Chloe Aguirre

Faculty and Research Mentors: **Kaitlyn Judge and Dr. Mike Wilson**

Mapping Climate Change Risk: Flood Vulnerability along the Cumberland River in Clarksville, TN

This project evaluates climate change vulnerability in Clarksville, Tennessee, focusing on flood risk along the Cumberland River. Using GIS data and permit records from Montgomery County, we analyzed development patterns in areas categorized as high risk, likely flooding, and least likely flooding zones. The vulnerability map highlights concentrations of high-risk structures near older infrastructure and labor-reliant areas, particularly in low-lying regions. The analysis reveals that new development continues to occur in flood-prone areas, raising concerns about the long-term resilience of the community. These findings can inform more sustainable land use planning and help guide future mitigation strategies to reduce climate-related impacts in vulnerable zones.

Sarah Ahlheit and Emily Gill

Faculty mentors: **Dr. Stephanie Bilderback and Dr. Dennis Pearson**

Empowering the Tech-Driven Workforce: Leveraging AI, Financial Literacy Training, and Economic Freedom

This paper explores how organizations can empower a generationally diverse, tech-driven workforce by integrating artificial intelligence (AI) and financial literacy training into employee development programs. The study introduces economic freedom as a guiding framework to enhance employee well-being, workplace engagement, and long-term organizational resilience.

Through a conceptual, literature-based methodology, the paper synthesizes current research across management, education, and technology to present a framework for implementing AI-enhanced financial literacy programs. Findings suggest that AI-driven tools—such as chatbots, recommendation engines, and fintech platforms—enable scalable, personalized training that meets employees' financial education needs. These strategies support not only financial wellness but also mental health, job satisfaction, and productivity. The paper highlights how generational shifts, especially the rise of Gen Z and Millennials, have created demand for value-driven, tech-integrated learning environments. It proposes a training model that includes gamification, AR/VR simulations, and mobile-first platforms to increase engagement and effectiveness. Ethical considerations related to data privacy, algorithmic bias, and digital literacy are also addressed to ensure inclusive implementation. This research contributes to workforce development literature by offering a practical and ethical framework for integrating financial empowerment into wellness strategies. It positions economic freedom as a key element of future-focused human resource planning and encourages organizations to view financial literacy not as an optional benefit, but as a critical investment in long-term success and employee empowerment.

Diego Alcala

Faculty mentor: **Jane Semler**

Procalcitonin: Antibiotic Stewardship and Costs of Sepsis

Procalcitonin testing has come to play a pivotal role in antibiotic stewardship in the context of rising costs of antibiotics and improving outcomes for patients. Rising costs of antibiotics both financially and on the patient's outcomes regarding antimicrobial resistance has become a real concern for healthcare workers. There is a fine balance between getting patients antibiotic treatment in a timely and efficient manner and preventing the overuse and misuse of broad-spectrum antibiotics. This project analyzes the fiscal impact on PCT implementation at Jennie Stuart and discusses the potential impact on healthcare outcomes for patients. Procalcitonin testing serves an important role in antibiotic stewardship as a tool to help guide healthcare professionals in the continuation and discontinuation of antibiotic treatment. This project emphasizes PCT in the context of de-escalation decisions and how it has impacted financial costs and how it might impact patient outcomes in the future.

Hannah Alloway

Faculty Mentor: **Rebecca E. Blanton Johansen**

Documenting darter diversity: systematic evaluation of *Etheostoma duryi*, Blackside Snubnose Darter, and *Etheostoma flavum*, Saffron Darter (Percidae)

Etheostoma duryi occurs in streams across the Tennessee River. Its sister species, *E. flavum*, is largely restricted to the Cumberland River, but occupies several streams in the Tennessee River, where it may co-occur with *E. duryi*. Whether *E. duryi* and *E. flavum* are reciprocally monophyletic or hybridize in contact areas has not been tested. For both species, we assessed geographic variation in morphology using scale and fin-element counts and evaluated their monophyly and phylogeographic relationships using Cytochrome b and ddRAD sequencing. Each species was monophyletic with no evidence of interspecific hybridization. We recovered four geographically definable clades for *E. duryi*: (1) Shoal Creek, (2) Elk River + Duck River, (3) Sequatchie River + Emory River, and (4) all other Tennessee River systems; two clades were recovered for *E. flavum*: (1) Cumberland River and (2) Tennessee River. We found low levels of morphological variation among clades, but shifts in mean values were noted for some. The phylogeographic relationships observed for *E. duryi* are largely consistent with historical isolation of the upper, middle, and lower Tennessee River; while the sister relationship between Duck and Elk River *E. duryi* may be explained by headwater stream capture. Divergence in *E. flavum* is consistent with isolation across the Cumberland-Tennessee drainage divide. Our results suggest possible cryptic diversity in each species. However, additional species delimitation approaches and clade divergence time estimations are ongoing to better understand the taxonomic implications of our work and describe historical events that have shaped species diversification.

Aife Asmo

Faculty Mentor: **Dr. Steve Kershner**

The Greek Kosmos: Religion, Philosophy, and Mathematics as Tools for Kosmological Thought

This research asserts that Greek Astronomy developed out of religious and philosophical thought but also aided advancements in religious pseudo-science. While people have observed the celestial sphere for millennia the Greeks acted upon their observations with a combination of religious representation and actions, philosophical arguments on the existence of the Universe and its composition and measured the celestial worlds to expand upon their knowledge. Although the Greeks are not unique in their passion for the Kosmos they directed their yearning for the stars in different avenues. Most evidence used in this research is from the Classical (480-322 BCE) and Hellenistic (322-146 BCE) Eras with some from the Archaic (800-480 BCE) and Roman (146 BCE-476 CE) eras. Religion in reference to Greek Astrological thought is represented by Mythology, Constellations, Astrology, and Witchcraft. Philosophy primary centers around the composition of the Universe but also theorizes on the motion of Celestial Objects. Greek Astronomy can be most easily defined as the use of mathematics as proof for celestial theories, and can be divided into Pythagoreans, Size, Geometry, Orbits, Observations with others like Ptolemy and Geminos directly viewed. The blended history of Astrology, Astronomy, and philosophy allow for an inclusive history of Ancient Greek Celestial Thought but also requires a vast observation of time and practices.

Yakub Babatunde *🏆

Faculty mentor: **Dr. Masum Bhuiyan**

An Interactive Dashboard for Online Learning Stacked Ensemble Model: A Credit Card Fraud Case Study

This study presents an innovative AI-driven framework aimed at detecting anomalies in high-frequency financial transactions, with a specific emphasis on credit card fraud detection. Central to this framework is an **online learning stacked ensemble** that combines three incrementally trained base models—SGDClassifier with log-loss, Passive-Aggressive Classifier, and Gaussian Naive Bayes—with a deep neural network (DNN) meta-model. The base classifiers are updated continuously through mini-batch partial fitting, enabling real-time adaptation to evolving data streams. Meta-features are created by integrating the probabilistic outputs of these base models with preprocessed transaction data, which are then passed to the DNN for refined prediction.

A key component of the framework is an **interactive Streamlit dashboard**, providing a user-friendly interface for monitoring and managing the model's continuous online training process. While validated on a credit card fraud dataset, the framework's modular and scalable design allows for straightforward adaptation to other high-frequency financial data analyses, including market anomaly detection, stock market data forecasting, and risk assessment.

Experimental results demonstrate that the stacked ensemble approach significantly enhances detection accuracy compared to individual online models, underscoring the effectiveness of merging online learning with deep ensemble techniques in dynamic financial environments. This work paves the way for broader applications across various financial domains, providing a robust and adaptable solution for complex fraud detection challenges.

Arianna Banta

Faculty mentors: **Leslie Hiatt and Carrie Brennan**

Metals and Their Concentrations in Cocoa

This research aimed to create a reliable method to extract, measure, and compare the quantity of metals between the different components of the cocoa bean, such as cocoa powder, the cocoa bean shell, and the inner cocoa nibs from several different countries. The metal concentrations present in cocoa beans sourced from Columbia found in prior literature was used as a basis for this research. A dry ashing method was used to analyze the cocoa samples. This method involved heating samples in crucibles at 500 °C in a furnace until all the cocoa was ashed. The mass of the ash was measured every 30 minutes to ensure all organic matter was burned off the sample. The ash was then dissolved in nitric acid and filtered. Afterward, calcium and other metal concentrations was assessed in each sample using flame atomic absorption spectroscopy. Multiple dry-ashing experiments were conducted. The experiments measured the metal concentrations in various parts of cocoa beans from multiple different countries. The results of the dry ashing experiments demonstrate promise as an accurate and precise technique for metal analysis as compared to published literature methods.

Emily Bau

Faculty mentor: **Jane Semler**

Extended-Spectrum Beta-Lactamase: Growing Antibiotic Resistance Trends and Risks to Healthcare

Extended-Spectrum Beta-Lactamases (ESBLs) are a group of enzymes produced by many gram-negative bacteria in the Enterobacteriaceae family that makes them resistant to a wide range of antibiotics. These bacteria can inactivate Beta-lactam antibiotics such as penicillin and cephalosporins, causing wide antibiotic resistance and increased patient mortality (1). Carbapenem is typically the next drug of choice for treating ESBLs, however there is an emergence of ESBL/Carbapenemase producing bacteria, leading to a significant risk to our populations if new forms of antibiotics are not discovered soon (2). In this research, ESBL positive bacteria were identified by MLS at Henry County Medical Center using a BD Phoenix M50 instrument. These bacteria were then recorded and are reported to the hospital's infection control monthly. This data was collected during 2024 and then compared after a literature review was conducted over the distribution and trends in ESBL bacteria. It was found that the two most common organisms, E. coli and K. pneumoniae were the most prominent in urine cultures among this generally high-risk population. 2% were both ESBL and Carbapenemase positive, which seems to be a trend in recent years. Without carbapenems, physicians are having to decide to use antibiotics like Aminoglycosides, Polymyxins, and Fosfomycin, which are rarely used now due to toxicity and efficacy concerns (2). This is why more research must be done to stop the growth of ESBLs.

Abdul-waliyyu Bello

Faculty mentor: **Md Al Masum Bhuiyan**

Predictive Modelling for Identifying Vulnerable Populations at Risk of Unemployment or Underemployment

This study investigates the factors contributing to employment vulnerability and seeks to identify at-risk populations through predictive modeling. Employment vulnerability, influenced by a complex interplay of demographic, socioeconomic, psychological, and structural factors, affects individuals' ability to secure stable, well-paying jobs. Data were collected from a representative sample using a structured questionnaire, focusing on variables such as education, income, mental health, digital skills, and access to job resources. Three machine learning models—Random Forest, Gradient Boosting, and Artificial Neural Networks (ANN) were used to analyze these variables. ANN demonstrated the highest predictive performance, achieving an accuracy of 78.1%, followed by Gradient Boosting at 77.9% and Random Forest at 77.2%. ANN also recorded the highest recall score (87.8%), making it particularly effective in identifying high-risk individuals. Key predictors of employment vulnerability included age, education, adaptability, and digital skills, highlighting the importance of targeted interventions.
Results indicate that respondents with lower educational attainment, limited financial resources, and restricted access to digital tools are at a heightened risk of job instability. Practical recommendations include the provision of digital skills training and mental health support programs, along with policy initiatives to improve structural factors such as transportation and financial aid. These findings suggest that a proactive, data-driven approach can effectively identify vulnerable populations, providing a foundation for policymakers and community organizations to implement targeted support. This study demonstrates the potential of predictive modeling in enhancing employment stability and informing policy interventions.

Lauren Berg, Gage Link, Carter Crague, and Luis Ramos

Faculty mentors: **Matthew Farrell and Stephanie Bilderback**

Artificial Intelligence Adoption in Organizations Affected by Leadership, Training and National Culture

This paper explores the complex process of artificial intelligence (AI) adoption in organizations by examining the influence of leadership, employee training, and national culture. The aim is to offer a deeper understanding of how human and cultural dynamics affect the integration of AI into organizational settings, focusing on strategies that align with long-term business objectives and employee adaptability. The study presents a narrative synthesis of interdisciplinary literature on AI implementation, leadership adaptability, and national cultural influences. Hofstede's cultural dimensions serve as the primary theoretical framework, particularly concerning uncertainty avoidance, collectivism, and masculinity. These cultural variables are analyzed regarding organizational readiness and response to AI. A combination of leadership behaviors, workforce training practices, and cultural context influences AI adoption. Leaders who demonstrate emotional intelligence, adaptability, and transparency more effectively guide AI integration. Ongoing, human-centered training initiatives reduce resistance and promote productive AI use. Cultural values play a significant role, as high uncertainty avoidance cultures show greater reluctance, collectivist societies treat AI as a collaborative tool, and feminine cultures support inclusive innovation. In contrast, masculine and individualistic cultures emphasize results and competition, which may limit experimentation and cross-functional collaboration with AI. This paper contributes a culturally grounded perspective to the literature on AI in organizations. By connecting leadership development, employee engagement, and cultural sensitivity, the study offers practical insights for business leaders and policymakers. It reinforces the view that AI adoption is a technological advancement and a strategic and human transformation that requires intentional planning, ethical leadership, and cultural alignment.

Cassidy Boyd 🏆

Faculty mentor: **Dr. Frank Ferdik**

Combining yoga with expressive writing to improve incarcerated person health: A waitlist control randomized experiment

It is not uncommon for custodial populations to experience depression, low resilience, difficulty regulating emotions, and poor self-esteem. Separate from one another, mindfulness-based yoga and expressive writing have each been found to improve the mental health of incarcerated persons. To date, however, no study has evaluated their combined effects on these outcomes. In a maximum-security state prison for men located in New York, a total of (N = 48) participants were randomly assigned to either a comprehensive yoga intervention that included expressive writing (n = 25), or to a waitlist control group (n = 23). Statistically significant improvements in the depression, resilience, emotional regulation, and self-esteem levels of the treatment group were detected at post-intervention. Findings not only reinforce the beneficial effects of yoga and expressive writing, but suggest that by pairing these treatments, this can further improve the health of carceral residents.

David Bridgers and Joshua Miner

Faculty Mentors: **Donald Sudbrink and Niranga Wickramarathne**

Comparative Assessment of Soil Arthropod Communities in Pasture and Forest Soils

Soil arthropods are key indicators of ecosystem function, contributing to nutrient cycling, organic matter decomposition, and soil structure. We hypothesized that arthropod biodiversity would be greater in forest soils than adjacent pasture soils due to increased habitat complexity and organic matter inputs. This study investigates differences in soil arthropod communities between a managed pasture and a forested area at the Austin Peay State University (APSU) Farm, both classified under the Sengtown soil series. In March 2025, triplicate soil samples were collected from each site. Arthropods were extracted using Berlese-Tullgren funnels equipped with incandescent light sources and ethanol traps. The thermal and light gradient facilitated the vertical movement of organisms toward the alcohol collection vials. Collected specimens were examined under a dissecting microscope for morphological identification and quantification. The poster will present taxonomic composition, relative abundance, and species richness metrics for each site. Comparative analyses of biodiversity (Shannon-Wiener Index), and community composition will be conducted to evaluate potential differences across land uses. All data was processed using standardized sampling and identification protocols to ensure consistency and reproducibility. Results of the study will be presented, offering insight into the different varying arthropod biological diversity between forested soils and pasture soils.

Sara Brown, Ian Darden, Shelbee Davis, Christianna Evans, Alexa Hunt, Milynn Page, Jongin Park, and Mackenzie Woodley

Faculty mentors: **Dr. Tyler Nolting, Dr. Heather Phillips, and Dr. Tasha Ruffin and Professor Mitzi Baker**

C-reactive Protein in Relation to Cardiovascular Disease

C reactive protein (CRP) is a biomarker released by the liver in response to inflammation and elevated level are linked to increase risk of cardiovascular diseases (CVD), such as atherosclerosis, heart attacks, and strokes. Monitoring CRP levels, along with lipid testing, can help predict future cardiovascular events and assess risk in Individuals, especially those with chronic conditions or unhealthy lifestyles like COPD. Having elevated CRP also plays a role in inflammatory diseases, and maintaining healthy CRP levels may reduce the risk of complications and improve health outcomes. The study analyzes the impact of smoking and sleep patterns on C-reactive proteins using both quantitative and qualitative survey questions, with 59 participants at event 1 and 51 participants at event 2. Survey data collected through Qualtrics will be analyzed and put into Microsoft Excel to examine the relationship between C-reactive proteins and cardiovascular disease indicators. Some lessons that I learned are the importance of informed consents, patient engagement and working different professions such as MTEC and nursing students.

Sara Brown and Ja'irah Wordlaw-Scruggs

Faculty mentor: **Jane Semler**

Assessing the Discrepancies Between Automated Platelet Clump Flags and Manual Smear Review

In routine laboratory analysis, complete blood counts (CBC) are essential for diagnosing various diseases and conditions, with platelet count and mean platelet volume being critical for assessing thrombocytosis, thrombocytopenia, and inflammation. This study investigates the frequency and implications of false platelet clump flags generated by the Sysmex XN-2000, which can misrepresent platelet counts due to clustering phenomena. Factors leading to platelet clumping include EDTA sensitivity, traumatic phlebotomy, and certain medications. The research aims to evaluate the prevalence of these false alerts, their correlation with actual clumping, and the preanalytical and analytical factors contributing to them. Data was collected to analyze these flags, revealing that approximately 60% of flagged samples were resolved after automatic reflex counts utilizing fluorescence. In contrast, a subset of unresolved flags indicated the presence of clots. The study emphasizes the necessity of troubleshooting procedures, including manual smear reviews and patient history assessments, to ensure accurate platelet counts. Overall, the findings underscore the importance of thorough analytical processes to mitigate the risks of misdiagnosis stemming from false platelet clump alerts.

Natilee Bunting 🏆 and Patrick Myers 🏆

Faculty mentor: **Tianyu Li**

Examining Demographic Disparities in Teacher-Student Relationships in Early Elementary Education

Teacher-student relationships (TSRs)—characterized by closeness, conflict, and involvement—are central to students' motivation and academic success (Pianta, 2001). Positive TSRs are linked to greater student engagement, academic achievement, and instructional quality (Roorda et al., 2011). Despite these benefits, few studies have explored demographic disparities in teachers' perceptions of TSRs, particularly in early childhood education. Using a secondary dataset of 784 first-grade students from Texas, this study examined whether teachers' perceptions of their relationships with students varied by gender, race/ethnicity, socioeconomic status (SES), and parental education levels. Results showed that teachers reported higher levels of TSRs for female students and students from higher parental education backgrounds. TSR did not show perception disparities between students with different racial/ethnic backgrounds or SES. Our findings stress the importance of building positive TSRs and addressing potential biases and inequalities in education settings. Intervention efforts such as culturally responsive teaching, implicit bias training, and intentional relationship-building strategies, like increased one-on-one interactions, positive feedback, and classroom-building activities, may strengthen TSRs and improve classroom inclusivity (Reyhner, 2011; Gay, 2018; Oliveira et al., 2021).

Natilee Bunting 🏆

Faculty mentors: **Tianyu Li and Jessica Hatz**

Co-development of Math Anxiety and Math Gender Stereotypes in Male and Female Secondary School Students

Math anxiety (MA) and math gender stereotypes (MGS) are key psychological barriers to students' math learning, particularly for girls. MGS reflects the belief that girls are inherently less capable in math than boys, and such stereotypes may contribute to heightened MA, reducing self-efficacy, performance, and motivation (Tomasetto et al., 2011). Drawing on Situated Expectancy-Value Theory and Social Learning Theory, this study examined the co-development of MA and MGS over six years among middle and high school students.

Using longitudinal data from 3,116 students in the Longitudinal Study of American Youth (LSAY), we analyzed self-reported levels of MA and MGS from Grades 7 to 12. Correlational analyses showed moderate to weak positive correlations between MA and MGS for both female and male students across all grades. In addition, higher MGS was consistently associated with higher MA across six years. Furthermore, both MA and MGS showed moderate year-to-year stability, suggesting persistent patterns of math-related attitudes throughout secondary education.

These findings highlight the importance of addressing the co-development of MGS and MA during adolescence, particularly among girls who are more vulnerable to stereotype threats. Persistent negative beliefs about math ability can result in long-term disengagement from math and limit future educational and career opportunities in STEM. Interventions such as stereotype threat mitigation, growth mindset training, and emotional support strategies are critical to fostering inclusive, equitable math learning environments and promoting sustained motivation and achievement for all students.

Stefanie Cannan and Sophia Robinson

Faculty mentors: **Dr. Jack Deibert and Dr. Phyllis Camilleri**

Petrology and Correlation of Cenozoic Volcanic Dacite and Tuff units in Knoll Basin, NE Nevada

New geologic mapping in the extensional Knoll Basin of NE Nevada revealed the presence of two newly recognized, distinct Cenozoic volcanic units below the 16-14 Ma Jarbidge Rhyolite. These new units include the felsic lava (Boies dacite) and an underlying ash-flow tuff (Jakes tuff). Based on their stratigraphic position, we infer that the age of these rocks is between ca. 45–16 Ma. The goals of this project were to analyze three samples of each unit along the western margin of the basin to assess possible lateral petrological and geochemical changes, and to compare them to known volcanic rocks in the region for possible correlation. Samples were analyzed for mineral content using a petrographic microscope and for major and trace element chemistry using XRF. The Boies dacite contains plagioclase, sanidine, biotite, hornblende, and minor quartz. Chemical analyses indicate that the northernmost two Boies dacite samples are dacite, and the southernmost is a rhyolite. The major and trace element composition of the Boies dacite was compared to rocks in the nearby Nanny Creek volcanic field. Our data indicate that the northernmost Boies dacite more closely matches Nanny Creek hornblende-biotite dacite in the East Humboldt Range. Chemical and thin-section analysis of southernmost Boies dacite reveals evidence of chemical alteration, suggesting its rhyolitic chemistry is a product of alteration. The Jakes tuff samples are dominantly composed of glass shards with minor amount of plagioclase, sanidine, quartz, biotite, and hornblende. Future research will include radiometric dating of samples to assist in correlating these units.

Chelsea Chavis 🏆

Faculty Mentor: **Manisha Gupte**

Investigating the Role and Regulation of Ghrelin (Hunger Hormone) in Diet-Induced Obese Zebrafish

Zebrafish (Danio rerio) is a suitable model organism for studying obesity due to similarities in structure and function to human organs and metabolic pathways. This study investigated the effects of a high fat diet on body weights and ghrelin receptor levels in the brains from control diet- and high-fat-fed zebrafish. Ghrelin is a peptide hormone essential in hunger regulation, produced by peptide D1 (P/D10) cells in the stomach, it exists in an active (acylated) and inactive(des-acylated) form. The active form of ghrelin binds to growth hormone secretagogue receptor 1a (GHS-R1a) in the hypothalamus, stimulating hunger. Chronic high calorie diets can impair ghrelin suppression, potentially leading to ghrelin resistance, resulting in overeating. This study hypothesized that obesity disrupts ghrelin signaling in zebrafish brains resulting in weight gain. Adult zebra fish (males and females) were fed either a control or a high fat for eight weeks. Body weights were checked weekly. Next, investigate the expression of three isoforms of GHS-R1 which are highly expressed in brains. Findings in this study may contribute to understanding the regulation of ghrelin receptor signaling with diet-induced obesity in the male and female zebrafish.

Ian Darden

Faculty Mentor: **Jane Semler**

Blood Culture Contamination Reduction

On average, physicians in the United States order over 30 million blood cultures annually. This fact, combined with a nearly 40% contamination rate of those submitted, equates to nearly 12 million contaminated cultures submitted for further laboratory results. As a primary tool to identify sepsis patients, contamination of culture specimens poses a serious risk to patient outcomes. In respecting patient care and efficient use of time and materials, derivatives of safe protocols can allow for exaggerated hospital stays and costs associated with treatments, where days can become weeks, and costs can reach well into the thousands of extra dollars for care. These are incurred via additional charges for care from departments such as microbiology, pharmacology, and other hospital-associated costs. It is, therefore, the proposal of the presentation to suggest to oversight authorities of medical facilities that awareness and action must be taken to lower the contamination of blood cultures submitted for analysis. These initiatives to lower contamination also aid in other facets of care, such as inappropriate or prolonged antibiotic use and nosocomial illnesses.

Daniela Diaz Campos, Sarah Ahlheit, Katherine Thrash, Kade Tjaarda and Carter Black

Faculty mentors: **Dr. Stephanie Bilderback and Dr. Matt Hampton**

Degrees of Separation: How College Majors and Demographics Shape Earnings

This study examines how college majors and demographic characteristics shape wage outcomes in the U.S. labor market. Using data from the 2009 to 2022 American Community Survey and the Mincer earnings function, we analyzed wage trajectories among over one million college graduates, focusing on five academic fields: Business, STEM, Behavioral and Health Sciences, Education, and Arts and Letters.

Our findings reveal that STEM and Business graduates consistently earn higher wages than those in other fields. However, the source of the wage premium differs. STEM premiums diminish when industry placement is controlled for, suggesting the advantage is linked to high-paying sectors. Business degrees retain consistent earnings advantages across all models, indicating greater cross-sector applicability. Graduates in Education and Arts consistently experience lower wages, with more limited growth over time.

The study also uncovers wage disparities by gender, race, and immigration status. For example, Black and immigrant STEM graduates benefit from stronger wage premiums, while female STEM graduates face earnings penalties. These findings demonstrate that demographic context significantly influences the returns on academic investment.

By identifying how education pathways, labor market dynamics, and demographic factors intersect, this study offers important insights for students, educators, and policymakers. The results emphasize the need for targeted career guidance, equity-driven education policy, and curriculum alignment with labor market demands.

Chasity Dubois, Diego Alcala, Emily Bau, Skylar Catlett, Morgan Hughes, Junsub Kim, and Miranda Richardson

Faculty mentors: **Dr. Tyler Nolting, Ms. Mitzi Baker, and Dr. Heather Phillips**

Total Cholesterol and HDL: Relation to Heart Health

For our poster, we are informing college students about total cholesterol and HDL in relation to their heart. Total Blood Cholesterol is the sum of both your High- high-density lipoprotein (HDL) and low-density lipoprotein (LDL) plus 20% of your Triglyceride level. Your high-density lipoprotein (HDL) is called your "healthy" cholesterol, and this may help to protect against heart attacks and strokes. The Low-Density Lipoproteins (LDL), or your "bad" cholesterol, can be lowered by talking with your healthcare provider. Triglycerides are the most common fat in your body, and there are many factors that contribute to them, like obesity, physical inactivity, eating processed foods, alcohol consumption, excess sugar intake, and many others. We have had 111 participants at our three Hub events for testing college students and informing them about their high and low cholesterol levels. With the Hub events to test Total Cholesterol and HDL, the materials and tools we are using are one pair of proper-fitting gloves, one alcohol swab, one lancet, one capillary tube, one plunger, one testing strip, one cassette, one band-aid, one cholestech machine, and one disposable underpad. Some lessons from doing the past two hub events for my group are always working together, making sure everyone is very informed on what we are testing for, and making sure to always have their consent. We surveyed all three events, which are shown in the graphs below. There were two questions for our topic presented at the events, and there were 89 people who answered our questions.

Sarai Faulkner

Faculty mentor: **Dr. Meagan Mann**

Solubility Analysis of Ursolic Acid

Ursolic acid is a naturally occurring pentacyclic terpenoid acid found in various medicinal herbs and plants. Numerous studies have highlighted its biological activities and medicinal properties, including anti-cancer effects and hepatoprotective activity. Although ursolic acid is widely available, it has not been efficiently incorporated into pharmaceutical formulations. While the compound has demonstrated effectiveness in in vivo rat models and in vitro cell lines, ursolic acid is not found in commercial pharmaceuticals.
While synthesizing ursolic acid derivatives, it was discovered that the published studies have unreliable protocols for isolation and purification of ursolic acid and related molecules. This has largely been due to solubility issues. Ursolic acid is a slightly polar molecule due to the presence of a carboxylic acid group and a hydroxyl group. However, its large molecular backbone, consisting of both five- and six-membered hydrocarbon rings, results in relatively low overall polarity. This project aims to further the body of research on the solubility of ursolic acid and its derivatives with the ultimate goal of aiding in easier purification, isolation, and characterization of these molecules.

Ella Galassi ⚕

Research mentor: **Dr. Mike Wilson**

Printing the Future; More Efficient Skeleton Models for Education

Skeletal specimens on average range anywhere from $50 and works its way upwards to costing thousands, making them a noticeable expense for students as well as institutions. Medical education is not a cheap route and the last thing that is needed is for future health professionals to spend hundreds and even thousands more on essential learning tools. Using an x-ray able filament called PLA XRS, there are hopes to make low-cost, high quality skeletal specimens. This would be a significant benefit to the medical education field as it offers a more accessible alternative to the skeleton models used for clinical and academic training currently.

Holly Garcia and David Burton

Faculty mentor: **Leslie Hiatt**

Beyond the Expiration Date: Quantifying Fluoxetine with GC-MS

Fluoxetine, often branded as Prozac, is a regulated prescription drug that is classified as a Selective Serotonin Reuptake Inhibitor (SSRI). It is often prescribed in the treatment of mental and behavioral health disorders at various dosages. This experiment aimed to quantify and compare the molecular concentration of prescription samples from 2025 and from 2023 as a demonstration of the effects of extended patient storage. Gas Chromatography Mass Spectrometry (GC-MS) was used to determine the concentration of each sample. An external calibration curve was created with standard solutions of Fluoxetine in methanol.
Method development included diluting the prescription sample in various solvents, including hydrochloric acid and methanol. Due to chromatogram behavior and safety considerations, methanol was selected for use throughout the experiment. The first chromatographic peak showed evidence of tailing. This peak distortion raised concerns about accurate integration and quantification of fluoxetine. Optimized instrument parameters and refinement of the original acquisition method improved peak shape. The results demonstrated there was not a significant difference between new and expired fluoxetine concentrations. The standard deviation between triplicate samples signifies a need for improved precision in sample preparation procedures for quantitated data to be conclusive.

Jacey Golden 🏆, Natilee Bunting 🏆 and Patrick Myers 🏆

Faculty mentor: **Tianyu Li**

The Associations Between Parental Math Anxiety and Young Children's Home Math Environment

The development of math skills is key to children's academic and career success; however, many students struggle with math learning (Duncan et al., 2007; OECD, 2020). One contributing factor may be the home math environment (HME)—including number games, everyday math talk, and homework help (Ellis et al., 2025). HME reflects the quality of parent-child math interactions and is linked with children's math development (Daucourt et al., 2021). It was demonstrated that HME is associated with children's cognitive and academic outcomes (Gottfried et al., 1998). Another key element that affects the creation of HME is parental math anxiety (PMA), which refers to the discomfort, stress, or fear experienced by parents when engaging with math-related tasks (Maloney & Beilock, 2012). Prior research has shown that there was an intergenerational transmission effect, whereby higher levels of PMA were associated with poorer math learning outcomes in children (Beilock et al., 2015). Building on this work, the current study aimed to examine whether parents with various levels of PMA influence the quality of the math-based HME they create for their children. Linear regression was used with a group of 1046 caregivers of children aged 2 to 6 years old. Results showed that caregivers with higher levels of PMA were less likely to create a math-based HME, compared with caregivers with relatively lower levels of PMA. Findings emphasized the needs to support parents in managing their PMA and fostering a more positive HME to promote children's math learning.

Jacey Golden 🏆

Faculty mentor: **Emily Pica**

Neuroticism and Its Relationship to Emotional Intelligence

Neuroticism is a personality trait that varies between individuals. It is one of the five traits within the Big Five framework. It can be categorized by emotional instability, excessive worry, mood swings, and an inclination for negative emotions to include anxiety and depression. In contrast, emotional intelligence (EI) is a person's ability to perceive, understand, regulate and manage emotions effectively. Emotional intelligence demands emotional regulation and cognitive control - abilities that are often lacking in highly neurotic individuals (Saklofske et al., 2007). It was hypothesized that a negative relationship between neuroticism and EI exists. The purpose of this study was to collect and examine survey data, exploring the relationship between neuroticism and EI to expand levels of knowledge within personality traits and how it influences mental, emotional, and social skills. The NovoPsych Five Factor Personality Scale – 30 item version (NFFPS-30) and TEIQue-SF – Emotional Intelligence scale were used through Qualtrics to generate survey data. A composite score was collected to run a bivariate correlation analysis between neurotic personality traits, emotional intelligence and age (N=111). Based on the current data in this study, a significant negative correlation between age and neurotic personality traits was identified; however, no relationship between neuroticism and emotional intelligence was found. This suggests that as people age, their coping skills and emotional regulation abilities increase due to life experiences.

Jenuel Gonzalez-Milian

Faculty mentor: **Mollie Cashner**

Assortative Mating in guppies: do artificially selected phenotypes impact male mate preferences?

Positive Assortative mating occurs when one sex of a species exhibits sexual bias towards members of similar phenotypes which would not be expected under a random mating point of view. Studies show that male guppies tend to choose larger members of their species for sexual reproduction due to higher fecundity. If we remove size as a factor, it is unknown what other mechanisms may influence assortative sexual behaviors. Appearance might be a good indicator as female wild type guppies are typically dark green in coloration with no markings, while female fancy guppies can present a variety of tail fin colors and body markings. In this study I hypothesize that wild type phenotypes in females are more attractive to wild type male guppies and vice versa. To test this, two females of differing phenotype were placed in tanks and males were allowed to choose between them. After testing, it is evident that there is a slight preference towards wild type phenotypes in both wild type and fancy varieties of guppies, implying that artificial selection for color and appearance does not result in assortative mating.

Marlana Goulet

Faculty Mentor: **Jane Semler**

Validation of the BD BACTEC Lytic 10/Anaerobic/F Medium Bottles

Blood stream infections are an important cause of mortality and the best way to test for the presence of pathogens is through a blood culture. Before any testing can be performed, labs must complete a validation study to prove results can be trusted. For this study, several facultative and a few obligate anaerobes were utilized. The glass anaerobic culture bottles and agar plates were inoculated with an organism and incubated. Acceptable results for this study were the BACTEC FX system flagging the culture bottle as positive for growth and the corresponding agar plate had only the identified organism present. Candida albicans posed the biggest challenge as it failed to grow several times. Despite this drawback, enough of the pathogens were successfully detected by the system to allow for reporting of results.

JaNiah Harris

Faculty mentor: **Dr. Mary L. Akinyemi**

Predictive Analysis of Treasury Bills

Artificial intelligence has given researchers access to a broader range of historical data, enabling the development of more accurate predictive models in finance. This study investigates the relationship between treasury bill rates and two high-demand commodities: gasoline and gold. We compiled a comprehensive dataset spanning ten years of historical prices: July 2014-July 2024, consisting of treasury bill rates, gasoline prices, gold-EPI, and natural gas consumption, and vital economic indicators such as GDP, inflation rates, and interest rates. Our analysis reveals that natural gas consumption exhibits the highest positive correlation (0.64) with treasury bill rates, while gasoline prices and the export price index of gold show moderate positive correlations (0.51 and 0.52, respectively). Training the data on a machine learning model (Artificial Neural Network) and three deep learning models (Recurrent Neural Network, Convolutional Neural Network and 3D Convolutional Neural Network). Their performance was assessed using mean absolute error, mean squared error, root mean squared error, and R2score. The Recurrent Neural Network architecture was the most effective at capturing the relationships between the variables and treasury bill rates, achieving a root mean squared error of 0.08.

Ethan Heatherly

Faculty Mentor: **Dr. Mollie Cashner**

Indirect Effects of Artificial Selection on Mating Display Frequency in Male Guppy (Poecilia reticulata)

The common guppy (Poecilia reticulata) is often utilized in the study of sexual selection due to the presence of vibrant ornamentation in the form of orange splotches on the body of the male, as well as the set of behavioral displays males perform to potential mates and competitors. Display rate and orange pigmentation are correlated, but whether this is causal or coincidental is unclear. Fancy guppies are artificially selected for extreme phenotypes, such as larger or absent orange splotches, but this artificial selection may have other consequences such as impacts on reproductive behavioral displays. I tested the display rate of 12 male guppies: four wild-type individuals, four individuals with low levels of orange pigmentation, and four individuals with high levels of orange pigmentation. While my findings indicate that a male guppy's orange pigmentation does not act as a predictor for its display rate, I found that a male's tail-to-body ratio, another trait that is under heavy artificial selection, does act as a predictor for display rate.

Gary Hendricks

Faculty mentors: **Dr. Carrie Brennan and Dr. Leslie Hiatt**

Wet Digestion of Cocoa Powder

Over the past five years, Consumer Reports has highlighted elevated levels of toxic metals, including lead, cadmium, and iron in commonly consumed chocolate products. This project aims to establish an efficient wet digestion method to accurately determine the heavy metal contents in chocolate products. To find a suitable method, calcium concentration was investigated, due to its lesser toxicity than lead or cadmium. Wet digestion is a method that breaks down the organic molecules to isolate the metal contents via "digestion". Small samples of Trader Joe's cocoa powder were treated with a water lipase mixture. These solutions were then treated with a combination of nitric acid and perchloric acid. These acidified samples were heated using heating mantles, with slow additions of hydrogen peroxide. This technique utilized lipase as a pretreatment option (for fat removal) before adding nitric acid, perchloric acid, and hydrogen peroxide. All samples were analyzed using an external calibration curve generated via atomic absorption spectroscopy. The resulting solutions were yellow and clear in color. These solutions matched the expected results, based on peer reviewed research articles. Wet digestion provides a foundation for future studies of metals in chocolates. With minor adjustments this method can be used to accurately determine the amounts of more toxic metals such as lead or cadmium.

Grace Holt ⚥ ★ **and Joyce Daaga** ⚥ ★

Faculty mentor: **Jackie Vogel**

What factors impact student learning with students who exhibit math anxiety?

Mathematics anxiety can impact students in many negative ways as they progress through school and into their careers. The researchers investigating the impacts of mathematics anxiety, Grace Holt and Joyce Daaga, are part of the Partners Engaged with Emerging Researchers (PEER) Program. This Program is a research collaboration between Middle College High School students and their university faculty mentor. The high school undergraduate researchers are conducting literature reviews and interviews to deepen their understanding of mathematics anxiety. Preliminary results indicate that teacher expectations, teacher anxiety, and gender impact the students' potential for mathematics anxiety. This research project is ongoing and is expected to illuminate additional factors impacting students' potential for mathematics anxiety and its associated impact on student learning.

Emily Horner and Samantha Ramirez

Faculty Mentor: **Jane Semler**

Illness Insights: Seasonal Trends of the Flu and COVID-19 in Southern Kentucky and Upper Middle Tennessee

Understanding and mitigating the spread of influenza and COVID-19 is crucial for protecting public health and maintaining societal stability. In the present study, we investigated and graphed all positive COVID-19, influenza A and influenza B test that resulted at Jennie Stuart and Tennova hospitals from the year 2024. Results: When compared nationally, both hospitals showed significantly higher percentages of influenza B around the beginning of 2024, where nationally we saw much higher percentages of influenza A or COVID-19. When this trailed off, both the national and local trends showed a spike in COVID-19 in the summer months. Then in December, we saw the local and national trends mimic each other again with a massive influenza A spike. The importance of watching these trends is so that we can see if there are contributing factors to higher illness rates. Graphs provide a clear and accessible way for the public to understand the current state of these diseases. This can encourage preventive measures like vaccination. In addition, visualizing the trends helps public health officials and researchers monitor the spread of these diseases in different regions over time. This data is crucial for identifying outbreaks and understanding seasonal patterns. Conclusion: Analyzing and graphing the collected data on COVID-19 and influenza trends is essential for improving public health strategies, enabling timely interventions, and fostering a more informed and prepared society.

Christine Jator

Faculty mentor: **Dr. Sumen Sen**

Food Insecurities in a Blooming Rural Town: A Statistical Analysis

Food is an essential part of daily life, providing vital nutrition to the mind and body. The lack of an essential resource can significantly hinder one's quality of life. In the south, "The state of Tennessee measures at 11.9% food insecurity" (Durnell, 2023, p.1). This statistic reveals that several people cannot acquire healthy food: in effect, decreasing their quality of life. Clarksville, a growing rural town in Tennessee struggles with the same issue. In this study, we seek to understand what factors classify food-insecure populations in Clarksville, TN, and how they compare on a smaller and larger scale. Using data from the United Census Bureau, we will analyze trends and formulate conclusions from Clarksville, TN data, and compare these results with Murfreesboro, TN, and USA data. The data contains food stamp information counts and percentages for different populations. This research aspires to aid food pantries and food-insecure populations in growing rural areas similar to Clarksville, TN. This project sheds light on remembering the impoverished and those who struggle to obtain healthy food in a progressing society.

Travis Jenkins and Ashlyn Clark

Faculty mentors: **Jack Deibert and Phyllis Camilleri**

Petrologic and Geochemical Correlation of the Jarbidge Rhyolite in Knoll Basin, NE Nevada

New mapping in Knoll Basin, an extensional basin in NE Nevada, reveals two stratigraphically distinct felsic lava flows along its NW margin. The upper unit is tentatively correlated with the 16–14 Ma Jarbidge Rhyolite. The lower unit was previously unrecognized and is informally named the Boies dacite. To assess lateral variation and viability of correlation with volcanic rocks elsewhere in Nevada, we characterized three samples from each unit using petrography and whole-rock XRF geochemistry. Geochemically, the Jarbidge Rhyolite samples are high-silica rhyolites, and thin-section analyses indicate they contain quartz, sanidine, plagioclase, and minor pyroxene. Major and trace element (Rb, Y, Nb vs. SiO_2) chemistry of our samples closely matches the published data from the Jarbidge Rhyolite to the west and east of the study area. Rb/Nb ratios in our samples have values between that in the Jarbidge Rhyolite to the west and east of the study area. This suggests a regional continuum of decreasing Rb/Nb values from west to east, possibly related to changes in depth of crustal melting and or the addition of a mafic component to the magma. Compared to the underlying Boies dacite, the Jarbidge Rhyolite samples exhibit higher silica content, lower alkali content, lower amounts of Rb, Y, and Nb, and they contain pyroxene instead of hornblende and biotite. These data refine the volcanic stratigraphy in Knoll Basin and serve to establish a petrogenetic distinction between the Jarbidge Rhyolite and Boies dacite.

Devin Jones and Jenna Eagle

Faculty mentor: **Dr. Carrie Brennan**

Development of an GC-MS Method for Simultaneous Analysis of Fragrance oils in Candle Samples

A method was developed for the extraction and analysis of fragrance compounds within a Sicilian lemon scented Yankee candle using GC-MS. Seven standards of potential fragrance compounds were chosen based on a literature review. Fragrance compounds were extracted from candle shavings into activated carbon strips using both a hot plate and a candle warmer. Extraction from the carbon strips was performed using acetonitrile. Various standard mixtures containing R-limonene, geraniol, linalool, benzyl alcohol, coumarin, eugenol, limonene, geraniol, and linalool in methanol were analyzed. The fragrance compounds extracted from the candle using a hotplate were determined using peak analysis. Benzyl alcohol, linalool, geraniol, and eugenol were identified in the extracted sample. The standards were identified by comparing known qualifiers and quantifiers from journal articles. The method used was a success and standards were able to be seen within the data collected even though the standards were expired. This research can help future projects and figure out potential allergens in candles. This research project will continue with valid standards to see if better results come from it. The project will continue to Fall 2025 semester.

Aaron Jumonville

Faculty Mentor: **Dr. Kallina Dunkle**

ModelMuse: An upgrade in Groundwater Flow Modeling – Coming soon to APSU

Students enrolled in Hydrogeology at Austin Peay State University currently use Groundwater Vistas as the graphical user interface, or GUI, to construct groundwater flow models with the United States Geological Survey's hydrologic model, MODFLOW, as part of this course offered by the Department of Earth and Environmental Sciences. However, APSU's Hydrogeology course is now switching over to a newer and arguably more effective GUI, ModelMuse. A groundwater flow model is defined as a mathematical representation of groundwater flow through an aquifer, which is an underground layer of water-bearing rock able to readily transmit water to wells and springs. Understanding aquifers and groundwater flow is crucial for humans to have access to clean, fresh drinking water. ModelMuse will be a more effective GUI for several reasons, with the two most important being that the program is free of cost and can be downloaded on any computer, making the program accessible to all. Switching to ModelMuse will require the creation of new models for use in lab exercises, as well as simple directions and videos to help students learn the program. As a result of this switch, students studying groundwater will have the ability to continue to learn and practice construction of various groundwater flow models at no cost.

Madyson Knox ⚥ ★

Faculty mentor: **Kallina Dunkle**

Analysis of Women's Experiences in STEM

Women have been historically underrepresented and undervalued in STEM fields, often facing barriers to both entry and retention. As part of an Institutional Review Board-approved study, focus groups are used to examine women's career motivations, experiences, and perceptions in STEM, focusing on factors that influence their educational and professional trajectories. The 90-minute focus group sessions will be audio-recorded for transcription, with participants also allowed to provide written responses. The study population includes Austin Peay State University students majoring in STEM who identify as women and are 18 or older. Eligible participants will receive a consent document detailing the study's procedures, data storage, risks, and benefits. The researchers will separately analyze transcripts for a priori or preset codes that include the importance of early support, such as mentorship and access to resources, in shaping career motivations and systemic biases, such as unequal access to leadership opportunities and persistent gender stereotypes, which remain significant barriers to success. Results will be used to develop actionable strategies to increase recruitment and retention for women in STEM fields by addressing these challenges and opportunities.

Shelby Koonce

Faculty mentors: **Dr. Kelly Kleinhans and Ms. Jennifer Brandon**

Case Study: Examination of Discourse Elicitation Stimuli for a Person with Chronic Fluent Aphasia

The aim of this case study was to examine the types of discourse elicited for a person with chronic fluent aphasia. Aphasia is an acquired language disorder that results from neurological damage, such as a stroke. Personal interests such as family and hobbies were incorporated into discourse samples to determine if Correct Information Units (CIUs) would increase with meaningful topics of conversation. Discourse refers to the fundamental, everyday use of language critical for interacting with others. Persons with aphasia (PWA) often face challenges related to carrying out efficient conversations. In this case, the client perseverates, or fails to change conversation topics when appropriate due to a lack of auditory comprehension related to fluent aphasia.

Natural conversational language samples were collected throughout daily speech therapy sessions during an Intensive Comprehensive Aphasia Program (CCC-ICAP) held at the APSU Speech-Language & Swallowing Community Clinic. Conversation about meaningful topics helped to increase engagement to the task and motivated the client to contribute to the provided topic. Meaningful narrative topics resulted in more robust responses from the client. This study revealed that communicative effectiveness for those with aphasia often relies on intrinsic motivation such as personally meaningful topics in contrast to standardized measures.

Maegan Litchfield

Faculty Mentor: **Dr. Mollie Cashner**

Enrichment Strategies for Captive Sea Turtles

Captive sea turtles, such as Chelonia mydas (Green Sea Turtle) and Caretta caretta (Loggerhead Sea Turtle), require consistent enrichment to reduce stereotypic behaviors and enhance welfare. At the Maritime Aquarium, the resident sea turtles have remained in the same enclosure for over 20 years with minimal enrichment, exhibiting stereotypic circular swimming and food-based competition. I evaluated the impact of targeted enrichment interventions on three focal turtles: 2 Green Sea Turtles and one Loggerhead Sea Turtle. Enrichment trials included JollyBall interactions and ice block feeding, and olfactory and food-based enrichments were prioritized. We collected data on maximum engagement levels, behavioral shifts, and potential reductions in aggressive interactions. We found that food-based enrichment had the highest engagement, which suggests that incorporating diet-aligned enrichment strategies can significantly enhance behavioral stimulation and welfare in captive sea turtles. Results from this study provide a framework for enrichment practices in AZA-accredited facilities, emphasizing individualized approaches to captive sea turtle welfare.

Taylor Lorance 🏆 and Comfort Ogbu *

Faculty mentor: **Dr. Manisha Gupte**

Investigating the Effect of High-Fat Diet on Genes Associated with Cognitive Function of Zebrafish

Obesity is a significant global epidemic that increases the risk of various metabolic disorders, including cardiovascular diseases, type 2 diabetes (T2D), and cognitive impairment. One important factor influencing the progression of these conditions is an individual's sex, which can affect susceptibility to obesity, T2D, and cognitive issues. The negative effects of an unhealthy diet, especially excessive fat intake, are well documented; these contribute not only to obesity but also to cognitive dysfunction in mammals. In this study, we investigate how a high-fat diet impacts cognitive function and gene expression in the telencephalon of zebrafish. Our findings aim to enhance the understanding of how high-fat diets affect genes related to cognitive function in both sexes.

Hannah Luck, Sharlyne Gul, Faith Suss, Courtney Wilson, Marlana Goulet, Ledger Chase, and Susan Montoya-Griffis

Faculty mentors: **Dr. Tyler Nolting, Dr. Tasha Ruffin, Dr. Heather Phillips, and Mitzi Baker**

The Importance of Maintaining and Understanding Iron Levels

This poster discusses the importance of understanding, prioritizing, and maintaining iron levels. The importance of maintaining one's iron levels is analyzed throughout this presentation, as it includes information regarding what iron does for the body, the causes of iron deficiency, and potential treatments. This poster presentation and the Govs Wellness Hub Events it is associated with both aim to promote wellness and knowledge regarding iron levels among college students at Austin Peay State University. At such events, students will have the opportunity to have their blood drawn, engage in finger-stick testing and body composition measurements, and communicate with health professionals to better understand their levels. After the events, primary data will be collected via digital or hard-copy surveys in which participants will respond to both qualitative and quantitative questions. The first event gathered 59 respondents while the second gathered 51 respondents, and there is an expected increase in the number of respondents for the third event. Data from the surveys, particularly the questions regarding iron levels, is gathered and analyzed via Microsoft Excel which analyzes things like the mean, median, and mode of responses. By the end of all three Govs Hub Wellness Events, it is expected that there will be an overall increase in knowledge and understanding regarding iron levels among participants and an increased confidence in maintenance ability.

Wisanee W. Mahawong, Lauren Tomasini, Samantha Ramirez, Cassidy Rayborn, Nakumae Styles, Jessica Shelton, Ebone Appleton, and Anthony Perry

Faculty mentors: **Dr. Tyler Nolting, Dr. Tasha Ruffin, Dr. Heather Phillips, and Mitzi Baker**

From Ocean to Orchard: The Key to a Healthier You

Implementing a healthy diet is essential for overall wellness and disease prevention. Major food groups such as fish and shellfish, whole grains, fruits, and vegetables provide key nutrients that sustain cardiovascular health, brain function, and metabolic control. Evidence indicates that high intakes of such foods lower the risk of developing long-term diseases such as diabetes, obesity, and cardiovascular diseases. Despite their health benefits, the availability and cost of these foods remain obstacles to their incorporation into daily diets. Future research must find ways to increase access to such nutrient-dense foods, particularly among university students.

This study used a mixed method design to examine dietary patterns and knowledge among Austin Peay State University (APSU) students. The surveys and health screens were conducted at three Govs Wellness Hub events. The population was APSU students aged 18 through their early 30s with varying socioeconomic and cultural backgrounds. The health screens measured blood pressure, glucose level, cholesterol level, and body composition, while surveys measured dietary patterns and nutrition knowledge—a total of 111 surveys were returned.

Early findings suggest that increased awareness and access to healthy foods positively affect dietary practices among students. Future initiatives must focus on education and cost-effectiveness to create long-term lifestyle changes prioritizing health and wellness. Increasing students' knowledge and access to essential food can help promote healthier eating habits and general wellness.

Keywords: Omega-3 fish, Socioeconomic, Metabolic control, Blood pressure, Cultural backgrounds, Dietary.

Jair Martinez, Keira Scott and Michael Graff

Faculty Mentor: **Dr. Eugene U. Donev**

Comparing Four Methods for Determining the Refractive Index of a Glass Prism Using a Multi-Wavelength Laser and a Versatile Optical Setup

We present an update on the progress of our work to include measurements and fits of the Fresnel reflectance curves for s- and p- polarization, using mixtures of both polarizations. Previously, we measured the dispersion of the refractive index of a glass prism using the angle of minimum deviation, fitting to the minimum deviation curve, and Brewster's angle. The angle of minimum deviation yielded the results closest to the Sellmeier values (maximum percent error: 0.03%), while the Fresnel method showed the overall largest inconsistency (percent errors between 0.05% and 1.54%). The minimum deviation fitting results are consistently lower due to a yet unknown systematic error, while the Brewster's angle results can be made to match by mixing in small fractions of s-polarization. The next steps include implementing the total internal reflection and rotating analyzer ellipsometry methods. These experiments and computations can be adapted to various undergraduate projects ranging from a few advanced laboratory sessions to semester-long student research experiences, teaching the importance of precise alignment, calibration, careful measurements, and fitting.

Madison Mixon-Rodriguez, David Thompson, Patrick Garcia, Taylor White, Shawnae Towner, Ashley Doyle and Trinity Thompson

Faculty mentors: **Dr. Tyler Nolting, Dr. Tasha Ruffin, Dr. Heather Phillips, and Mitzi Baker**

How the Growing Risk of Hypertension Affects College Students

In recent years, hypertension has become a rising issue that is starting to be steadily seen in the young adult population ages 18-25. Hypertension, also commonly known as the silent killer, is caused by inadequate lifestyle habits, such as unhealthy foods, elevated alcohol intake, and inactivity. At the hosted events a total of 110 participants participated in the health screenings. The first event consisted of 59 participants, and the second had 51. This event was set with several tables that all conducted different health screenings, where blood pressure was conducted using blood pressure cuffs and stethoscope. The surveys are a compiled list of qualitative and quantitative questions testing participants' knowledge of what they are being screened on. For the final hosted event, there is expected to be approximately 55 participants that will receive a health screening and approximately 27 surveys completed. Through the events, lessons of patience and patient interactions were learned. From this experience, it was learned that a majority the young adult population is unaware of what hypertension is and what causes it. By having patience, it improved patient interactions and increased their knowledge on the topic of what normal blood pressure is, and how to maintain a healthy lifestyle.

Gazala Momin, Luke Ritenour, William Richmond, Alaina Chandler, Valentina Ormaza, Jasmine Favors, Nalayah Fort and Ebony Thomasson

Faculty mentors: **Dr. Tyler Nolting, Dr. Tasha Ruffin, Dr. Heather Phillips and Mrs. Mitzi Baker**

Body Composition, Obesity, and Cardiovascular disease

Cardiovascular diseases, coronary heart diseases, and heart failure are disease processes that result from people who are overweight and obese. This is due to adipose tissue producing pro-inflammatory cytokines that impair arterial blood pressure, leading to atherosclerotic plaques. In a survey of 1509 Americans, 81% agreed that obesity is the number one health problem facing the country, with 95% stating it can increase the risk of early death. Diet and the amount of physical activity a person can impact health and health outcomes. Participants for the surveys were students from Austin Peay State University who attended and participated in the three Wellness Hub events. Event 1 had 59 participants, event 2 had 51 participants, and event 3 had 50 participants. We assessed students using multiple resources to screen and determine risks with BMI, waist circumference, and body fat percentage. When asking the quantitative question to the students, "How often do you eat fast food?" almost half of the individuals stated that they sometimes do. The qualitative question that was asked to students, "Do you feel that your body composition affects your daily life? Why or why not?" showed that 64.6% stated yes, 31.4% said no, and the remaining 4.2% did not know. Figure 2 chart has examples of how body composition affects daily life answers from different students. Many participants learned during the event that there are many ways that certain diets and physical activities can help with overall health and impact a positive outcome. The data that was collected among the college student helped us determine how much they know, risk factors, & how to prevent it.

Hedeshkahen Mondesir

Faculty Mentor: **Leslie Hiatt**

Analyzing Chocolate's Stimulants: GC-MS Detection of Theobromine and Theophylline

Theobromine and theophylline, two naturally occurring methylxanthines in cacao, contribute to chocolate consumption's stimulant and physiological effects. Theobromine, which contributes to the bitter taste in chocolate, is compared to caffeine due to its similar chemical structure containing the xanthine backbone. This study aims to develop and validate a gas chromatography-mass spectrometry (GC-MS) method for the qualitative and quantitative analysis of these alkaloids in various chocolate samples. Chromatographic separation was achieved on a capillary column and analytes were identified using mass spectral fragmentation patterns achieved through electron impact ionization and chromatography retention times. Calibration curves demonstrated linearity within the tested concentration range, with limits of detection and quantification sufficient for trace analysis. Adjusting oven temperature, solvent type, and concentrations of theobromine and theophylline affected the quality of chromatographic separation. Among these factors, the concentration of the alkaloids played a critical role in peak shape and intensity. Higher concentrations produced taller, more defined peaks, lower temperatures resulted in longer retention times, and certain solvents changed the peak variability. These findings show how GC-MS can be used to identify key compounds in chocolate, offering useful insight into its chemical makeup for quality control and nutrition-related research.

Campbell Moore, James Faulk, Jocelyn Wu, Alana Escue and Brody Burgess

Faculty mentors: **Dr. Stephanie Bilderback and Dr. Shiyun Chen**

Social Media in Sports and Business: Athlete Branding, Fan Engagement, and Crisis Management

This study explores the evolving role of social media in sports management and corporate communication, with a focus on three central themes: athlete branding, fan engagement, and crisis management. Through a systematic literature review, the project analyzes how platforms such as Instagram, Facebook, X (formerly Twitter), and TikTok reshape audience relationships, brand visibility, and reputation strategies in both sports and business environments.

Findings reveal that social media enables two-way interaction that strengthens parasocial relationships and fosters brand loyalty. Athletes use these platforms to develop personal brands and enhance sponsorship opportunities, while teams leverage digital engagement to promote merchandise and build global communities. Crisis management has also shifted, requiring real-time, transparent digital responses to protect brand integrity.

The study identifies platform-specific strategies, emphasizing that tailoring content to audience preferences and media formats is key to optimizing impact. For example, TikTok favors creative short-form videos, Instagram supports lifestyle storytelling, X provides real-time coverage, and Facebook builds long-form relationships. Additionally, user-generated content emerges as both a powerful tool for engagement and a challenge for brand control. This research contributes to the understanding of digital strategy in both sports and business contexts. It offers practical insights for teams, athletes, and organizations seeking to enhance audience engagement, maximize sponsorship potential, and prepare for crisis communication in today's fast-paced digital environment.

Austin Morse *

Faculty mentors: **Dr. Mir A. Hasan and Professor Barry Bruster**

Cyber-attacks on the rise: What are they and is the U.S. prepared?

There is a growing threat to the United States (U.S.) relating to the cyber domain. This paper delves into what a cyber-attack is and how it fits with UN charter Article 2(4). The proper justification for cyber warfare and the moral obligation of the U.S. to improve its cyber capabilities will also be discussed. Lastly research into the cyber threat landscape as well as the cost of cyber incidents is conducted. The focus is to enable a proper response to cyber threats from the U.S. that align with international treaties and law.

Avery R. Neufeld, David D. Robbe and Citali Dominguez

Faculty Mentor: **Dr. John X. Volker**

The Role of Generative AI in Business Education: A Student Perspective

This study explores the integration of generative artificial intelligence (AI) in business education from the perspective of students. Drawing on survey data collected from members of GovsFund, a student-run investment group, the research investigates how generative AI tools are currently being adopted and perceived within academic settings. The findings reveal a notable disconnect between faculty and student engagement with AI: while professors exhibit reluctance toward adopting generative AI in their teaching practices—often due to concerns about academic integrity, unfamiliarity, or institutional limitations—students report frequent and diverse use of these tools to support their learning. Students commonly utilize AI for tasks such as summarizing readings, generating study materials, brainstorming ideas, and clarifying complex concepts. The study highlights the growing importance of understanding and addressing this gap in adoption, suggesting that future business education frameworks should account for students' evolving technological practices and preferences.

Christian Newman, Joseph Howell, Carson Tolbert, and Matthew Thompson

Faculty mentor: **Emmabeth Vaughn**

Abstract For 3D Printing Filament Recycling Project

The growth of 3D printing has dramatically improved prototyping, however, it has also led to an increase in single-use plastic waste. Users of 3D printers tend to throw waste and failed prints directly into the trash. This project aims to develop a sustainable recycling pipeline for 3D printing filament waste generated on APSU's campus. Improving campus sustainability, specifically recycling the immense amounts of 3D printing filament waste generated by the Library Makerspace, GIS Center, and Engineering Technology Building, motivated this project. We have completed a literature review, established contact with campus printing stations, created a recycling flowchart, and initiated pelletizing waste filament. The literature review indicated that filament recycling has a high Material Circularity Indicator score and that existing research on recycling 3D printing waste lacks consistency and standardization. Thus, this project has an opportunity to be a pioneer in the study of recycling 3D printing waste. We are currently working on creating a backstock of waste pellets, sourcing more virgin material, and optimizing the delivery of recycled products and the pickup of waste from 3D printing stations on campus. Our future work will focus on creating an operation and maintenance manual, automating the recycling process as efficiently as possible, and establishing solid contact with the 3D printing stations to make the pass-off of our work to future students as easy as possible. This project has the potential to not only reduce campus waste but also to establish a model for filament recycling that other universities can follow.

Zoeigh Owens and Zachary Allen

Faculty mentor: **Dr. Stephanie Bilderback**

Global Benchmarking of Snapchat: Insights for Employee Development and Business Training in the Digital Age

This study explores the use of Snapchat as a strategic tool for employee development and business training, using global benchmarking methods to assess its effectiveness compared to other social media platforms. With over 613 million users worldwide, Snapchat has become a leading platform among Generation Z and Millennials, offering a dynamic space for real-time, visual, and interactive communication.

Using data from Statista, the study evaluates key performance indicators such as user engagement, growth rates, and demographic reach, benchmarking Snapchat against competitors like Facebook, Instagram, and TikTok. Findings show that Snapchat's features, including the AI-powered chatbot 'My AI' and the subscription service Snapchat Plus, create unique opportunities for personalized and engaging training experiences.

The research applies social learning theory and the technology acceptance model to explain how Snapchat's design supports knowledge sharing, skill development, and employee motivation. Recommendations for practice include using Stories for onboarding, Filters for training demonstrations, and Snapchat Plus for progress tracking.

This work contributes to understanding how non-traditional platforms can be used to enhance employee learning and communication in today's fast-paced, tech-driven work environments. It highlights the importance of meeting the next generation of workers where they already are, on platforms they know, trust, and enjoy.

By positioning Snapchat as more than a social tool, this study encourages businesses to rethink digital training strategies through innovation, benchmarking, and generational relevance.

Allison N. Palmer 🏆 * and Mason D. Ferrell *

Faculty mentor: **Dr. Mollie F. Cashner**

Investigating the Influence of Maternal Care on Isopod Movement

Terrestrial isopods in the clade Crinocheta (Oniscidae) engage in obligatory maternal care, where the eggs are brooded in a ventral pouch called a marsupium. Along with providing nutrition to the developing offspring the marsupium is also filled with a fluid similar to seawater, and thus the prevailing hypothesis is that the marsupium is a structure which facilitated Oniscid isopods' transition to terrestrial life. While parental care may improve the offsprings' odds of survival, providing care can incur costs to the parents' fitness. Females in the genus *Armadillidium* do not feed while carrying mancae and a filled marsupium may impair movement. We investigated the behavioral costs of maternal care in the terrestrial isopod *A. nasatum* by assessing differences in locomotion, as changes in movement activity may indicate a tradeoff between reproduction and foraging, predator avoidance, and desiccation prevention. Non-gravid, egg-carrying, and manca-carrying isopods were identified and placed in separate petri dishes during each trial. We measured their locomotion by filming their movement for 30 minutes and then quantified the isopods' speeds and distance traveled using the software Kinovea. We analyzed the resulting values using an ANOVA and students t-test, and we found that there were minimal differences between isopods at different reproductive states.

Zeel Patel and Cristiana Snyder

Faculty mentors: **Dr. Niranga Wickramarathne and Dr. Anuradha Pathiranage**

The Antimicrobial Effects of Temporary Hair Dyes on Beneficial Scalp Microbiota

Synthetic hair dye products often contain antimicrobial compounds, yet their effects on beneficial skin and scalp microbiota remain underexplored. This study evaluates the antimicrobial activity of five commercially available temporary hair dyes. Hot Hot Pink, Electric Lizard, Psychedelic Sunset, Sunshine, and Atomic Turquoise against three common commensal or potentially beneficial bacterial species: *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, and *Micrococcus luteus*. These organisms are integral to maintaining skin health and microbial balance. The agar disk diffusion method was used to assess bacterial inhibition on Nutrient Agar, Mueller-Hinton Agar, and Tryptic Soy Agar. Each bacterial strain was inoculated uniformly, and sterile paper disks impregnated with dye formulations were applied. Ethanol-treated and untreated disks served as negative and baseline controls, respectively. All assays were performed in triplicate, and inhibition zones were measured following incubation. All tested dyes exhibited antimicrobial activity, with zone diameters ranging by formulation and bacterial species. The strongest inhibition was observed for Electric Lizard (24.59 mm) and Atomic Turquoise (22.43 mm) against *S. epidermidis. Pseudomonas aeruginosa* showed the greatest susceptibility to Atomic Turquoise (20.09 mm), while *M. luteus* displayed the least susceptibility across all dyes, with inhibition zones below 21 mm. Ethanol controls demonstrated minor inhibition; untreated disks showed no inhibition, confirming the antimicrobial action of the dye components. These findings suggest that temporary synthetic hair dyes can inhibit the growth of beneficial skin-associated microbes, potentially disrupting the natural scalp microbiota. Further studies are warranted to assess long-term dermatological implications.

Neel Patel

Faculty Mentor: **Anuradha Pathiranage**

Extraction and Isolation of Coumarin from Natural Products

Coumarin is a naturally occurring aromatic compound found in several plant species, known for its distinctive fragrance and diverse biological properties. Coumarin's anticoagulant properties and its role in medical and industrial applications underscore the importance of its characterization and regulation. It has historically been used as a flavoring agent in foods, beverages, and tobacco products—particularly in traditional German May wine and herbal teas. However, due to concerns over its potential hepatotoxicity and carcinogenicity at high doses, the U.S. FDA banned its use as a direct food additive in 1954, a decision also reflected in European Union regulations.

This project focuses on the extraction and isolation of coumarin from five natural sources: cassia cinnamon, Tonka beans, sweet clover, sweet woodruff, and licorice root. Soxhlet extraction was employed to isolate coumarin from these plant materials, followed by thin-layer chromatography (TLC) for preliminary identification and confirmation.

Future work will include quantitative analysis using gas chromatography-mass spectrometry (GC-MS) to determine coumarin concentrations in the extracted samples, providing insight into potential exposure risks and supporting the safe use of these natural products.

Shalaya Perkins, Allison Morton, Annabella Romano, Eniola Peter, Katherine Fyke, Alexis Osowski, Ward Graddey, and Haley Sherrill

Faculty mentors: **Dr. Tyler Nolting, Dr. Tasha Ruffin, Dr. Heather Phillips, and Mitzi Baker**

CVD Risk Pertaining Diabetes, HbA1C, and Glucose

In our poster presentation we will share the purpose of measuring blood glucose and hemoglobin A1C, share the risk of having an unhealthy lifestyle, sharing workshop interventions for college students, and we will also share our future research as for what we should do for the barriers that are preventing our population from following health advice. For the past few weeks, we have been hosting Hub events at Austin Peay State University for students to participate in by receiving a health screening. After the health screening we collected several data of health screening results and survey results by using quantitative and qualitative questions as well as demographic data. With our qualitative question that students answered on the Hub event survey, we were able to find key and sub themes and with our quantitative question, we were able to find the mean, median, mode, statistical deviation, and the frequency of all answers. In our poster we will also talk about the procedure of getting your Hemoglobin A1C checked as well as the materials needed to perform the procedure. Our expectations for the students who participated in the Hub event were for them to learn about how important their hemoglobin A1C is and how vital it can become if one does not maintain a healthy lifestyle. We want this poster to be an eye opener to our population therefore people can begin switching over to a healthier lifestyle to help reduce rates for CVD and diabetes.

Bailey Perry*

Faculty mentor: **Dr. Kimberly Coggins**

Mental Health Services and College Students' Retention Rates: A Post COVID-19 World

The purpose of this convergent parallel mixed methods study is to explore the causal and correlational relationships between mental health service usage and student GPAs, as well as explore students' perceptions of counseling service impact on academic success. This study will address these questions: (1) Do students who utilize campus counseling resources demonstrate statistically significant changes in their GPA? (2) Is there a correlation of students' GPAs and their usage of mental health service usage? (3) Is there a correlation between the number of counseling sessions attended and the change in students' GPA? (4) Is there a relationship between counseling attendance and intent to return? (5) What are the students' thoughts on counseling and the impact it has on their academic career? and (6) How do the students' thoughts on counseling and its impact help explain the changes in GPA and retention information? Data is still be collected at this time.

Emily Poteete

Faculty mentor: **Dr. Jennifer Bancroft**

Efficacy of Integrated Phonological Awareness Intervention

This case study reports data and anecdotal observations to measure the effectiveness of Integrated Phonological Awareness (IPA) intervention in improving articulation and phonological awareness skills, specifically initial and final phoneme isolation, in a preschool-aged male diagnosed with a speech and language impairment. Intervention sessions were conducted both individually in a speech-language therapy setting and in a group format within the preschool classroom. Research indicates that individuals with speech and language impairments are at an increased risk for reading and spelling difficulties due to deficits in phonological awareness (Gillon & McNeill, 2009). Phonological awareness is a foundational skill for early literacy development, as it facilitates word recognition and spelling acquisition (Gillon & McNeill, 2009). Additionally, phonological awareness contributes to a child's ability to self-monitor articulation errors for accurate speech production. To assess changes in phonological awareness, initial and final phoneme isolation skills were measured at baseline and weekly using the Heggerty Phonemic Awareness Assessment for Pre-Kindergarten (Forms A, B, and C). Findings from this case study demonstrate improvements in both phonological awareness and articulation following IPA intervention. These results support the use of IPA as an effective approach for enhancing phonemic awareness and speech production in preschool-aged children with speech and language impairments.

Jaire Richardson, Sarah Ahlheit and Landry Hampton

Faculty mentors: **Dr. Matthew Farrell and Dr. Stephanie Bilderback**

Determinants of Faculty Pay: A Quasi-Replication and Extension of Gomez-Meija and Balkin (1992)

Much has been added to our understanding of agency theory since Gomez-Meija and Balkin's (1992) landmark study. This paper replicates and extends their approach, incorporating institutional variation in agency theory's predictions regarding faculty compensation.

Using qualitative comparative analysis (QCA), the study explores multiple pathways leading to high faculty pay. Preliminary findings suggest that these pathways are not limited to a purely research-focused model, as previously assumed, but may involve diverse mechanisms that combine monitoring and incentive alignment strategies.

The research underscores how different national and sub-national contexts influence compensation outcomes. It provides the first known application of QCA to faculty pay, offering a series of causal "recipes" organizations may consider when seeking to enhance compensation strategies.

This study contributes to academic literature on agency theory and compensation and presents actionable insights for institutional leaders seeking to align faculty incentives with organizational goals in varied governance environments.

William Richmond

Faculty Mentor: **Jane Semler**

Utilizing Seasonal Trends to Influence Test Orders: Reducing Waste of Resources by Diagnosing with Data

For thousands of years the seasonality of respiratory viruses has been recognized, with environmental factors and host behavior being responsible for an uptick of respiratory cases worldwide every year. There are nine viruses that are common causes of respiratory tract infections. Among these, human respiratory syncytial virus, influenza virus, and human coronavirus are known to have peak incidences in the winter months. Many of the symptoms of these viral infections are shared among the three, and often times a test is ordered to test for all of these viruses in the case of a respiratory infection.

Testing is performed via the Sofia Analyzer, performing a novel fluorescent immunoassay to detect these viruses within 15 minutes. This method of testing has shown a 74% sensitivity and 95.4% specificity for influenza A in patients with a flu-like illness, proving to be a reliable and easy-to-use diagnostic tool.

However, even with the knowledge of the seasonality of these viruses, often times hospitals still have a large number of negative test results during the summer that are ordered in suspicion of this kind of infection. It is hypothesized that if physicians are not relying on seasonal data to influence their presumptive diagnosis, then the lab will report a lower percent positive value during the summer months as opposed to the winter months..

Marie Risner and Mitchell Clay

Faculty Mentor: **Dr. Jack Deibert**

Heavy Liquid Separation Techniques for Detrital Zircon Geochronology of Cambrian Sandstone in Middle Tennessee

Neoproterozoic rifting in eastern Laurentia, followed by Cambrian transgression that spread cratonward, caused the Great Unconformity. This must have involved the recycling of sediment produced during the Grenville Orogeny. The goal of studying basal Cambrian sandstones is to determine whether the Cambrian transgression reworked Neoproterozoic Grenvillian sediment, or if new sediment was generated from underlying Precambrian basement. Crustal elements within the basement of KY include (1) the ~1.12 Ga East Continent Rift (ECR); (2) the ~0.98 Ga Grenville Frontal Thrust Fault that separates Geon 14 Granite-Rhyolite crust in the footwall from Geon 13-10 Grenvillian orogenic crust in the hanging wall; and (3) the Early Cambrian Rome Trough, a failed rift that cuts the ECR and Grenville Front. Recent interpretation of the basal Cambrian in KY determined that the sandstone is a product of erosion of the underlying basement: the Grenville and Granite-Rhyolite Provinces. The basal Cambrian between the Appalachians and US midcontinent are only available from rare drill cores. Rock core drilled in Waverly, TN during the early 1990s purportedly contains the basal Cambrian sandstone, which has yet to be studied in the Middle Tennessee region. U-Pb detrital zircon geochronological analyses will be carried out on samples of this core to determine sedimentary provenance of basal Cambrian sandstone in Tennessee and tectonic relationships to similar rock units throughout eastern Laurentia. Here we discuss methods involved in extracting detrital zircon from sandstone samples collected from JSSW – 7647 core drilled in Waverly, TN.

Luke Ritenour

Faculty mentor: **Jane Semler**

Troubleshooting the effectiveness of using a Massive Transfusion Protocol and how it can reduce waste, cost, and improve efficiency of distribution of blood products in hospitals.

Blood products are an invaluable resource in a hospital setting. Consisting of RBCs, Fresh Frozen Plasma, and Platelets, doctors are responsible for knowing when and how much blood products need to be used. One common problem is blood products are wasted due to a multitude of reasons. One way to combat this is the use of massive transfusion protocols (MTPs). MTPs are different from hospital to hospital depending on their specialty which means the MTP requirements would be different. At St. Thomas West Hospital the MTP is a 4:4:1 ration of RBCs to FFP to Platelets with FFP being the most wasted product and they want to optimize their MTP so that it can be more efficient. In conclusion there is not one way to optimize an MTP but a blend of a multitude of methods that must be tailored for each hospital.

Abby Robertson, Daniella Stiles, Alexandra Tanafon, Jaclyn Lucas, Gabriela Trester, Ngan Tran, Johana Hernandez, and Olivia Heflin

Faculty mentors: **Dr. Tyler Nolting, Dr. Tasha Ruffin, Dr. Heather Phillips, and Mitzi Baker**

Sodium, Sugar-Sweetened Beverages Impact on Cardiovascular Disease

Cardiovascular Disease (CVD) is a leading cause of morbidity and mortality, with risk factors including diet, physical inactivity, and genetics. Among dietary contributors, high sodium intake and frequent consumption of sugar-sweetened beverages (SSBs) have been linked to increased risks of obesity, hypertension, and metabolic disorders, all of which contribute to cardiovascular disease. This study investigates the impact of sodium and sugar sweetened beverage consumption on cardiovascular disease risk, specifically among college students, a population often exposed to unhealthy dietary habits due to limited food options. A mixed-methods approach was utilized, incorporating both quantitative and qualitative data collection. Surveys were given out to participants at three wellness events, assessing weekly sodium and sugar-sweetened beverage consumption and perceptions of its short- and long-term health effects. Quantitative data were analyzed using descriptive and inferential statistics, including t-tests, while qualitative responses were analyzed using thematic analysis. Additionally, biometric screenings, including cholesterol, blood pressure, and body composition assessments provided further insights into participants' cardiovascular health. Results can indicate a strong correlation between frequent sodium and sugar-sweetened beverage consumption and elevated cardiovascular risk factors. These findings emphasize the need for targeted health education and intervention programs to promote healthy dietary habits and reduce cardiovascular prevalence. By raising awareness and encouraging lifestyle modifications, such initiatives can contribute to improved cardiovascular health outcomes in college populations and beyond.

Ross Rodriguez ♟ and Steven Warth ♟

Faculty Mentor: **Dr. Emmabeth Vaughn**

Quantifying the Mechanical Properties of 3d-Printed Resin Materials

Additive manufacturing is an emerging practice within engineering that has allowed for increased efficiency in rapid prototyping of designs. The practice of 3d-printing has been observed in many fields ranging from applications in the dental industry, to nuclear fusion research. With such a wide range of applications for 3d-printed materials, it is important to identify which materials and conditions should be used for specific applications. Our study systematically examines the impact of print orientation and layer height to quantify the impact of these parameters on print fidelity and mechanical properties. We have observed that print orientation impacts fidelity; vertical specimens printed at 0.1 mm layer height will result in the most faithful surface area compared to the ASTM Type I standard tensile test specimen. We hypothesize that the highest mechanical strength will be observed in tensile samples printed at a 45-degree print orientation with a 0.05 mm layer height. Understanding how printing parameters impacts mechanical properties and fidelity 3d-printed materials allows engineers to better design the manufacturing infrastructure for modern materials. Our results can aid engineers in industry in optimizing their prototype designs to meet their strength and fidelity needs.

Kyra Rust

Faculty Mentor: **Dr. Cody Covington**

Conformational Analysis of 1-Indanol Using Vibrational Circular Dichroism Spectral Similarity

The accurate determination of molecular conformations in solution is essential for understanding chemical and biological processes. Vibrational Circular Dichroism (VCD) spectroscopy, sensitive to molecular chirality and vibrations, provides a valuable tool for this purpose. This research presents a conformational analysis of 1-indanol in solution, employing a computational approach that optimizes conformer populations to maximize the similarity between predicted and experimental VCD spectra. The method, based on a genetic algorithm and gradient optimization, was applied to calculated VCD spectra of 1-indanol conformers. The optimized conformer populations were compared to those obtained using traditional Boltzmann weighting based on calculated Gibbs energies in both CCl4and DMSO solvent. The results highlight the potential pitfalls of relying solely on spectral similarity for conformational assignment, as different conformer sets can yield acceptable agreement with experiment.

Grace Samuelson 🏆, Jacey Golden 🏆, Patrick Myers 🏆, Natilee Bunting 🏆, Liam Wenck, Sophie Sutton, and Leah Dean 🏆

Faculty mentors: **Tianyu Li, Rong Huang, and Zachary Barnes**

Understanding How Early Childhood Adversity and Executive Function Shape College Students' Academic Success

The existing literature suggested that individuals with adverse childhood experiences (ACEs) may encounter various maladaptive learning outcomes, such as poor academic performance and unhealthy academic well-being (Oeri & Roebers, 2024). However, it is unclear how ACEs increased the academic risks, which left unknown ways to promote academic resilience for students with ACEs. One of the important cognitive factors, namely executive functioning (EF), is a higher-level cognitive process for the development of academic competence. Research showed that EF difficulties were associated with high ACEs and poor academic performance (Lund et al., 2022; Willoughby et al., 2017). Therefore, the current ongoing study examines the associations between college students' ACEs and EF on their academic competence. Firstly, participants fill out online surveys and complete standardized achievement tests online via Zoom. The standardized achievement tests are used to assess students' math and reading competence. The second section is administered in the APSU psychology lab setting. Participants use an iPad to complete three cognitive tasks on the NIH toolbox app. Participants will receive a $25 gift card as compensation for their time and contributions to this study. We hypothesize that students with higher levels of ACES will be associated with poorer EF and lower academic competence. We will also explore the potential mediating (indirect) effects of EF between ACES and academic competence. The findings would provide critical insights to inform higher education about the strategies and interventions necessary to promote academic success particularly for students with ACEs.

MacKenzie Sellers, Jariah Wordlaw-Scruggs, Jennifer Holt, Kendra Svensson, Nelson Ramos, Alex Pearson, and Carmen Uriquia

Faculty mentors: **Dr. Tyler Nolting, Dr. Tasha Ruffin, Dr. Heather Phillips, and Mitzi Baker**

Fueling for the Day: College Students' Breakfast Frequency and Healthy Beverage Choices

College students often struggle to maintain healthy eating habits due to busy schedules, financial limitations, and academic stress. Skipping breakfast and poor meal preparation can contribute to chronic conditions such as obesity, cardiovascular disease, and type 2 diabetes, while also negatively impacting mental health and cognitive performance. This study aimed to explore breakfast consumption habits, meal preparation behaviors, and healthy beverage preferences among students at Austin Peay State University (APSU). Data were collected through surveys administered at three Wellness Hub events held on campus in collaboration with the Public Health, Medical Laboratory Sciences, School of Nursing, Community Engagement and Sustainability, UT-Extension, and the S.O.S. Food Pantry. A total of 111 students participated in the survey, which included both quantitative and qualitative questions. Descriptive statistics and t-tests were used to examine the influence of gender and age on breakfast frequency and meal preparation habits. Thematic analysis was conducted on open-ended responses about ideal healthy beverages and smoothies. Results indicated that most students eat breakfast 3–4 times per week, with females eating breakfast more frequently than males. We performed a number of t-tests to compare means between a variety of demographic groups based on how often they eat breakfast per week, but found no significance at $p<.05$. The most common smoothie ingredients reported were fruit, especially strawberries, and spinach. Water was the most frequently mentioned healthy beverage. The findings highlight the importance of nutrition education and accessible food resources on campus. The results also suggest that while students are aware of healthy eating practices, time, cost, and accessibility remain barriers. This study provides insight into the eating habits and health priorities of APSU students and can inform future campus health initiatives aimed at improving student nutrition, food security, and wellness behaviors.

Haley Koren Sherrill

Faculty mentor: **Jane Semler**

HIT and its Effects of Routine Chemistry Testing

There are three main interferences that are measured in samples at WMC before a sample is ever even run. These interferences are hemolysis, icterus, and turbidity of samples, also known here as HIT. When a sample is run on an analyzer it measures the HIT and reports results for the laboratory technician and doctor to see on the patient's charts. If the measurement of the HIT score is below a certain threshold, then the sample is run, and results are reported. If the measurement of the HIT score is above the threshold, then samples will be marked for a redraw due to unusable sampling. The goals of this research are to determine how much of an effect sample interferences have on test results and to possibly lower the acceptable levels of these interferences.

Lily Skau

Faculty Mentor: **Dr. Emmabeth Vaughn**

Retrospective Insights in Choosing a Career in Engineering

Women have historically been underrepresented in science, technology, engineering, and mathematics (STEM) fields. The gender gap in participation in engineering remains especially large, and the cause of this gap is the question of many researchers. We held focus groups with 10 engineering faculty, seeking to answer the research questions "What motivates individuals to become engineers?" and "How can the knowledge of these motivators be used to broaden participation in this field?" Focus group responses were analyzed using thematic analysis with Situated Expectancy-Value Theory (SEVT) as a framework. Components of SEVT, expectancies for success or subjective task values, were found in all participant responses. While responses from many participants included the motivations of interest in STEM and curiosity towards building and creating, females demonstrated a greater interest in the profession due to the communal goals of engineering as opposed to the agentic goals expressed largely by the male participants. Two contributions to expectancies of success emerged from participant responses: past achievements and extrinsic motivation. Female participants more often discussed extrinsic motivators than achievement compared to the male participants. Additionally, cultural context was found to be an unexpected but prevalent intrinsic motivator mentioned in both male and female participants. This paper contributes examples of the need for explicit and extrinsic motivators for women to become engineers due to the historical lack of societal pushes towards engineering that often men receive.

Cristiana Snyder

Faculty Mentors: **Dr. Niranga Wickramarathne and Dr. Anuradha Pathiranage**

Azo Hair Dyes: Synthesis, Application, and Color Variability

Azo dyes have long served as vital components in the dyeing industry, widely used in textiles, cosmetics, and particularly in hair dye formulations. In temporary hair dyes, azo compounds are prized for their ability to bind to the hair cuticle without penetrating the cortex, enabling reversible color changes. The color of an azo dye is influenced by the nature of its auxochrome groups, which modify the electronic properties of the dye compound's chromophore, leading to variations in hue. In this study, sixteen structurally varied azo compounds were synthesized and applied to human hair swatches to evaluate their binding affinities and visible color outcomes. Future work will investigate the interactions of these synthesized azo compounds with scalp microbes—including Staphylococcus epidermidis, Micrococcus luteus, and Pseudomonas aeruginosa—to assess their potential impact on the scalp's microbial ecosystem. This dual focus on aesthetic performance and microbiological safety aims to support the development of advanced, scalp-friendly temporary hair dye formulations.

Daniella Stiles

Faculty mentor: **Jane Semler**

An Analysis of Post Analytical Expired Blood Products at Tristar Centennial Medical Center

Blood Bank is a critical component to ensuring efficient, adequate and timely supply of blood products for patients during emergencies or surgical procedures. Blood products in healthcare play an important role in patient care but have a limited shelf life. Efficient management is essential to reducing blood product wastage, particularly in platelets. However, blood product wastage remains a significant challenge for hospitals, leading to increased costs and potential shortages. Platelets have the highest expiration of any blood product due to their short shelf life compared to plasma and cryoprecipitate. This study will use data collected to analyze the inventory management procedures, utilization patterns, and wastage of platelet products at Tristar Centennial Medical Center to propose evidence-based strategies to enhance efficiency of platelet products.

Alexandra Tanafon

Faculty Mentor: **Jane Semler**

Platelet transfusions are essential for managing thrombocytopenia, surgical bleeding, and hematologic disorders

Since the 1970s, room temperature-stored platelets (RTPs) have been the standard due to their longer circulation time, making them ideal for patients needing prolonged platelet support. However, RTPs have a short shelf life of 5–7 days and an increased risk of bacterial contamination, posing logistical and safety challenges.

Cold-stored platelets (CSPs) were used historically but were largely abandoned because of their rapid clearance from circulation. Recently, CSPs have regained attention for their superior hemostatic function, especially in trauma and emergency settings where immediate clot formation is critical. CSPs also have a longer shelf life of up to 14 days and a lower risk of bacterial growth, offering potential inventory and safety benefits.

This study reviews existing literature alongside data from Skyline Medical Center to evaluate the clinical and logistical trade-offs between RTPs and CSPs. While CSPs excel in acute bleeding scenarios, their shorter in vivo lifespan limits their use for patients with chronic bleeding conditions or cancer. Conversely, RTPs remain the preferred option for patients requiring sustained platelet support.

The ongoing debate over platelet storage highlights the need for a tailored approach, using CSPs for emergencies and RTPs for chronic care. Advances in storage techniques, including new additives and pathogen reduction technologies, could further improve CSP viability and safety. Future research should focus on optimizing storage strategies and developing patient-specific transfusion protocols to balance hemostatic performance with long-term platelet availability.

David Thompson

Faculty mentor: **Jane Semler**

Daratumumab (Darzalex) treatment interference during serological testing in patients with multiple myeloma at VA Medical Center (Nashville, TN)

Multiple Myeloma is a type of blood cancer which primarily affects plasma cells, causing them to spread and replace normal cells, overtly producing abnormal proteins (M-proteins) concomitantly. Currently, it accounts for about 10% of all hematological malignancies worldwide. Amongst the veteran population, there is a disproportionately high incidence of multiple myeloma, primarily due to exposure to certain toxic agents such as agent orange and pesticides when compared to other patient populations. One common therapeutic agent utilized is a monoclonal antibody called Daratumumab (DARA), which targets the CD38 protein on the surface of myeloma cells by enlisting the patient's own immune system. However, DARA has shown to interfere with blood compatibility testing, including antibody screens and cross-matching prior to blood transfusions, which are frequent for patients due to therapy-related anemia. This interference delays serological testing and increases the financial burden, requiring many facilities to send specimens to a reference laboratory for further workup. During fiscal year 2024, send out costs amounted to $150,000 at the Nashville VA Medical Center. This study aims to evaluate antibody screens for patients requiring pre transfusion testing using solid phase methodology and observe effects produced by DARA interference, determining potential factors that could contribute to the observed variability of DARA pan reactivity

Christopher Tillett*

Faculty Mentor: **Dr. Ramanjit Sahi**

Natural Disaster Effect on the Agricultural Industry

Climate change and natural disasters have significantly threatened Belize's sugar cane industry, exacerbating market volatility, environmental challenges, and credit risks. This research investigates the far-reaching consequences of these natural phenomena on the country's agricultural sector, using the sugar cane industry as a focal point. By analyzing historical data, case studies, and industry trends, the study aims to uncover patterns of disruption and assess their economic and structural impacts. Through a comprehensive approach that integrates quantitative analysis with qualitative insights, this research not only evaluates the financial risks but also sheds light on the broader implications for sustainability, resilience, and long-term industry viability. The findings aim to equip stakeholders with a deeper understanding of these risks, fostering informed decision-making and strategic adaptation in an increasingly unpredictable climate.

Lauren Tomasini

Faculty mentor: **Jane Semler**

Understanding Specimen Rejection: Causes, Consequences, and Prevention

Accurate laboratory results are critical to quality patient care and correct diagnoses. However, it's possible for error to occur during any of the three stages of laboratory testing – preanalytical, analytical, and postanalytical. Preanalytical errors, including improper sample collection and sample quality, are considered to be the leading cause of laboratory mistakes. These types of errors typically lead to specimen rejection by the laboratory, which can have a significant impact on patient care, leading to discomfort from additional collection, extra costs, and delayed diagnosis and treatment. The goal of this study is to identify the most common causes of specimen rejection, determine areas of improvement by comparing rejection rates to location and phlebotomist type, and evaluate the most appropriate preventative measures. By identifying causes of specimen rejection and how to prevent them, the quality of laboratory results, and ultimately, patient care, will increase.

Spencer N. Trimpe*

Faculty mentor: **Rebecca Blanton Johansen**

Genetic Evaluation of Conservation Efforts for *Etheostoma sitikuense*, Citico Darter

Species reintroduction efforts have historically relied on population demographics rather than genetic diversity to evaluate their success, despite the invaluable information genetic data can provide about the long-term adaptive potential of both the reintroduced and source populations. The genetic evaluations of reintroduction efforts that have been performed for fishes have mostly focused on large bodied, high dispersal species while few evaluations exist for small bodied, low dispersal species such as the Citico Darter (*Etheostoma sitikuense*). The Citico Darter is a federally endangered fish species native to Citico Creek and Abrams Creek in eastern Tennessee. However, the population in Abrams Creek was extirpated in 1957. In response, the US Fish and Wildlife Service (USFWS) and Conservation Fisheries Inc. reintroduced the Citico Darter into Abrams Creek in 1993 and introduced it to the Tellico River in 2003 with continuing population augmentation efforts up until present day. In 2012, the USFWS conducted a genetic assessment of the species in Citico Creek and Abrams Creek using nine microsatellite loci and found low levels of overall genetic diversity and conflicting results regarding population differentiation. Using the same nine microsatellite loci, we will compare contemporary levels of genetic diversity and differentiation in the species to those found in 2012 to evaluate the success of reintroduction and augmentation efforts. We will also generate a contemporary baseline of genetic diversity for all Citico Darter populations using ddRADseq. Thus far, we have collected fin clips from 217 Citico Darters across their entire range and genetic analyses are currently underway.

Nicholas Vincent 🏆, Comfort Ogbu * and Sai Nesanuru *

Faculty Mentor: **Dr. Manisha Gupte**

Glucose-Mediated Modulation of Insulin Sensitivity and Glucose Transport in Mature Adipocytes

Alarmingly, the number of US adults (34 million) diagnosed with Type 2 diabetes mellitus (T2D) has doubled in the last twenty years, a trend closely linked to the rising rates of overweight and obesity. This underscores the pressing need to investigate the effects of hyperglycemia in adipocytes, the primary cell in adipose tissue that undergoes significant changes in T2D. In this study, I propose to examine the impact of glucose on adipocyte insulin-signaling and glucose transport. Differentiated adipocytes will be incubated in control (0 mM), standard (5 mM), and high (25 mM) glucose for 48 hours. I will investigate the expression of proteins involved in insulin signaling and glucose transport to determine the effects of varying glucose concentrations in glucose homeostasis. Additionally, the effect of glucose on lipid content in adipocytes will be determined by Oil Red O staining. I hypothesize that high glucose will lead to an increased lipid storage and lower glucose uptake than usual or low glucose, providing insights into hyperglycemia's impact on adipocyte function and its role in insulin resistance, contributing to obesity and T2D.

Liam Wenck and Patrick Myers 🏆

Faculty mentor: **Tianyu Li**

The Associations Between School Belonging and School Adjustment among Third Grade Elementary Students

School belonging (SB) refers to a sense of affiliation, inclusion, and connectedness that students experience in the school environment (Goodenow, 1993). Guided by self-determination theory, a sense of SB is a basic psychological need and motivational affordance that drives students' academic motivation, engagement, and well-being (Ryan & Deci, 2020). Existing literature primarily focused on adolescents with few studies examining students in elementary school (Tian et al., 2016). However, developing early experiences of SB can lay the foundation for meeting students' academic needs and yield long-term benefits for their academic well-being (Osterman, 2000). Therefore, the current study aimed to understand whether elementary schoolers' SB was associated with four dimensions of school adjustment outcomes, namely academic achievement, classroom engagement, teacher-student relationship, and peer relationship. Multiple regression analyses were used with a sample of 474 third graders in elementary school. Students self-reported their sense of SB. Academic achievement was assessed using standardized achievement test. Teachers reported on students' classroom engagement and teacher-student relationships. Peer acceptance was measured using sociometric interview procedures. Results showed that higher SB was associated with higher classroom engagement, better teacher-student relationships, and better peer relationships, compared with students with relatively lower SB. However, SB was not related to students' academic achievement at third grade. Overall, these results highlighted the importance of enhancing students' sense of SB by fostering a supportive and inclusive learning environment, which may in turn promote positive school adjustment skills.

Tahja Williams

Faculty mentor: **Anuradha Pathiranage**

Formulation and Stability Evaluation of Shampoo and Conditioner Products

This research project focuses on the formulation and evaluation of shampoo and conditioner products by incorporating key components such as surfactants, conditioning agents, preservatives, pH adjusters, and humectants. Each ingredient plays a specific role in enhancing cleansing efficacy, promoting hair health, and improving overall user experience. The project involves developing formulations within recommended concentration ranges for each component, with particular attention to achieving desirable texture and foaming properties. Following formulation, a series of stability tests will be conducted, including pH analysis, foaming ability, bacterial assay, and viscosity measurements. These tests will assess the long-term performance, safety, and quality of the products, contributing to the development of effective and consumer-friendly hair care solutions.

Ricardo Wolfe

Faculty Mentor: **Erin Carlin**

A Curriculum Comparison of Master's in National Security Studies "Sister Programs" for Implementation Consideration at APSU

The purpose of this study is to obtain information on "sister programs" to a Master's in National Security Studies for Austin Peay State University's Institute for National Security & Military Studies faculty and leadership to use in their possible proposal of a new master's degree program. To carry out this research, I collected data from 18 universities with 26 close peer programs. In this paper, I report the typical modalities of those programs, the required hours for program completion, a comparison of the ways the programs test students' knowledge of the field before graduation, common course categories and frequencies in the program, and required methods hours. I also report interesting findings from other programs and offer my suggestions on ideas from other programs and common requirements APSU may want to adopt.

Farrin Yarbrough, Emily Horner, Caleb Bauske, Erica Fortune, Gracie Williams, Stephanie Webb, Ryelee Odom, and Enkhchimeg Nyamdori

Faculty Mentors: **Dr. Tyler Nolting, Dr. Heather Phillip, Dr. Tasha Ruffin, and Mitzi Baker**

How Smoking and Vaping Effects CVD

Smoking cigarettes increases the risk of developing acute and chronic cardiovascular diseases such as sudden cardiac death, stroke, or an aneurysm. The aerosol produced by e-cigarettes contains harmful substances such as nicotine, formaldehyde, and acrolein, which can damage blood vessels and increase the risk of hypertension and atherosclerosis. Hub events were conducted at Austin Peay State University to screen the participant's risk of early heart disease. Tests included A1C, blood pressure, pulse, body composition (body fat percent, body mass index, and waist circumference), high-density lipoprotein (HDL), and total cholesterol. One hundred and sixty participants attended a series of three events. The hub events were advertised to Austin Peay students. The questionnaire focused on the use of smoking/vaping around the University. We asked questions that provided the population's qualitative and quantitative data to track environmental factors contributing to how or why the population smokes or vapes. 21% of respondents stated that they currently smoked/vaped, and 12% stated they did but have since quit. 92% of participants agreed or strongly agreed that smoking/vaping is associated with heart disease. By the end of each event, participants gained the opportunity to understand further how smoking/vaping increases the likelihood of developing heart disease.

Hannah Zahn and Emma Dunavant

Faculty Mentor: **Dr. Gilbert Pitts**

Development of a Prosthetic Hand

Prosthetic technology is a pivotal bridge between engineering, anatomy, and physiology. Prosthetists study anatomy and physiology of the human body, as well as have knowledge in computational mechanics, to produce devices that attempt to replicate the natural function of a body part and, even sometimes, its natural appearance. The goal of this project was to accurately replicate the anatomy of the hand in an electrically controlled prosthetic that mimics the biomechanical movement of the hinge joints of the fingers. We created a 3D-printed hand with 5 digits. Software systems were used to construct computer aided designs to be converted into printable files for fabrication. On the 5 digits, the phalanges were replicated. Thus, 3 phalanges on each of the fingers and 2 on the thumb. Each digit was tethered to its own motor with fishing wire tied to the built-in bracket. A software and hardware system were used to program and control the motors, causing flexion of the digits. Additionally, finite element analysis was used to determine the stress points and total force required to move each digit. The simple design is used to emphasize that beneficial prosthetics do not need to be overcomplicated, but their importance is in affordability to ensure greater accessibility which could allow more individuals to benefit from essential prosthetic solutions.