervous activation from cold

exposure, and the peripheral vasodilatory effect of heat exposure in particular are of interest in recovery from exercise. They play an important role in maintaining homeostasis and our responses to threats in our environment. The purpose of this project is to test how cold vs hot temperatures impact recovery from physical exertion, as measured by grip strength. Participants in this study are exposed to cold and hot water in two separate trials and their grip strength is measured. Statistical analysis is performed to compare the effects of each treatment. We hope that these results better inform exercise and health decisions made by trainees at all levels.

Solubility of Anti Inflammatory substances: Pau D'arco vs. Leading Over-the-Counter Anti Inflammatory Medication Ibuprofen

Ella Nguyen, Karina Bondaruk
Faculty Mentor: Laurie Yoder

Some people prefer to take natural supplements before relying on medication to treat inflammation. Our goal is to compare solubility of Pau D'arco, a natural anti-inflammatory supplement, to the leading over-the-counter NSAIDs, Ibuprofen. We will do this by testing solubility partitioning of each substance in a water and octanol separation apparatus. We expect Pau D'arco and Ibuprofen to differ in solubility characteristics because of their varying origins.

Analyzing the Relationship Between Forested Land Cover and Water Quality in the Upper James Watershed, Virginia

Jenna Oostland
Faculty Mentor: Doug Graber Neufeld

Forested areas typically have higher water quality than agricultural areas due to pollutants from fertilizers and other farm runoff. The relationship between land cover and water quality is analyzed in the Upper James Watershed in Virginia, where land cover is patchy, and there is no clear boundary between forested areas and agricultural land. Nitrate and phosphate levels, and total suspended solids data are taken from the open-access water quality portal and analyzed using GIS at the watershed level. A t-test is used to assess the significance of the relationship between % forested land cover and nitrate concentrations. There is a significant difference in nutrient levels, with higher concentrations in highly forested areas. Since this is not as expected, more research can be done to determine other factors that may affect water quality. This information can be used to identify remediation methods in the Upper James River Watershed.

Risk, resilience, and criminal behavior: How early trauma, psychological traits, and high-crime environments shape life outcomes

Royale Parker
Faculty Mentor: Bryce Van Vleet

Criminal behavior is shaped by a complex interaction of psychological traits, environmental exposure, and social influences. This study examines how aggression, exposure to violence, peer delinquency, parental monitoring, and early offending experiences relate to criminal involvement. Drawing on the nature versus nurture framework, the project explores how individual characteristics and environmental conditions jointly influence patterns of offending.

Data were drawn from the Pathways to Desistance study, a large longitudinal dataset following serious juvenile offenders over time. Using a sample of 1,164 participants, a multiple linear regression analysis was conducted in JASP to examine how five predictors: aggressive offending behavior, peer delinquency, exposure to violence, parental monitoring, and age of first offense relate to offending frequency.

The regression model was statistically significant and explained approximately 15.3% of the variation in offending frequency. Results indicated that aggressive offending behavior and exposure to violence were significant predictors of higher offending frequency, while parental monitoring was significantly associated with lower offending. Peer delinquency showed a positive but non-significant relationship with offending, and age of first offense was not a significant predictor once other variables were included in the model.

These findings support existing research suggesting that criminal behavior emerges through interactions between psychological predispositions and environmental experiences. The results also highlight the importance of protective factors such as parental monitoring. Understanding how risk and protective factors interact may help inform prevention strategies, early intervention programs, and community based approaches aimed at reducing youth involvement in crime.

Implications of the correlation of earthquake frequency and fracking activity

Kai Peachey-Stoner
Faculty Mentor: Doug Graber Neufeld

This study re-examines the link between fracking and earthquakes using GIS analysis of Oklahoma and Kansas, while also exploring other implications of this relationship, including possible correlations with home value and air quality. Fracking data is from the FracTracker public database, and earthquake data is from the USGS.

Natural Buzz vs Synthetic Boost: Spectroscopic Analysis of Energy Drink Caffeine

Claire Reichenbach, Sophia Nguyen, Dulce Shenk Zeager
Faculty Mentor: Steve Cessna

Caffeine is one of the most widely consumed compounds in the world and is commonly marketed in commercial beverages as either plant-derived or synthetically produced. Although the molecular structure of caffeine is chemically identical regardless of its source, beverages containing plant-derived caffeine may also include additional

organic compounds originating from botanical extracts such as green tea or guarana. The two synthetic beverages used were Red Bull and Monster, and the two plant-based beverages were Starbucks Energy and Celsius. All beverages were analyzed to evaluate potential differences between plant-based and non–plant-based caffeine compositions. Proton nuclear magnetic resonance (^{1}H NMR), carbon-13 nuclear magnetic resonance (^{13}C NMR) spectroscopy, and gas chromatography–mass spectrometry (GC/MS) were used to analyze the beverages. Spectral data were compared with reference spectra to verify proton and carbon signals associated with caffeine. GC/MS analysis allowed for the detection of additional compounds that may originate from plant extracts, flavoring agents, or other additives included in the formulations. The purpose of this study is to differentiate between natural and synthetic caffeine present in zero-sugar energy drinks. This highlights how spectroscopic and chromatographic techniques can be used together to characterize the chemical components of commercial energy drinks.

Accessing The Viability Of Car Free Living In Harrisonburg

Adam Rhodes

Faculty Mentor: Doug Graber Neufeld

For this project I will be using GIS mapping software to access the areas in Harrisonburg that are the most accessible to car free living. In order to evaluate this I am looking at road comfort for bikers based on road size, traffic patterns and existing bike infrastructure to see how viable vehicle free transportation is in various parts of the city. Additionally, I am looking at the proximity of grocery stores, schools and bus stops to see how far individuals would need to travel to meet basic needs. This project will highlight the areas in Harrisonburg where people can start living less car dependent lives and identify areas where pedestrian/ bike infrastructure could be improved. Gathering this information is a step in the right direction towards making a healthier, more sustainable city.

Plant Copper Remediation

Adam Rhodes, Samuel Myers

Faculty Mentor: Steve Cessna

This project attempts to address the problem of copper contamination in soils using natural methods of phytoremediation to remove the copper from the soils. We are running three tests with 500ppm, 200ppm, 0ppm copper concentrations. Looking at the effects of onions, tomatoes and a control (no treatment) to see how well the copper is pulled from the soil. The goal of this project is to test whether plants can be effectively used to phytoremediate in contaminated soils. To quantify this we will access the copper concentrations in the soil, plants, and algae growing on soil, as well as plant health indicators such as measured growth, chlorophyll, and photosynthesis. Our hypothesis is

that tomato plants will be most effective followed by onions then the control because it is known that tomatoes are effective phytoremediators of copper.

The Effects of Temperature on Dissolution of Tylenol
Olga Salama, Jane Baker
Emmy Teodoro
Faculty Mentor: Laurie Yoder

People store their Tylenol in varying temperatures. In this experiment, we will determine if this causes a significant difference in the dissolution of Extra Strength Tylenol in Hydrochloric Acid (HCl), simulating gastric acid. Using dissolution methods, FRAP Assay, and a spectrometer, we will test how higher temperatures affect how fast the Extra Strength Tylenol dissolves.

Brand positioning in a competitive market
Roumany Sefin, Adnan Hamdan, Fadi Michael
Faculty Mentor: Cherelle Johnson

In increasingly competitive beverage markets, many companies struggle to understand how consumers perceive their brand compared to competitors and which factors most strongly influence customer loyalty. This problem is particularly relevant in the bottled water and premium beverage industry, where brand differentiation and customer retention are critical. The purpose of this study is to examine the effects of market segmentation, social media engagement, and brand positioning on brand perception and customer loyalty, using Liquid Death as a case study. Prior research suggests that effective segmentation and positioning strategies enhance brand equity and loyalty (Tokhtasinovna, 2025), while active social media engagement strengthens brand perception and competitive advantage (Nugraha, Nengsih, & Feriandy, 2025). Using a quantitative research design, data will be collected through an online structured questionnaire distributed to consumers who are aware of or have purchased Liquid Death products. The survey will measure respondents' perceptions using a five-point Likert scale. Statistical analysis will be conducted to test the hypothesized relationships between the variables. The findings are expected to provide insights into how beverage brands like Liquid Death can improve consumer perception and foster long-term loyalty through strategic market positioning and digital engagement.

EMU's Values
Payton Simmons, Kate Castillo
Faculty Mentor: Cherelle Johnson

Eastern Mennonite University is a private, Christian university. Furthermore, it's unclear how students feel about the way the university expresses its evolving religious values. Because students' views about EMU's religious identity could affect their overall

experience, it's important to figure out how students perceive the direction of EMU and if they are satisfied with it.

Our purposes of the study are to: examine whether students feel that the university is maintaining its Christian identity, becoming more religious or less religious, assess students' satisfaction with how EMU expresses its Christian values in campus life, policies, and academics, and determine which aspects of the university most influence the general perception of religious identity at EMU. We will do this using online surveys sent out to students via email.

Graber Miller (2002) wrote an article titled, "From engaged social activists to disengaged academicians?". Her article emphasized the switch in the way Mennonite universities outwardly expressed their Christian identities in recent generations. They went from trying to remain separate from political and social justice issues, to making this the main medium to exercising their faith and ideologies. This study suggests that generational shifts in religious identity may influence how students interpret the religious mission of Christian universities, making it important to examine how EMU students perceive the university's evolving identity

Lemonade antioxidant levels among different brands.

Jonas Stafford, Filipo Toelau

Faculty Mentor: Laurie Yoder

Antioxidant levels are essential components of human health. In this experiment, we will compare the antioxidant levels between three different brands of lemonades. To measure antioxidant levels, we will be using a FRAP assay between the three different brands: Minute made, Milos, and Simply lemonade. Using the three different brands and the assay we will determine the absorbance at 593nm. This experiment is essential in order to understand the health benefits of common lemonade brands, and to help the consumer know the health of the different brands

Paper vs. Pollution: Which Material Removes Copper Best

Skylar Stevens, Apekshya Karki, Maya Tutton

Faculty Mentor: Steve Cessnas

The purpose of this lab is to compare the effectiveness of different types of paper in removing copper pollution from water. Copper is a heavy metal that becomes harmful at elevated levels; the drinking-water action limit is 1.3 ppm, meaning water suppliers must intervene if concentrations rise above that threshold. Our results showed that papers with rougher surfaces were more effective at reducing copper levels.

Analysis of Food Accessibility through Active Forms of Transportation in Harrisonburg

Elias Stoll

Faculty Mentor: Doug Graber Neufeld

This project examines neighborhoods in Harrisonburg by census tract, assessing their distance from food access points, including grocery stores and food pantries. Additionally, the amount and location of active transportation routes, such as sidewalks and bike lanes, are observed to determine a neighborhood's level of active transport. Accessing food by active transportation is advantageous because it promotes healthier lifestyles and reduces everyday expenses.

Exploring Historic Gentrification in Washington DC with ArcGIS

Levi Stutzman
Faculty Mentor: Doug Graber Neufeld

This study leverages ArcGIS Pro to scrutinize the relationship between a number of social factors that may indicate the process of gentrification in Washington D.C. and Denver, Colorado between 2000 and 2020. In the US, gentrification may be observed by investigating the change in time of median household income, median home value, and proportion of white population. Denver and DC were chosen to compare a quickly growing city population to a relatively stable city population. Historically, the two cities have very different population demographics. DC is historically majority black, and Denver is historically majority white. This study aims to compare these similarities and differences across time to determine if these measures are useful to compare across dissimilar environments.

Energy Drink Consumption and Effects: Focusing on EMU students

Guadalupe Tenorio Ramirez, Esdras Burgos, Peri Moo
Faculty Mentor: Cherelle Johnson

Our project analyzes how the program teaches language skills while it helps learners build self-assurance and effecive communication abilities and develop their ability to adjust to new cultural situations. The IEP includes important elements that make up its program through interactive classroom learning and customized educational experiences, and through actual language use training. The IEP program helps students develop their academic abilities because it creates a real-world educational experience that includes multiple teaching methods and social learning environments. The program helps students from different backgrounds create a fellowship that students can use to work together and help each other.The IEP program at EMU functions as an essential bridge because it helps students overcome their language difficulties to achieve academic sucess. The program provides students with critical English language proficiency, which enables them to participate in academic and social activities and results in better educational and professional possibilities.

Community based interventions and depression among unhoused individuals.
Kaylene Todd
Faculty Mentor: Bryce Van Vleet

This literature review examines whether community-based interventions like peer support groups, shelters, and community mental health services can lessen depressive symptoms among unhoused individuals. Due to factors like social isolation, unstable housing, and restricted access to healthcare, people who are homeless have a far greater risk of depression. By offering easily accessible mental health resources, social support, and service connections, community-based therapists seek to address these issues. According to research, shelter-based mental health services can improve access to treatment and enhance participation in psychiatric care. For example, research has shown that those who engage in shelter-based mental health interventions are more likely than those who do not obtain psychiatric care and therapy. Collaborative care initiatives and shelters have also been demonstrated to enhance depression outcomes for vulnerable groups such as unhoused mothers. Peer support programs are another important intervention. According to research, peer support can dramatically lessen depressive symptoms by promoting emotional support, social connection, and shared experiences. Additionally, community-based management programs assist people in finding housing resources, navigating healthcare systems, and receiving mental health treatment, which can contribute to improved psychological well-being. Overall, the findings indicate that community-based interventions can be effective in reducing depressive symptoms among the unhoused. Expanding new services may improve mental health outcomes and provide more stability for vulnerable groups.

How does coffee's antioxidant concentration change based on roast level?
Reuben Wenger, Davis Bert
Faculty Mentor: Laurie Yoder

Millions of people drink coffee daily. An understanding of antioxidant concentration in coffee roasts can help inform brewing choices. The goal of this study is to determine whether different roasts of Arabica coffee have different levels of antioxidant concentration when brewed with the same mass of coffee and water. Each roast was drip brewed and diluted with deionized water to be measured on a FRAP assay. A FRAP assay is used to compare the absorbance of the coffee roasts and determine differences in antioxidant concentration. We expect to find greater antioxidant concentration in darker roasts because they weigh less from longer roasting and therefore are more concentrated at the same weight when used in a cup of coffee.

Quiet Time Book - Toy Project

Sarah Wheeler
Faculty Mentor: Holly Herr Stravers

This project involved designing and presenting a developmentally appropriate toy for a toddler. The toy, called the Quiet Time book, was created for children around 2 years of age and is intended to promote calm, interactive play while supporting early emotional regulation. At this age, toddlers are developing gross motor skills such as walking and carrying objects, fine motor skills like grasping and manipulating items, as well as social skills through parallel play and caregiver interaction. Cognitive development includes early problem-solving and understanding cause-and-effect relationships. The Quiet Time Book supports these domains through activities like Velcro matching and textured fabrics, which encourage hands-on engagement, coordination, and exploration. The toy also promotes social interaction by allowing caregivers to model behaviors and language. Safety considerations were prioritized by using soft, non-toxic materials, avoiding small detachable parts, and ensuring all components are securely attached, making the toy appropriate and safe for supervised toddler play.

Peekaboo Place House - Toy Project

Emilee White
Faculty Mentor: Holly Herr Stravers

Peekaboo Place House is an interactive, developmentally appropriate toy designed for children aged two years, aligning with milestones identified by the Centers for Disease Control and Prevention and supported by early childhood guidance from Bright Futures. This toy-sized house promotes cognitive, motor, and social-emotional growth through hands-on exploration. The structure features four fabric curtains—one on each side—that toddlers must lift to locate the correctly shaped opening for matching blocks. This activity supports object permanence, problem-solving, shape recognition, and early critical thinking skills.The colorful blocks, each decorated with friendly faces resembling people entering the home, encourage imaginative play and symbolic thinking. Manipulating the curtains and inserting blocks into matching holes strengthens fine motor development, hand–eye coordination, bilateral coordination, and wrist rotation. The twist knob on one side of the roof allows children to practice rotational movements while retrieving the blocks, further refining fine motor control. Bright painted elements such as bees, butterflies, and flowers enhance visual stimulation and language development as caregivers label and discuss these features. Safety considerations include ensuring all blocks are larger than 1.25 inches in diameter to prevent choking hazards, securely fastening curtains to avoid detachment, using non-toxic paint, smoothing all edges to prevent injury, and reinforcing the cardboard structure with sturdy tape to maintain durability. Adult supervision is recommended.

Overall, Peekaboo Place House fosters developmentally appropriate learning through play while prioritizing safety and engagement for two-year-old children.

Stressors that affect in-season student athletes GPA

Andrew Wise, Jett Cabanban, Andrew Ritterskamp, Walker Dixon
Faculty Mentor: Cherelle Johnson

Our study will examine whether being an in-season athlete at the NCAA division three level affects academic performance, specifically GPA. Prior research shows that student-athletes have a small decline in academic performance. Scott (2008), found that across all divisions at the NCAA level, athletes earned slightly lower GPAs and fewer credited hours earned compared to the off-season. This was very clearly seen in sports such as football, baseball, and basketball (Scott, 2008). Ward (2022) found that there is a very small correlation between athletic commitments and academic success, specifically in NCAA divisions three student athletes (Ward 2022). In our study, we also want to find out which academic, physical, or psychological stressors could most strongly affect GPA. We also want to find out if GPA fluctuates based on what sport you play. Our data will be collected through surveys. By analyzing stress and academic performance, we hope to better understand how competing in athletics at the collegiate level affects academic performance.

Evaluating Student Satisfaction With Dining Hall Food Quality, Variety, and Overall Experience

Simon Yoder, Hezekiah Brown, Derek Diaz
Faculty Mentor: Cherelle Johnson

The purpose of this study is to discover how undergraduates' students at EMU with meal plans feel satisfied with the dining hall. As researchers we have heard concerns from students about the full dining hall experience. More specifically the food quality, nutritional value, service from employees, and overall experience. We hope to discern whether these concerns are validated by research or simply concerns that most students don't hold. Therefore, this data can help provide clarity with patterns and statistics. This feedback can also help administrators get a better understanding of how undergraduate students feel about the dining hall.

Our data collection method will be surveys through Qualtrics. We will provide a survey for students that walk to the dining hall lobby and throughout campus to bring awareness. This includes academic buildings, library, and other common areas that undergraduate students commonly pass through. For ease of convenience, we will provide paper flyers with QR codes across these different locations so students can easily take this survey. This research can be critical to discerning how the EMU experience feels to many students. Students eat at the dining hall for many meals a day across many months of the year. Additionally, this is a key location for importation socialization and community that can form. Evaluating the dining hall is an important

part of campus life and culture and we hope to find how students feel about the dining hall experience.

Antioxidant concentrations in different apple varieties
Malia Yoder, Claire Hurst
Faculty Mentor: Laurie Yoder

Apple varieties are known to have different flavors and contain antioxidants that are beneficial to human health. The purpose of this study is to determine the antioxidant concentrations of four different apple varieties. Apples were washed and the peels were combined with 20ml of water and pressed in a mortar and pestle. A serial dilution was performed to obtain a measurable concentration value. Ferric Reducing Antioxidant Power (FRAP) assay was used to determine the absorbance values at a wavelength of 593nm, which are proportional to the antioxidant concentration. We hypothesize that there will be a difference in antioxidant concentrations with Red Delicious having the lowest among the apple varieties tested. Our findings will be important for personal diet choices and understanding the health outcomes of consuming different apple types.

Impact of monoculture agriculture on rusty patched bumble bee populations
Lisa Zimmerman
Faculty Mentor: Doug Graber Neufeld

Monoculture is a widespread agricultural method and reduces crop diversity in farmland areas. The Rusty Patched Bumble Bee is a native bumblebee species that was once more widespread in the United States and is a valuable bioindicator species but has recently been experiencing population decreases. This project aims to use the ArcGIS program to determine whether monoculture agriculture could be a contributor to the Rusty Patched Bumble Bee's decline as well as general biodiversity loss.

Comparing antioxidant concentration of green tea vs. black tea
Mara Zimmerman, Amy Munkh
Faculty Mentor: Laurie Yoder

Tea companies often promote their products as having high antioxidant concentrations which help to reduce oxidative stress. We aim to compare the antioxidant concentrations of green tea and black tea, which will help us determine which beverage provides the most benefit. We used the FRAP assay to assess the antioxidant concentrations of the two types of brewed tea.

Assessing bird biodiversity in preserved areas over a six-year time period
Mara Zimmerman
Faculty Mentor: Doug Graber Neufeld

Globalization has led to a steady increase in fragmentation worldwide, negatively impacting native organisms on every continent. Preserving wild areas is one way to

support native species, by helping to protect ecosystems that are rapidly being squeezed into smaller and smaller spaces. This study uses GIS data to examine the impact preservation efforts in Lancaster County, Pennsylvania had on bird biodiversity during a six-year span. Abundance of birds in their preferred land cover was also analyzed, with slight correlations being found between bird abundance and percentage of their preferred habitat. Overall, simply preserving land does not seem to have a huge impact on bird biodiversity levels, which are more dependent on localized factors.