

SYMP SIUM

TWENTY-SECOND ANNUAL UNION UNIVERSITY SCHOLARSHIP SYMPOSIUM

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TUESDAY, APRIL 8, 2025

AFTERNOON CONCURRENT SESSIONS

Poster Presentations (P)

Carl Grant Events Center

Student Presenters

12:30-2:00 p.m.

Anahi Cruz (ART)
Regan Sheddan (ART)
Alison Keener-Eskola (ART)
Kristina Wooldridge (ART)
Emily Gray (ART)
Grace Beem (CHE)
Halle Webb (CHE)
Andrew Bragg (CHE)
Isaac Stickles (CHE)
Jude Lampley (EGR)
Josiah Hays, Matthew Meyn, Bobby Perry, and Timothy White (EGR)
Jewelina Black (EGR)
Kyle Whitmark (EGR)
Benjamin Kuhl (EGR)
Landon Haywood (EGR)
Cameron Kennedy, Gideon Miller, Samuel Moss, and Jake Pinggen (EGR)
Jonathan Carroll, Jordan Prunty, and Cody Tjomsland (EGR)
Zane Bolton (EGR)
Landon Haywood, Judah Lampley, Ryan Metcalf, and Elijah Patton (EGR)
Eli Patton (EGR)
Rachel Allabaugh, Mia Duncan, and Stacia Talbott (EGR)
Ryan Metcalf (EGR)
Evan Parkinson and Samuel Vrinios (NUR)
Ze'Erica Duncan, April Robinson, and Stefannie Wilkes-Pounders (NUR)
Shelby Harris, Lauren Johnson, and Audra Romney (NUR)
Samantha Hall, Rachel Patton, and Ashley Steinberger (NUR)
Jonathan Hooper, Elijah Pecheny, and Rand Pressley (NUR)
Christine Deere, Amy Gray, and Corey Long (NUR)
Kelsey Myracle, Sydney Naseman, and Renee Rogers (NUR)
Crystal Hill (NUR)
Meghan Pinson and Lindsay Votow (NUR)
Jake Curtis, Octavio Rivera-Sanchez, and Zach Schwabe (NUR)
Taylor Cochran, Elisabeth Tribeck, and Destene Webb (NUR)
Matthew Kelly, Kenton Lee, and Kristopher Stone (NUR)
Denitra Carter, Yi Peng, and David Pierre-Louis (NUR)
Shawn Lords, Wesley Russell, and Lucas Wigal (NUR)
Ryan Blackburn, Baylee Bridges, and Anna-Grace Terry (NUR)
Paige Eberle and Laura Ellis (NUR)
Alexis Alexander and Tiffani Ivery (NUR)
Amy Haynes and Josh Sellman (NUR)
Reece Moody (NUR)
Shannon Lantz and Andrea Montani (NUR)
Krystle-Anne Crespo and Tejal Patel (NUR)
Carmen Abarca and Ithzel Solis (NUR)
Brian Julian and Michael Reiser (NUR)
Dustin Lane and Javaris Polk (NUR)
Samuel Jones and Gaines Wilson (NUR)
Devin Daffron and Maxwell Obasuyi (NUR)

SCHEDULE

Poster Presentations (P)

Carl Grant Events Center

Student Presenters

Melanie Callazos-Valencia, Emily Fulkerson, and Julia Stauffer (NUR)
 Phillip Tatum (NUR)
 Noor Alnadi (PHRM)
 Halli Friedrich, Caden Greene, Sean King, Matthew Lee,
 Sarah Rogers, and Jonquil Simms (PHRM)
 Darius Gale (PHRM)
 Andrew Nguyen (PHRM)
 Carson Corley (PHRM)
 Nate Daniels, Christian Dudley, McKenna Hunter, and Jonquil Simms (PHRM)
 Ola Boateng (PHRM)
 Sandy Saied (PHRM)
 Grant Gay (PHRM)
 Nate Hogan (PHRM)
 Christopher Nunez (PHRM)
 McKenzie Thomas (PHRM)
 Amanda Gammons, Delaney Peterson, Noah Travis,
 and Samarah Wallace (PHRM)
 TJ Hjelte (PSY)
 Eliana Isom, Alexandra Reeder, and Lily Grace Wamble (PSY)
 Sydney Arnolds, Sydney Coffman, and Ethan Hager (PSY)
 Rivers Abshire (PSY)
 Makenna Tiffany (PSY)
 Caleb Cook and Mollie Carter (PSY)

Oral Presentations (O)

Dept.	Room	Student Presenters	Time
BIO Session Chair: Andy Madison	WH 101	Cami Haas	1:00 p.m.
		Melody Friesen	1:20 p.m.
		Ella Curneal	1:40 p.m.
		Olivia Mueth	2:00 p.m.
		Devin McDonagh	2:20 p.m.
		BREAK	2:40 p.m.
		Kira Finkley	3:00 p.m.
		Scout Fluet	3:20 p.m.
		Elijah DeCuir	3:40 p.m.
		Christian Schlehuber	4:00 p.m.
		Danielle Lowe	4:20 p.m.
BIO Session Chair: Robert Bowen	WH 102	Hailey Sipes	1:00 p.m.
		BriAnna Benson	1:20 p.m.
		Tanner DeCuir	1:40 p.m.
		Emily Hall	2:00 p.m.
		Adah Davis	2:20 p.m.
		BREAK	2:40 p.m.
		Emiliano Lopez Ortiz	3:00 p.m.
		Lynley Brooke Puckett	3:20 p.m.
		Grace Orewiler	3:40 p.m.
		Emma Sanborn	4:00 p.m.
		Jeremiah Chapman	4:20 p.m.

CSC/MAT Session Chair: Brian Glas	ETHOS EF-365	Hayden Shirley (CSC)	2:00 p.m.
		Meilyn Massie (CSC)	2:20 p.m.
		Roger Blankenship and Brendan Fields (CSC)	2:40 p.m.
		Titus Mullin (CSC)	3:00 p.m.
		Brandon Jordon (CSC)	3:20 p.m.
		Greyson Watkins (CSC)	3:40 p.m.
		Rhen Milton (CSC)	4:00 p.m.
		Joseph Carmen (MAT)	4:20 p.m.
		Josiah Hayes (MAT)	4:40 p.m.
EGR/PHY Session Chair: Georg Pinggen	ETHOS EF-319	Jonathan Brewer, Daniel Lancaster, and Nathaniel Thomas (EGR)	2:00 p.m.
		Northview Middle School Presentation Academy STEM Students (EGR)	2:20 p.m.
		Colby Davis, Ryan Keeton, and Mikaila Rogers (EGR)	2:50 p.m.
		Jacob Arehart, Caleb Krueger, and Braeden McAlister (EGR)	3:10 p.m.
		Jacob Carbonell, Eli Snelson, and Micah Valdivia (EGR)	3:30 p.m.
		Ian Banderchuk, Jewelia Black, Ethan Brasher, and Michael Kirk (EGR)	3:50 p.m.
		Rachel Allabaugh (PHY)	4:10 p.m.
		Caleb Knapp (PHY)	4:30 p.m.
ENG/MUS PSY/STM Session Chair: Mollie Carter	PAC D-53	Lili Pettigrew (ENG)	2:00 p.m.
		Samuel Stevens (ENG)	2:20 p.m.
		Anna Guelcher (MUS)	2:40 p.m.
		Sydney Arnolds, Ethan Hager, Alex Reeder, and Lily Grace Wamble (PSY)	3:00 p.m.
		Natalie McVay (PSY)	3:20 p.m.
		Rivers Abshire, Sydney Coffman, Eliana Isom, and Makenna Tiffany (PSY)	3:40 p.m.
		Michael Tankersley (STM)	4:00 p.m.
NUR Session Chair: Shari Wherry	WH 202	Cassie Garner	2:20 p.m.
		Macy Morrison Arnold	2:40 p.m.
		Aubrey Tucker	3:00 p.m.
		Drew Lewis	3:20 p.m.

ART



Multicultural Art Education in K-12 Classrooms (P)

Presenter: Regan Sheddan

Faculty Project Advisor: Daniella Sierra

Since the Civil Rights Movement, multiculturalism has surfaced as a topic of discussion among art educators. This research explores the significance of multicultural art education in K-12 classrooms and emphasizes inclusivity, understanding, and appreciation of diverse cultural backgrounds and perspectives. It is increasingly important to structure an art curriculum that provides students with opportunities to explore a variety of cross-cultural artistic expressions. This paper uses peer-reviewed journal articles to discuss breaking down stereotypes, fostering empathy among students, and transitioning from a Western, ethnocentric perspective to a more globalized and inclusive art curriculum. My research examines practical strategies for implementing multiculturalism in the classroom, considering challenges such as limited resources, teacher qualification, and stereotyping that may hinder educators from embracing it. Ultimately, my paper concludes that the integration of multicultural art education in K-12 classrooms equips students with the necessary tools to interact with the art world on a global scale.

Veil-Shock: Identity and Healing Through Photographic Portraiture (P)

Presenter: Alison Keener-Eskola

Faculty Project Advisor: Danille Sierra

Women who have been through an abusive marriage and traumatic divorce can sometimes find themselves suffering from Post Traumatic Stress Disorder following the end of their marriage. This diagnosis causes extreme depression, high anxiety levels, nightmares, fear, changes in eating and sleep patterns, weight loss, mood swings, mental strain, confusion, and a loss of self-identity. While traditional therapy is essential to healing through this process, the use of art therapy in the specific form of photographic self-portraiture can be an incredibly cathartic experience. Many women who choose to marry fully embrace their new role as a bride, and the title “wife” becomes an integral part of their identity. When that fundamental title and role is ripped away, their identity follows. Using photographic self-portraiture as a means of self-expression and identity exploration can then be a redeeming and healing experience as they see themselves anew through a camera lens.

More Than a Random Color (P)

Presenter: Kristina Wooldridge

Faculty Project Advisor: Danielle Sierra

The consumer may commonly overlook the color selection of a product. This commonly happens with a pair of sneakers. However, the manufacturers of sneakers do not overlook this aspect of sneaker design. Color decisions in sneaker production are not an aimless approach but rather calculated design solutions. The Air Jordan 1 broke barriers in the footwear industry in the 1980s, revolutionizing color design in sports and consumer footwear. In 2025, footwear design has blossomed into different design technologies like kansei design, which focuses on the wear intentions of a shoe. Color psychology has proven to impact perceptions; for example, the use of colors such as red and blue have proven to enhance an athlete’s performance. Sneaker design tactics deal with more than choosing a random color. They focus on storytelling using color and footwear silhouettes to impact emotional, psychological, and structural perceptions that lead a customer to purchase a shoe.

How the Visual Arts Impact the Success of High School Students (P)

Presenter: Anahi Cruz

Faculty Project Advisor: Danielle Sierra

Taking a Visual Arts course can improve a high school student’s performance in course curriculum and testing. The students’ emotional and psychological development is improved by the visual arts with its proven positive impact on mental health. The visual arts develop critical

thinking skills and problem-solving abilities. Engaging in artistic processes allow students to approach problems from different angles, which improves their ability to analyze and integrate information in the areas of math, science, and literature. Art courses help students develop visual literacy, which helps students communicate and organize more effectively. The hands-on aspect of art projects encourages concentration, perseverance, and attention to detail, all of which lead to improved academic performance.

The Use of Traditional Media in Graphic Design (P)

Presenter: Emily Gray

Faculty Project Advisor: Danielle Sierra

Although its roots are in traditional, non-digital art materials and processes, the graphic design field has become largely digital. While it is true that technology has revolutionized graphic design, many technological developments have also

been said to be detrimental to the field, compromising on its artistic integrity or personal nature. These arguments have been furthered by developments such as Canva and AI, which supposedly remove the need for the graphic design profession altogether. However, there are some design studios that continue to use traditional media and processes, such as Hatch Show Print and Anderson Design Group. This reveals that there are many overlooked benefits of incorporating traditional media into graphic design processes, even when technology no longer necessitates the use of such materials. Both traditional and digital media present many benefits and hindrances to graphic designers, but considering a synthesis of these media may allow for the most successful approach. ■



BIOLOGY



Determining Bottomland Hardwood Forest Restoration Success on Tosh Farms Wetland Restoration Site (O)

Presenter: Emma Sanborn

Faculty Project Advisor: Michael Schiebout

Restoration plans are continually being developed to restore wetlands due to their valuable ecological function. This study evaluated the success of a bottomland hardwood wetland restoration project in Carroll County, Tennessee, providing an understanding of how the previously farmed site has responded to restoration operations implemented 10 years prior. During the growing season of 2024, a floristic survey on both the restoration site and an adjacent bottomland hardwood forest reference site was taken. Species composition was compared between the two sites and with initial floristic survey data from 8 years prior. An abundance of hydrophytic plants within the restoration site indicates that the site is moving toward a healthy, functioning wetland. In addition, species composition shows a shift from ruderal species to understory wetland species. The progress suggests that restoration has been successful, and supports restoration plans as effective strategies for ecosystem recovery.

Field Validation of a Novel Primer for American Alligator (*Alligator mississippiensis*) Environmental DNA (eDNA) Surveys (O)

Presenter: Danielle Lowe

Faculty Project Advisor: Micah Fern

There has been an increase of sightings in Tennessee of the American alligator (*Alligator mississippiensis*) in recent years. Traditional survey methods to locate and monitor these animals time intensive, costly, and ineffective. As an alternative, environmental DNA (eDNA) survey techniques can be especially beneficial for cryptic animals or low-density populations, for which alligators residing in Tennessee are both. A novel primer specific to the alligator has been designed and tested in the lab but repeatedly failed to amplify alligator DNA when using gel-based polymerase chain reaction (PCR) on field samples. Through this research, we validated the primer's ability to select and amplify alligator DNA from samples collected in West Tennessee and Louisiana when using the more sensitive qPCR (quantitative PCR) technique. This fully validated primer will enable researchers and wildlife managers to confidently use eDNA survey methods to effectively monitor the presence or absence of alligators across large distances.

Influence of Biofilm Formation on Wound Healing of 3T3 Cells with the Presence of Thrombin (O)

Presenter: Kira Finkley

Faculty Project Advisor: Marc Lockett

Several factors affect the activity and efficiency of the four phases of wound healing: hemostasis, inflammation, proliferation, and remodeling. This research aimed to determine the effect of thrombin and supernatant from the biofilm-forming bacteria *Staphylococcus epidermidis* on cell growth and migration of 3T3 mouse fibroblast cells. 3T3 cells were exposed to (1) thrombin alone, (2) bacterial supernatant alone, (3) both chemicals, or (4) neither chemical. The change in cell number, cell migration rates, and gene expression levels of CYR61 and CTGF were assessed for each exposure group. Thrombin increased cell migration, and the supernatant decreased cell migration. RT-qPCR results are pending.

Effects of Environmental Factors on *Candida albicans* Biofilm Formation (O)

Presenter: Lynley Brooke Puckett

Faculty Project Advisor: Esther Choi

Candida albicans is a commensal fungus that resides in the oral cavity, gastrointestinal and vaginal tracts, and on the skin. However, it can become pathogenic when its environment is disrupted, leading to biofilm formation. This study examines the effects of pH, *Pseudomonas fluorescens* culture supernatant (CS), and oxygen availability on *C. albicans* biofilm development. Biofilm formation was significantly elevated when *C. albicans* was grown in yeast peptone dextrose (YPD) media at pH 6, whereas no increase was observed at pH 4 or pH 10. These findings suggest that pH 6 promotes the yeast-to-hyphae transition, facilitating biofilm formation. However, neither *P. fluorescens* CS nor oxygen availability had a significant effect on *C. albicans* biofilm formation. This study highlights environmental factors influencing *C. albicans* biofilms and may contribute to future strategies for preventing biofilm-associated infections.

BIOLOGY

Proliferation of *Aureoumbra lagunensis* in Response to Variable Nitrogen, Salinity, and Temperature (O)

Presenter: Melody Friesen

Faculty Project Advisor: James Kerfoot

The brown tide *Aureoumbra lagunensis* forms Harmful Algal Blooms (HABs) that threaten coastal marine life globally. It was first identified in Laguna Madre, TX where record-breaking HABs caused incredible economic losses in the shellfish industry. Few laboratory studies have examined what physical and chemical variables optimize *A. lagunensis* growth. This study determined the effect of all different combinations of salinity (20 ppt and 35 ppt), temperature (19°C, 24°C, and 29°C), and nitrogen levels (10 mg L⁻¹ and 35 mg L⁻¹) on *A. lagunensis* growth. Absorbance was measured at 450 nm to determine chlorophyll pigment production, an indicator of *A. lagunensis* abundance, over 7-day experimental trials. A three-way ANOVA analysis was conducted on rank-transformed preliminary data at 450 nm absorbance. It reveals a significant difference between the temperatures on *A. lagunensis* growth, notably, that 19°C supports the greatest *A. lagunensis* densities.

Efficacy of Denatonium Saccharide as a Squirrel Repellant at Bird Feeders (O)

Presenter: Cami Haas

Faculty Project Advisor: Andy Madison

The raid of bird feeders by eastern gray squirrels (*Sciurus carolinensis*) is the plight of bird watchers across the United States and Europe. Denatonium, the most bitter chemical known, has been marketed in products like Bitrex and Ropel as a squirrel deterrent but has mixed reports of success. In this study, the consumption of black-oil sunflower seeds coated with 560 ppm denatonium saccharide (DS) was compared to the consumption of untreated seeds by eastern gray squirrels and bird species on campus. Animal activity was observed over 10-minute increments and seed mass weighed in January-February 2025 at 3 feeders. The DS treatment did not appear to affect the consumption of seeds at feeders; in fact, across all 3 treatments, treated seeds were consumed more than untreated seeds. Possible explanations include weak dosage, differing heights of hoppers, or ability of squirrels to remove the outer coatings of seeds.

The Effects of *Staphylococcus epidermidis* Supernatants on Human Plasma Clotting (O)

Presenter: Olivia Mueth

Faculty Project Advisor: Marc Lockett

Staphylococcus epidermidis, a commensal skin bacterium, can form biofilms on implanted medical devices, leading to infections resistant to immune responses and antimicrobial therapies. Understanding biofilm interactions with body

tissues is crucial for developing new treatment strategies. This preliminary study examined the effect of *S. epidermidis* biofilm supernatant on blood clotting using a plasma clotting assay and a chromogenic assay. Qualitative observations indicated an effect on enzyme activity in the presence of biofilm supernatant, though a more detailed kinetic analysis has yet to be completed. These findings suggest a potential interaction between *S. epidermidis* biofilms and the coagulation system, warranting further investigation into biofilm-associated alterations in hemostasis.

Examining Effects of Sargassum and Invasive Seagrasses on Estuarine Seagrass Ecosystems (O)

Presenter: Scout Fluet

Faculty Project Advisor: James Kerfoot

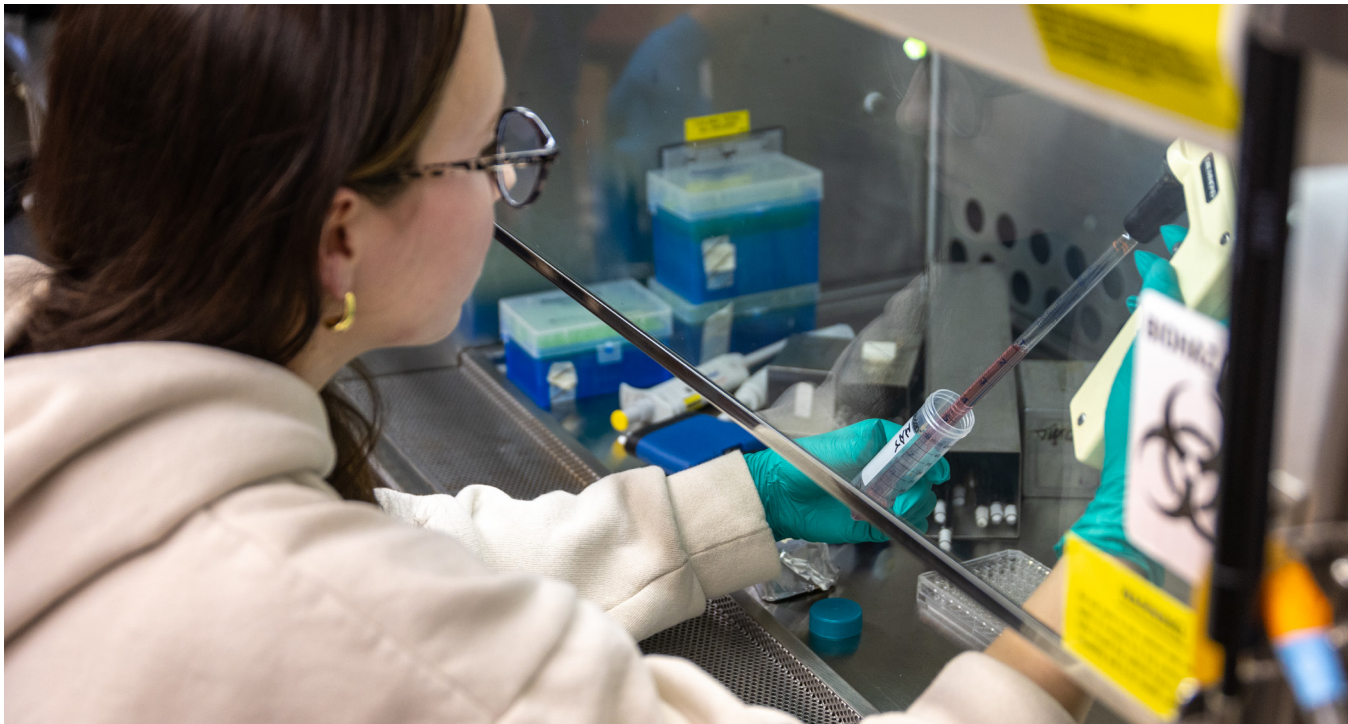
Seagrass beds are integral habitats for coastal ecosystems. Overabundance of invasive species and macroalgae (sargassum) potentially alter habitats within estuaries. This study examined potential differences between fish species observed in open-water habitat and mangrove-bordering habitat and secondarily examined potential differences between invasive versus endemic seagrasses on faunal community. Seagrass cover and water quality data were collected from 2 sites in Jobos Bay, Puerto Rico. A Principal Component Analysis was used to summarize water quality data between habitat types and Spearman Rank correlation analyses were conducted to test relatedness between community data including invasive and endemic percent cover, summarized water quality data, and sargassum density. Results showed that invasive seagrass coverage was negatively correlated with endemic seagrass cover in mangrove-bordering habitat, but the presence of sargassum did not correlate. Results indicate invasive seagrasses potentially altering habitat structure in some ecosystems.

Investigating the Effects of Extracellular Potassium Concentration on the Expression of Inflammatory Signaling Pathways by Microglia (O)

Presenter: Elijah DeCuir

Faculty Project Advisor: William Thierfelder

Microglia are macrophages that regulate immune responses in the central nervous system. In Alzheimer's disease, microglia increase their pro-inflammatory signaling while their phagocytosis of debris is impaired. Inflammation is activated by the release of potassium from injured cell membranes, and extracellular potassium levels are elevated in the brains of Alzheimer's patients. This suggests a possible role for potassium in regulating microglial inflammatory states. In this study, we expose cultures of a microglial cell line (SIM-A9) to increasing concentrations of extracellular potassium in the presence of amyloid- β to induce inflammation. Quantitative polymerase chain reaction assays of cell lysate were used to determine the



expression of a variety of inflammatory signaling proteins that regulate inflammation and neuronal survival. Our results suggest that elevated extracellular potassium concentrations dampen the inflammatory response in microglia. The results of this study offer insight into the role of potassium as an immunomodulator in Alzheimer's disease.

The Effect of Temperature on The Ability of Invasive Tropical Oscar Cichlid (*Astronotus ocellatus*) to Feed on Native Subtropical Prey (O)

Presenter: Ella Curneal

Faculty Project Advisor: James Kerfoot

Tropical fish species introduced to subtropical ecosystems can become invasive, affecting native fish populations and creating dynamic predator-prey interactions. The introduction of a tropical predator into a subtropical ecosystem may alter its ability to capture prey, while also providing subtropical prey with a potential escape advantage. This study investigates the effects of temperature on the predator-prey relationship between the invasive oscar cichlid (*Astronotus ocellatus*) and native mosquito fish (*Gambusia affinis*). Predator-prey interactions were filmed at 19, 24, and 29°C using a high-speed camera, and prey escape and predator attack velocities were measured. Preliminary results show a significant difference in predator approach velocity at varying temperatures. The average approach velocities at 24°C and 29°C were 6.02 cm/s and 17.99 cm/s, respectively. This indicates an increased ability of prey capture at high temperatures and a decrease at lower temperatures.

Computational Analysis and Expression of CACNA1C In Adult Zebrafish: Exploring Connections to Human Mental Health Disorders (O)

Presenter: BriAnna Benson

Faculty Project Advisor: Faith Zamamiri-Davis

The mental illness epidemic has created a wave of research that aims to combat the nescience attributed to the dynamic field of neuroscience. Genetic research has revealed that genes, such as the CACNA gene group, may be impacted by mutations caused by mental disease. To simulate a stress response, zebrafish were exposed to a caffeine stimulant at varying concentrations for 2 different lengths of time. Following euthanasia, total RNA was isolated for use in RT-QPCR to assess changes in gene expression. The short exposure group expressed signs of stress through aggressive swimming and thigmotaxis. The long exposure group expressed thigmotaxis and hemorrhaging in the eyes. RT-QPCR results are pending, but the expectation is to see measurable differences between the control and experimental groups. These results would support the hypothesis that caffeine exposure has effects on the stress response through CACNA associated pathways, which may be linked to mental disorders.

BIOLOGY

Effects of Urbanization on Bat Populations in West Tennessee (O)

Presenter: Grace Orewiler

Faculty Project Advisor: Michael Schiebout

Bats provide a vital element to the environment, acting as pest control, pollinators, and by spreading seeds. Urbanization has negatively affected bat populations by removing natural roosts, creating light pollution, interrupting torpor, and increasing fatal anthropomorphic interactions. This study investigated bat populations at 3 sites in West Tennessee of varying urbanization levels: low urbanization (Middle Fork Bottoms State Park), moderate urbanization (Union woods), and high urbanization (Liberty City Park). Acoustic data was collected for five consecutive weeks using detectors placed at locations near water, culverts, or natural corridors. The most diverse location was the lowest urbanized site, followed by both the moderate urbanized and highest urbanized site with the same amount. The endangered species *Myotis grisescens* was detected at one site and a proposed endangered species, *Perimyotis subflavus*, was detected at every site, indicating the importance of conserving these areas for threatened species.

A Bioinformatics Approach for the Identification and Study of Novel Genes in Alzheimer's Disease, Using Zebrafish as a Disease Model (O)

Presenter: Tanner DeCuir

Faculty Project Advisor: Faith Zamamiri-Davis

Alzheimer's Disease (AD) is the most common form of dementia, affecting millions of people in the U.S. Large-scale genetic analyses indicate that AD predisposition is the result of multiple genetic factors, many of which have not been thoroughly studied. This study examined a bioinformatics-based protocol for the characterization of novel AD-associated genes. We identified a promising AD-associated gene, GRID2IP, containing an AD-associated variant of unknown significance from a genetic database. An AD model was then performed in zebrafish (*Danio rerio*) and their expression of a zebrafish ortholog of GRID2IP was analyzed by RT-qPCR. Yet Another Scientific Artificial Reality Application (YASARA) computational protein modeling software was also used to assess the possible pathological effects of wildtype and variant human GRID2IP proteins. From these data it was determined that GRID2IP expression is significantly altered in AD models and is likely to have a role in AD pathology, potentially through an excitotoxic mechanism.

Using GC/MS to Analyze the Secondary Metabolite Profile of *Artemisia abrotanum* Exposed to a Seed-Derived *Acer ginnala* Osmoticate (O)

Presenter: Emily Hall

Faculty Project Advisor: Mark Bolyard

Artemisia abrotanum is a medicinal plant known for producing secondary metabolites contributing to its antimicrobial, anti-inflammatory, and therapeutic properties. The essential oil containing the metabolites can be extracted using steam distillation and gas chromatography-mass spectrometry. This study explored how exposure to seed-derived osmoticate from *Acer ginnala*, a plant known for its allelopathic properties, influenced the secondary metabolite profile of *A. abrotanum*. It was hypothesized that exposure to the osmoticate will alter the secondary metabolite profile, potentially inducing new bioactive compounds. To test this, regenerated *A. abrotanum* shoots were placed in a set concentration of the osmoticate, followed by steam distillation and GC/MS analysis. The osmoticate also underwent a GC/MS analysis. By comparing the metabolite profile of treated and untreated plants, it is expected to see new metabolites in the oil extracted from treated plants. Results are pending.

The Effects of *Staphylococcus epidermidis* Biofilm Supernatant on Fibroblast Activity (O)

Presenter: Devin McDonagh

Faculty Project Advisor: Marc Lockett

Fibroblasts play a critical role in wound healing by producing collagen, synthesizing fibronectin, migrating to wounds, and secreting growth factors. *Staphylococcus epidermidis* biofilm supernatant contains components that may influence fibroblast migration and adhesion. This study investigated whether biofilm supernatant disrupts fibroblast migration toward wound sites using chemotaxis, scratch, and cell growth assays. While *S. epidermidis* may influence fibroblast chemotaxis through chemoattractant signaling, the biofilm supernatant appeared to have no effect. This suggests that the chemoattractant may not be present in the supernatant. Additionally, no significant impact on cell growth or scratch migration was observed. Future studies should analyze the supernatant's composition to identify factors affecting fibroblast behavior.

Running Wild: The Use of Running Wheels by Critters at Union University (O)

Presenter: Hailey Sipes

Faculty Project Advisor: Robert Bowen

This research project aims to investigate whether wild animals are inclined to use a running wheel to voluntarily engage in physical activity. An exclusionary cage equipped

with a running wheel and video camera was placed in a wooded area on the campus of Union University in Jackson, TN. The cage was initially left without food for three weeks, followed by three weeks with food as an attractant to the cage. The number of visits was compared between each phase of this study. If visits occurred, wheel running characteristics (running distance, duration, and speed) were evaluated. The use of a running wheel by wild animals might indicate wheel running is an inherent, biologically programmed behavior that approximates human physical activity behavior.

Unlocking Antibiotic Resistance: Effects of Glucose on *Staphylococcus aureus* and *Staphylococcus epidermidis* Biofilm Formation (O)

Presenter: Emiliano L. Ortiz

Faculty Project Advisor: Esther Choi

Staphylococcus aureus and *Staphylococcus epidermidis* are commensal bacteria but can become opportunistic pathogens due to their ability to form biofilms, which protect against host immunity and antibiotics. This study examined whether increased glucose levels affect biofilm formation in these species. Bacterial biofilm and growth were measured in the presence of 1% glucose, compared to normal Tryptic soy broth (TSB) media. Results showed that *S. aureus* exhibited increased biofilm formation with 1% glucose, whereas *S. epidermidis* did not. Additionally, both bacteria showed significantly reduced growth with 1% glucose. However, the zones of inhibition for vancomycin or chloramphenicol against *S. aureus* remain unaffected by glucose supplementation. Further study will explore whether the additional glucose alters *S. aureus* metabolism, possibly affecting the pH of the surrounding medium and biofilm matrix. Our findings provide valuable insight into conditions such as diabetes, where blood sugar levels may increase the risk of staphylococcal infections.

Developing Sterilization and Regeneration Procedures for *Ulmus Parvifolia* Variants (O)

Presenter: Adah Davis

Faculty Project Advisor: Mark Bolyard

Plant organogenesis is the process by which a plant can be grown from a mass of undifferentiated cells called callus. This plant regeneration method involves 3 major steps: sterilization of the starting plant material, dedifferentiation into callus, and redifferentiation into a new shoot from the callus. Regeneration systems have been established for different species of elm trees with the use of phytohormones, but not yet for the Hallelujah, Seiju, or Hokkaido *Ulmus Parvifolia* (Chinese elm) variants. Different sterilization procedures and phytohormones were tested for developing callus formation from these elm tree explants. A successful sterilization procedure was carried out for the Hallelujah elm with HgCl₂, although

no callus formation was observed. Successful sterilization, callus formation, and one instance of shoot formation occurred for the Seiju elm with NaOCl and Thidiazuron media. Results are pending for the Hokkaido elm.

Effect of Deiodinase-3 Expression on Thyroid Hormone-Induced Migration in a Breast Cancer Cell Line (O)

Presenter: Christian Schlehuber

Faculty Project Advisor: William Thierfelder

The hormone triiodothyronine (T₃) carries out a wide variety of metabolic functions and is reported to support metastasis and migration of breast cancer (BC). Reduced expression of the T₃-inactivating enzyme deiodinase-3 (DIO3) by BC cells should result in increased levels of T₃ in the cellular microenvironment. The purpose of this research is to evaluate the effects of DIO3 deletion in a breast cancer cell line (MCF-7 cells). Scratch tests were used to compare DIO3-deleted and wild-type (WT) MCF-7 cells *in vitro* by measuring migration rates with and without T₃ and phorbol 12-myristate 13-acetate (PMA) exposure. The results suggest that DIO3-deleted MCF-7 cells exhibit increased migration in T₃ compared to WT cells. PMA exposure also led to increased migration in all MCF-7 cells. These results imply that down regulation of DIO3 leads to increased BC migration and therefore likely supports BC metastasis.

The Effect of Fluctuating Temperature on the Expression of ABCB4 and ABCB5 Genes, and the P53 Tumor Suppressor Gene in Adult Zebrafish (O)

Presenter: Jeremiah Chapman

Faculty Project Advisor: Faith Zamamiri-Davis

Temperature's influence on gene expression has long been studied in the medical field. While the principal temperature for most creatures stays comparatively the same, there are animals whose core temperatures fluctuate drastically, and these specimens show a decrease in the potential of developing cancer. Based on this knowledge, medical studies have been done to understand the effectiveness of hyperthermia. This study aimed to observe the effect of fluctuating body temperature on three genes closely associated with cancer in adult zebrafish (*Danio rerio*). Eight trials were used to fluctuate the temperature of the zebrafish. Data was then attained on the amount of expression for each of the anti-cancer genes. The results of this study will show the contrast between the non-fluctuating and fluctuating fish. This will allow for discussion to be had about the effectiveness of fluctuating one's core body temperature to fight against cancer. ■

CHEMISTRY

GC/MS Analysis of Cuticular Hydrocarbon Profiles to Identify Cricket Assassin Wasps (P)

Presenter: Grace Beem

Faculty Project Advisor: Jimmy Davis

The goal achieved in this research was the determination that two potential wasp clades within the Rhopalosomatidae family can be differentiated based on their cuticular hydrocarbon profiles using gas chromatography-mass spectrometry (GC/MS).

Design and Site-Directed Mutagenesis of the PRMT1 R353P Protein Variant and its Possible Role in Colorectal Cancer (P)

Presenter: Halle Webb

Faculty Project Advisor: Betsy Caceres

Protein Arginine Methyltransferases (PRMTs) are a family of enzymes that performs arginine methylation, a post translational modification, which is found in all eukaryotes and many prokaryotes. As the study of PRMTs has developed over the course of many years, the importance of PRMTs and their functions in the human body have spiked the interest of many. Through these studies, PRMTs have proved to be important factors in many physiological processes such as aiding in DNA damage response, signal transduction, and mRNA splicing. In addition to this, these enzymes have also been linked to the development of many diseases such as cancer, cardiovascular disease, and diabetes. There are three major types of PRMTs, all of which catalyze ω -NG-monomethylarginine (MMA). Type I PRMTs catalyze the formation of asymmetric ω -NG-dimethylarginine (ADMA), Type II PRMTs form symmetric ω -NG-dimethylarginine (SDMA), and Type III PRMTs solely catalyze MMA. PRMT1 is a type I PRMT. It is the major isoform found in mammals, and it is known to be involved in many types of cancers. Based on the results of several structural studies, as well as computer models of this enzyme, it is hypothesized that Aspartate 37 (a negatively charged amino acid) is forming a salt bridge with Arginine 353 (a positively charged amino acid). This salt bridge is found in the dimerization interface and might aid in the stability and catalytic activity of the enzyme. Previous studies have shown that interactions such as this play an essential role in the formation of PRMT1 dimers, with the dimerization of PRMT1 being indispensable to enzyme activity. Interestingly, Arginine 353 has been reported to be mutated to a Proline in colorectal cancer. We believe that this mutation might be disrupting the salt bridge and interfering with the enzymatic activity of the enzyme in this type of cancer. In order to begin to unravel these assumptions, the PRMT1 colorectal cancer mutant, R353P, was successfully designed using site directed mutagenesis. In the future, this construct will be used to assess the overall oligomeric state and enzymatic activity of this enzyme.

Alternative Method for Inhibiting Crystallization in Diastereomeric Glucoheptonate Mixtures (P)

Presenter: Andrew Bragg

Faculty Project Advisor: Michael Hayes

Glucoheptonate is a versatile compound that has enjoyed widespread use in a diverse set of fields, such as a cement curing retarder, additive for oilfield drilling fluids, and in pharmaceutical compositions. Existing as two diastereomers, the beta form has never been isolated, so its physical appearance is uncertain, while the alpha form is colorless and more commercially valuable than its counterpart. It is less water-soluble than the beta isomer and thus exhibits a tendency to crystallize during long periods of storage. Current methods to prevent crystallization in the alpha isomer involve a borate crystallization inhibitor. However, this borate agent has attracted scrutiny due to potential environmental concerns. Therefore, the present study investigates heat treatment as an alternative method of inhibition. Several samples of dextrose-cyanide reaction products were subjected to varying temperatures for extended periods of time. These tests revealed that upon heat treatment at approximately 80 °C for a period of at least 24 hours, the sample turns from its copper color to black. After this color change, the samples no longer exhibit crystallization in the short term. Furthermore, there is no evidence that the glucoheptonate isomers suffer any degradation in the process. This novel method holds potential as an environmentally friendly way to prevent alpha glucoheptonate crystallization in commercial mixtures and warrants further study of its long-term effectiveness.

Exploration of an Iron(II) Hydrosilylation Catalyst in Search of a Greener Alternative to Wilkinson's Catalyst (P)

Presenter: Isaac Stickles

Faculty Project Advisor: Randy Johnston

Catalysis, one of the many foundational concepts learned in an undergraduate chemistry laboratory setting, was explored in this research. The focus was on attempting to replace the current laboratory synthesis of the well-known Wilkinson's Catalyst and subsequent hydrogenation reaction with an Iron catalyst driving a hydrosilylation reaction. The reason for this research is twofold: finding a replacement for a current experiment used, and opening opportunities for undergraduate university students to be able to learn the concepts of synthesizing and utilizing a catalysis. Wilkinson's Catalyst requires the use of rhodium, a rare-transition metal, which is not what is considered "green" compared to alternative inexpensive transition metals like iron. Replacing the rhodium with iron would not only decrease the toxic waste of the reaction but would also decrease the cost of running the reaction, potentially opening the door for other undergraduate universities to utilize this experiment in their classes. The results of this work will be presented. ■

COMPUTER SCIENCE

Machine Learning's Application in Spam Email and Phishing Detection (O)

Presenter: Hayden Shirley

Faculty Project Advisor: Brian Glas

A “phishing” email is one that tries to trick the recipient into giving the attacker sensitive information. Spam emails and phishing attempts are at an all-time high: around 36% of all data breaches involve phishing, and an estimated 91% of all cyberattacks begin with a phishing email. These emails are disguised as legitimate and are difficult for many spam filters to detect accurately. This project looks to use machine learning to detect malicious emails with greater accuracy. It does this by analyzing the contents of emails and comparing them to known malicious text. When combined with traditional spam filtering technology, this has the potential to greatly reduce the likelihood of a successful cyberattack.

Singo Bingo, A Music Web Application Game (O)

Presenter: Meilyn Massie

Faculty Project Advisor: Brian Glas

Singo Bingo is a music version of bingo and allows you to play locally with your friends and family. This game operates similarly to Jackbox Games. It allows players to connect their personal smartphones to a host website on a device such as your laptop. The assets used to produce this game are JavaScript, React, Node.js, WebSockets (Socket.io), AWS, YouTube Data v3 Api, and the Spotify API. Spotify API is called to pull playlists from an account and then

uses this playlist to generate unique bingo cards to display on each player's device. After this, YouTube API plays 10 seconds of a song without showing the lyrics, artist, or song title. The rest of the game runs very similar to bingo. This project highlights the importance of understanding how to connect the front end to the back end and how to properly set up the connections. I hope this game provides players with a sense of competition and enjoyment.

Building a Unilab Virtual Environment Management Project (O)

Presenters: Roger Blankenship and Brendan Fields

Faculty Project Advisor: Brian Glas

This project aims to develop an interactive virtual network management system tailored for university students, utilizing a web-based portal to facilitate hands-on learning in networking and systems administration. By leveraging QEMU/KVM virtual machines and GNS3 for network simulation, the platform provides users with fully configurable lab environments that allow for realistic, scalable network topologies. Students can access virtual environments through VNC via the web portal, which also allows them to manage the GNS3 network topology. The system supports multiple users concurrently, promoting flexibility in the learning experience. Ultimately, this project serves as a tool for professors to provide engaging, interactive learning environments that foster the development of essential technological skills among students



COMPUTER SCIENCE

Groundwork for 'Nine Dungeons: Draco Rex' (O)

Presenter: Titus Mullin

Faculty Project Advisor: Brian Glas

Over the last few decades, video games have gained much popularity as multimedia interactive experiences. In this time, many beloved game series have evolved and changed, and though these newer games are often enjoyed, many wish for more traditional experiences. Based off this idea, this project aims to serve as a starting point for a game titled "Nine Dungeons: Draco Rex" which draws heavy inspiration from classic action-adventure role playing games. A variety of elements were drafted, including gameplay mechanics, level and puzzle design, worldbuilding, and narrative. Functionality of gameplay mechanics was implemented using the Unity game engine, and an interactive scene was created to showcase possible level design. Because a complete game was beyond the scope of this project, the focus was instead on laying significant groundwork for future development.

From Ideas to Creation: Bad Omens Videogame Demonstration (O)

Presenter: Brandon Jordon

Faculty Project Advisor: Brian Glas

This project has been a passion that has lingered around in thought alone for a long time. It will be able to encompass the teachings and skills learned throughout my college experience, combining my love for coding and storytelling. Using the Unity development platform, I will

be creating a demo of an original game "Bad Omens". It is a metroidvania about a kid stuck in an endless nightmare, who must conquer his fears in order to escape. The demo will revolve around a circus themed level, focusing on the fear of clowns. The demo will also feature a unique mechanic called Omens. These Omens are temporary effects inflicted on the player by certain enemies. Omens can include reduced speed, damage, etc. While some Omens are temporary, some will last for the duration of the level. Thus, beating a boss will remove the Omen and make the player stronger and more resilient than ever. The goal would be to eventually create a complete game post-college.

Information Technology Support and Focused Risk Assessment (O)

Presenter: Greyson Watkins

Faculty Project Advisor: Brian Glas

Businesses have many facets of IT that weave in out of its daily operations. This project focuses on supporting those operations by providing need-based IT support during the project's run time, while also creating and editing policy, frameworks, and controls to incorporate a combination of methods to reduce risk and support a local company's further development. This company is a small but growing team that is working to build the necessity infrastructure for their business, which poses new challenges as the industry it lies in is not one that has a heavy background in security and technology and the business and its tools are evolving.

Mobile Habit Tracker Application (O)

Presenter: Rhen Milton

Faculty Project Advisor: Brian Glas

This project is the development of a mobile habit tracker application, built using React Native and Expo Go, with authentication and data management using Clerk and Convex. The application enables users to create and track different habits, set achievable goals, and monitor progress over time. With a user-friendly interface, the app promotes good changes in behavior, motivate users, and create some accountability. This project demonstrates the potential of mobile technology to support individuals in developing healthy habits and achieving their goals. The applications architecture and implementation will be discussed, highlighting the integration of React Native, Expo Go, Clerk, and Convex to create a good user experience. This project contributes to the growing field of mobile health and wellness applications, providing a valuable tool for individuals seeking to improve their daily habits and overall well-being. ■



ENGINEERING

Design of Expansion Arbor for Three-Phase Coils (O)

Presenters: Jonathan Brewer, Daniel Lancaster, and Nathaniel Thomas

Faculty Project Advisors: Jay Bernheisel and Georg Pinggen

In this project, our design team was tasked with standardizing the process by which ERMCO winds three-phase coils on their mechanical arbor. As these require various plate dimensions, our team created an expansion shaft in order to fit all of the dimensions with a single modular device, which will implement a significant improvement for ERMCO's arbor system at their Dyersburg plant. This was accomplished by creating a mechanism that will allow for easy adjustment of the dimensions, allowing the coil to be wound in the appropriate sizes. Standardizing the process will yield substantial improvement in changeover time for the operator, leading to less overall downtime for the plant. This presentation will detail the entire engineering process, from the original prompt to design conceptions and the final product.

Large Spool Lifting (O)

Presenters: Colby Davis, Ryan Keeton, and Mikaila Rogers

Faculty Project Advisors: Jay Bernheisel and Georg Pinggen

This project entails the design for building a device capable of lifting and moving large spools up to 6,000 pounds. The project was given by Prysmian to Colby Davis, Mikaila Rogers, and Ryan Keeton. Prysmian manufactures fiber optic cables and uses large metal or wooden spools to handle the cables in their facility and to ship to consumers. At the conception of this project, they had no good way to handle these large spools. The creation of this spool lifting device will enable them to better handle and move these large spools that can otherwise be very difficult to maneuver.

Design and Construction of Small-Scale Wind Tunnel (O)

Presenters: Ian Banderchuk, Jewelia Black, Ethan Brasher, and Michael Kirk

Faculty Project Advisors: Jay Bernheisel and Georg Pinggen

Wind tunnels are used as a tool to model air flow around objects. This can be useful in the design and testing of airplane, car, and spacecraft components to list a few. This project includes the design and construction of a small-scale wind tunnel. Our team, in collaboration with Young Touchstone in Jackson, TN, worked to design, fabricate, and assemble a cost-effective wind tunnel solution. We worked to specify pressure drop through the wind tunnel as well as desired air velocity for testing. Subsequently, we moved to ranking and choosing key

components for the wind tunnel, like the fan and variable frequency drive. We also designed the key structural components. Finally, we selected appropriate sensors, flow visualization equipment, and other hardware before finally assembling the completed wind tunnel.

Hitachi Energy High Temperature Mold Vacuum Seal Project (O)

Presenters: Jacob Carbonell, Eli Snelson, and Micah Valdivia

Faculty Project Advisor: Georg Pinggen

Our team worked on a project with Hitachi Energy in Alamo, Tennessee, a major supplier of parts in the energy industry. We were tasked with addressing the occasional trouble they were having with bushing, which is an integral part of transformers. They were having a problem where air was leaking into the bushing during the casting process allowing for porosity to form in the exterior of the bushing which could compromise the functioning of the bushing. Thus, the Hitachi Energy High Temperature Mold Vacuum Sealing Project aimed to design and produce a solution to Hitachi's problem of occasional porosity in bushings. To solve this problem, we designed an additional vacuum seal under the problematic seal to create a vacuum around the problematic area thus eliminating porosity.

DCI Conveyor Belt Slippage Solution Project (O)

Presenters: Jacob Arehart, Caleb Krueger, and Braeden McAlister

Faculty Project Advisor: Georg Pinggen

This project sought to find a solution to the common problem of conveyor belt slippage. Diversified Conveyors, a company dedicated to providing innovative conveyor belt solutions to a variety of customers, requested that we design, prototype, and test an early warning system that will detect when their conveyor belts start to slip off the rollers. Their goal was to drastically reduce damage, downtime, and maintenance that is caused by the belts slipping. They hoped that our lack of experience in the conveyor belt industry would help us find a more creative solution than what is already offered on the market. We followed the engineering design process to identify the important variables, generate prototypes, evaluate these prototypes, build a prototype, and then finally test our prototype at DCI's state-of-the-art conveyor belt training facility. From our testing, we concluded that our preferred prototype could fulfill our requirements. We recommend that DCI bring our final design to market and install it throughout their current and future conveyor belt systems.

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Testing Factors Affecting Goalkeeper Performance (P)

Presenter: Kyle Whitmark

Faculty Project Advisor: Don Van

One of the most important jobs on the soccer field is that of the goalkeeper. The goal of this experiment is to test different factors affecting the performance of the goalie. Eight factors that will be tested are: shoes, gloves, skill level, distance, kicking foot, kick type, ball inflation, and time of day. To design and analyze this experiment more effectively, the fractional factorial method was used to reduce the 256 (2⁸) original experiments needed to a more manageable 16 (2⁴) experiments.

Rubber Band Flight Factorial Experiment (P)

Presenter: Judy Lampley

Faculty Project Advisor: Don Van

The aim of this experiment will be to determine which factors affect the distance of the flight of a rubber band. The factors that will be considered are as follows; the length of rubber band, thickness of rubber band, the length stretched, whether or not it has a staple in the middle, whether it is twisted or not, and whether or not they have been stretched prior to the experiment. With this many different factors changing between each test, there are 144 different experiments to do. This can be reduced through the factorial experiment method. To launch these rubber bands consistently, the use of a launcher device with a variable stretching ability will be needed. A device to pre-stretch rubber bands consistently will also be needed. The different diameters of the rubber bands are going to be 7-inch and 3-inch, and the thicknesses will be 1/16-inch, 1/8-inch, and 1/4-inch. The length stretched will be based on percent of total length of a given rubber band due to the fact that a 3-inch diameter rubber band can stretch to 6-inch, but a 7-inch rubber band cannot. The percent stretched will be 100%, 125%, and 150%. A 100% stretch would be stretching a 3-inch rubber band to 6 inches. The distance flown will be measured via a tape measure and will be measured from a predetermined spot on the launcher to the closest edge of the rubber band. By the end of this experiment, the factors that affect the distance the most will be listed on a pareto diagram.

Electrical Circuit Integrator Using Filters (P)

Presenters: Josiah Hays, Matthew Meyn, Bobby Perry, and Timothy White

Faculty Project Advisor: Jeannette Russ

Our group used a sine-wave generator, coupled with filters, to make a electrical integrator. Sine-wave generators have many applications including in-power inverters and in-testing audio and communications systems. We will design a sine-wave generator circuit by taking a square-wave generator

and connecting it to a sequence of low-pass filters. The filters remove the harmonics of the square wave, producing a clean sine wave of the desired frequency as a result.

Maximizing RC Car Jump Distance (P)

Presenter: Jewelia Black

Faculty Project Advisor: Don Van

This study explores the factors influencing the distance traveled by an RC car after a jump, with the goal of maximizing performance. Key variables include speed, terrain type, ramp angle, car type, added weight, initial distance from the ramp, signal strength, and battery level. Each factor was tested at two levels, such as fast vs. slow speed, smooth vs. rough terrain, and major vs. minor jump angles. A fractional factorial design was used to reduce the number of experimental trials from 256 (or 2⁸) to 16 (or 2⁴) while still capturing significant interactions. The results will help identify optimal conditions for achieving maximum jump distance, offering valuable insights for RC car enthusiasts and hobbyists.

Determining the Most Influential Factors on the Accuracy of Disc Golf Putting (P)

Presenter: Benjamin Kuhl

Faculty Project Advisor: Don Van

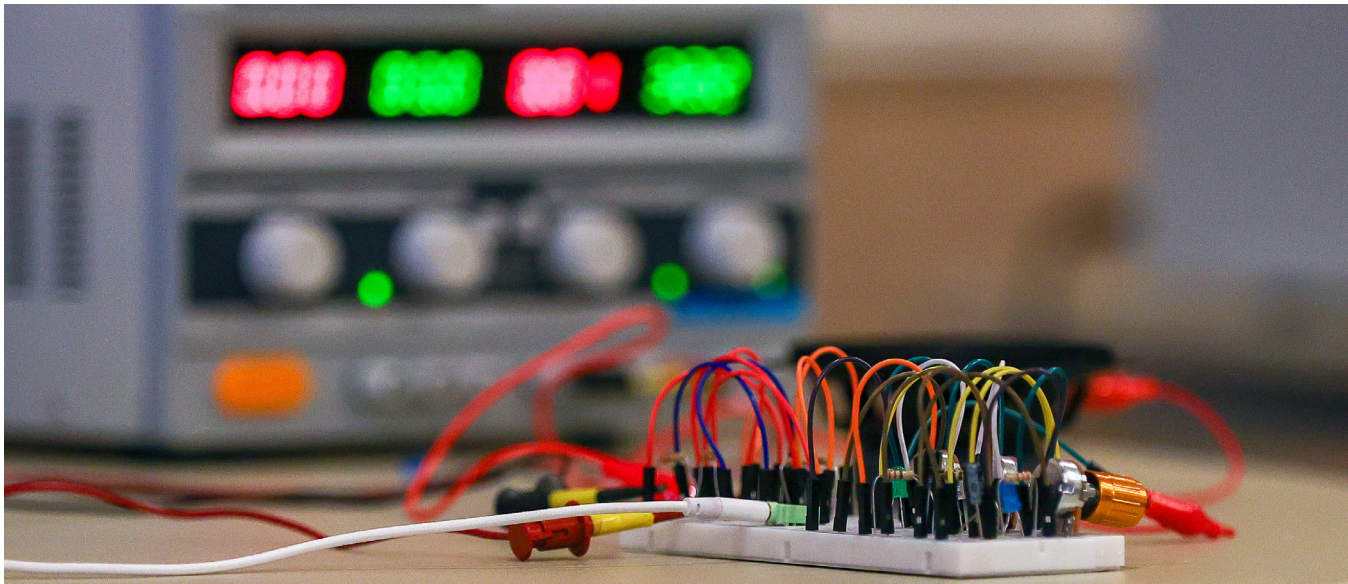
Disc golf is a popular activity for many people, and putting is a large part of the game. For this experiment, the goal was to study the different factors that can affect the accuracy of putting. A basket was set up within a controlled environment and tests were run. The following eight factors are considered relevant to this study: weight of the disc, distance from basket, wind speed, the individual putting, the day on which the putting was done, obstruction, elevation, and whether the individual follows a consistent routine before putting. The 16th fractional factorial design of experiment method was then used to conduct this experiment with 16 instead of the full 256 experiments. Throughout the experiment, the data was imported to Excel and then later analyzed.

Minimizing Your Heart Rate During a One-Mile Run (P)

Presenter: Landon Haywood

Faculty Project Advisor: Don Van

Our heart rate determines how well-conditioned we are when we run a mile. A lower heart rate correlates to our bodies being in better shape. This experiment aims to determine which factor influences our heart rate the most during a one-mile run using the 16th Factorial Design method. The eight factors in this experiment are: consuming 100 or 200 mg of caffeine before the run, running in the morning or at night, running a flat or hilly route, consuming the



caffeine right before or thirty minutes before the run, eating or not eating before the run, static stretching or dynamic stretching, no music or music, and running shoes or everyday shoes. The heart rate will be analyzed and tracked using an Apple watch periodically throughout the run while running a consistent eight-minute mile pace.

Hummingbird Detection with Bandpass Filters (P)

Presenters: Cameron Kennedy, Gideon Miller,
Samuel Moss, and Jake Pingen

Faculty Project Advisor: Jeannette Russ

A hummingbird feeder is a common signature and decoration for households across North and South America, providing both an aesthetic appeal of the feeder itself as well as entertainment. However, it can be somewhat cumbersome to constantly monitor the hummingbird feeder for the activity of hummingbirds. To help address this issue, our team plans to use a bandpass filter, which is a device capable of isolating certain electrical frequencies and is composed of operational amplifiers, resistors, and capacitors. Our team plans to design a filter of this type to isolate the hummingbird's natural chirps and/or wing beat frequencies, which could then be used to signal when a hummingbird is at the feeder.

Bandpass Filter-Based Guitar Tuner (P)

Presenters: Jonathan Carroll, Jordan Prunty,
and Cody Tjomsland

Faculty Project Advisor: Jeannette Russ

Bandpass filters (BPFs) allow only a specific range of frequencies to pass through, making them useful for many real-world tasks. This project explores the design of BPF

to tune a guitar by isolating specific frequencies. Using TL081 operational amplifiers, resistors, and capacitors on a protoboard, the circuit processes a sinusoidal input from a function generator, targeting the note C (~261.63 Hz). Rather than real-world signals, we use the function generator to provide a clean input, keeping the focus on the BPFs. The system features three filters: one activates an LED when the correct frequency is detected, while two additional filters indicate if the pitch is too high or too low. By using a function generator in place of analog-to-digital conversion circuitry, the design emphasizes the BPFs' precision and functionality. This work demonstrates frequency selectivity in action, blending circuit design with a practical musical application.

Analysis of Conditions Influencing the Accuracy of a 3-Point Shot Utilizing Fractional Factorial Experimental Design (P)

Presenter: Zane Bolton

Faculty Project Advisor: Don Van

There are a variety of external factors that affect the accuracy of a 3-point shot in basketball. The most skilled athletes can adapt and perform at a high level of consistency in games despite these factors, having prepared for a variety of situations in their training. This experiment studies how each of 8 different 2-level factors affects the accuracy of a 3-point shot from the men's college line at the top of the key. The factors are shooting stationary vs. moving, guarded vs. unguarded, rushed vs. taking your time, warmup vs. no warmup, audience present vs. none, off the catch vs. off the dribble, tired and winded vs. rested, and under pressure vs. not under added pressure to make the shot. This experiment makes use of the 16th fractional factorial design to conduct 3 trials of 10 shots under each of 16 unique

ENGINEERING

sets of conditions. The data collected are the percentages of shots made (out of 10) in each set of conditions, which are then averaged across the 3 trials. The data is analyzed using Excel to ultimately determine which factor has the greatest effect on the accuracy of shooting a 3 pointer.

Experiments to Enhance Mechanics of Materials (P)

Presenters: Landon Haywood, Judah Lampley, Ryan Metcalf, and Elijah Patton

Faculty Project Advisor: Georg Pinggen

Many of the concepts in Mechanics of Materials can be difficult for students to understand based on in-classroom lecture alone. Having a hands-on lab can enhance students' ability to understand and apply the concepts learned in lecture; however, the equipment used in these types of labs is often prohibitively expensive. However, with increasing access to low-cost electronics, 3d printers, and other makers items, the ability to design and make customized lab equipment has become increasingly viable. We took on the goal of creating two pieces of lab equipment for use in Mechanics of Materials. The first project is a low-cost tensile tester for 3d printed samples. Typical tensile testers cost anywhere from \$10k to \$20k. A low-cost tester would allow for a better understanding of how printing methods, filaments, and formats would affect tensile strength. The second project is an experimental apparatus for observing the forces in statically indeterminate structures. The completion of these projects will help students in Mechanics of Materials to more fully understand the concepts learned in lecture.

Factors Affecting Flight of a Pump Bottle Rocket (P)

Presenter: Eli Patton

Faculty Project Advisor: Don Van

As exploration into space furthers, rockets are being tested and pushed to their limits to maximize speed, distance, and efficiency. Companies like NASA and SpaceX's primary mission is to learn more about space and offer spacefaring for more professional, government, and civilian uses. However, in this experiment, rockets will not be exploring the bounds of outer space travel, but they will be tested to find maximized thrust and distance based on different variables. Different compressed air bottle rockets will be experimented with. An air pump will pressurize the air in the rocket, ejecting a liquid propellant, shooting the rocket. The factors tested in this study are: rocket size, type of liquid propellant, amount of liquid propellant, lift-off angle, use of fins, and use of a nose. An eighth fractional factorial design of the experiment will be conducted to reduce the total number of experiments from 64 to a more manageable 8.



Transforming Music Into Light (P)

Presenters: Rachel Allabaugh, Mia Duncan, and Stacia Talbott

Faculty Project Advisor: Jeannette Russ

Filters can be used in circuits to control the effects of a variable input, either limiting the results to high or low inputs, or a bracketed middle range of inputs. Understanding music only through listening to an audio file can be limiting, but filters can be used to convert an audio file from pitches to LED flashes which will allow users to see the changes in pitch throughout a song. Using a variable function generator with changing voltages that correspond to notes in a song, we built a circuit using filters for each pitch, so that the corresponding LED would light up while the pitch was playing.

Optimizing Bending Strength of 3d Printed Beams (P)

Presenter: Ryan Metcalf

Faculty Project Advisor: Don Van

With the boom in low-cost 3d printers, 3d printed parts are becoming increasingly common in academic, professional, and personal settings. However, many FEA software packages such as Fusion 360 are unable to perform static stress analysis of 3d printed parts due to their unique strength characteristics. Furthermore, the specific print settings used will change the strength of the beams. In order to better understand the material properties of 3d printed parts, I will analyze several factors – the bending strength of 3d printed beams to optimize their strength. These factors will namely be print orientation, infill percentage, wall thickness, print speed, and beam design. The weight supported as well as the position and type of break will be observed. The design of this experiment will use the fourth fractional factorial method to determine which factors have the greatest effect on bending strength. ■



The Hunters Chapter (O)

Presenter: Lili Pettigrew

Faculty Project Advisor: Christine Bailey

This novel is a part of a work-in-progress epic fantasy series being written by Lili Pettigrew. It tells the story of a teenage girl named Essie gifted with special abilities to see beyond her eyesight. This ability to see, however, is viewed as a disability and a curse, and her parents hide her from their society which centers itself on successful hunting to earn money. This society is unaware of the kingdoms that lie beyond their forest, just as those kingdoms are unaware of it, until a boy, Seth, stumbles into the forest. Through their friendship, Essie realizes that the gift given to her is not a curse, but instead a part of who she is, which she must accept and cherish. Lili aspires for this novel to encourage Christian and non-Christian girls alike to enjoy the bodies and talents God has given them instead of wishing for something else.

Chapter Six: The Musician (O)

Presenter: Samuel Stevens

Faculty Project Advisor: Christine Bailey

Storman, son of Jeruth, is training to become a guard, the highest honor in a culture separated from its god, given a prophecy unbelieved, maintaining a spartan culture of war against an enemy already defeated, protecting a book never stolen. The sixth chapter of this novel, "The Musician," captures some of the Storman's final moments of stability, dashed by the rising of an old enemy, and the first workings of the prophecy. Storman must survive the deepest betrayals and protect everything he can, even if he loses himself in the war. ■

MATHEMATICS

Solving "Lights Out" and Variations with Linear Algebra (O)

Presenter: Joseph Carman

Faculty Project Advisor: Matt Lunsford

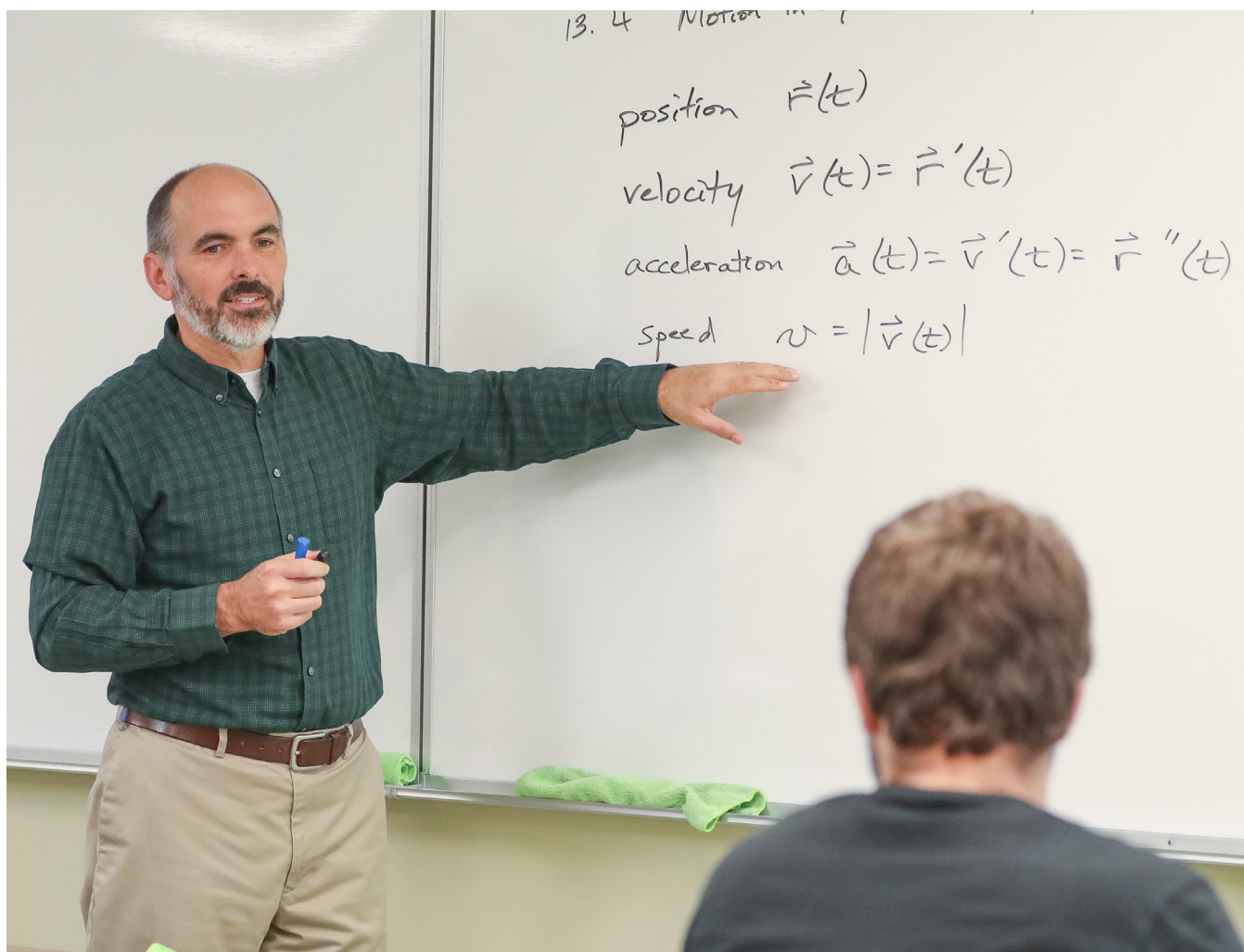
Using linear algebra, we model the game Lights Out. The game is played using a 5×5 square grid of lights in which some lights are turned on and some are off. The objective of the game is to turn off all the lights from a configuration, using the rules of the game. We construct a matrix that represents the rules of the game and a matrix equation whose solution yields a strategy for winning. The matrix equation models how to obtain a solution of the game (if it exists) from the scrambled configuration. We expand the model to grids ranging from a 1×1 to a 9×9 representations of the game. Then we explore the same process but for a variation of the game called "Knight's Move". The talk will end with results and observations for further research.

Symplectic Algorithms for Hamiltonian Dynamical Systems (O)

Presenter: Josiah Hayes

Faculty Project Advisor: Troy Riggs

In a Hamiltonian dynamical system, 'area' in the phase space of the system is conserved over time. Symplectic algorithms are numerical algorithms that solve for the time evolution of a Hamiltonian system and are explicitly designed to preserve areas in phase space. Due to their area-preserving properties, symplectic algorithms often demonstrate much higher accuracy over long time intervals than the equivalent non-symplectic numerical algorithms for Hamiltonian systems. However, symplectic algorithms are still susceptible to rounding error as they use finite-precision floating-point numbers in their computations. We describe a modified symplectic method due to Robert Skeel that takes rounding errors into account, and we mathematically verify the accuracy of this method for the case of the simple harmonic oscillator. ■





The Redemption Oratorio: From Death to Life—A Hymn of Hope (O)

Presenter: Anna Guelcher

Faculty Project Advisor: Mark McDowell

This project consists of the presentation of an original oratorio, *The Redemption Oratorio*. The oratorio follows the Biblical story of Anna and Simeon (based on Luke 2 passages). It explores how they work with their own mortality and the mortality of their loved ones as they faithfully anticipate the coming of Christ. This oratorio demonstrates how Christ has conquered death. Rather than fearing death, believers can rejoice in the hope and joy that Jesus brings. The orchestration for this 25–30-minute work includes soprano solo, baritone solo, chorus, string quartet, and piano. Additionally, it incorporates elements of species counterpoint, lament bass, cyclical unity, thematic coherence, classical and modern forms and harmonic structures, thematic transformation, original libretto, modification of a hymn, and thematic motifs. The presentation highlights the research, compositional aspects, and thematic and theological elements demonstrated in the oratorio. ■



NURSING [GRADUATE]

Increasing Referrals for High-Risk Screening and Genetic Testing for Breast Cancer Using QR Codes: A Quality Improvement Project (O)

Presenter: Cassie Garner

Faculty Project Advisor: Cathy Ammerman

Early detection and prevention are two critical components to beating breast cancer. Providing patients with health information about their potential risks and the availability and benefits of genetic testing can help save lives. This quality improvement project allowed patients sitting in a cancer clinic imaging waiting room to access a QR code survey linked to a risk assessment tool. The patients identified as high-risk were contacted and referred to the genetic counseling Nurse Practitioner who explained their risk, offered genetic testing, and advised them on appropriate screenings that would help them and their provider inform their individualized treatment plan. The results show that using QR codes in clinical can improve cancer screening and patient care.

Teaching Clinical Judgment Through Simulation: A Quality Improvement Project (O)

Presenter: Macy Morrison Arnold

Faculty Project Advisor: Christina Davis

The art of simulation has long been recognized as an effective learning tool for nursing students. Still, nursing students continue to face one of the most significant challenges: translating classroom knowledge into clinical judgment when faced with patient specific challenges. While clinical reasoning and judgment have been integral parts of nursing curricula, the ways in which this content is assessed need to be carefully tailored to help students effectively apply their knowledge in real-time clinical settings. An essential component of the simulation experience is debriefing, which plays a pivotal role in reinforcing learning. Debriefing allows students to reflect on their performance, evaluating what worked well and identifying areas of improvement. Through modifying standard debriefing techniques, this project assists nursing students in bridging the gap between theory and practice, ultimately strengthening their clinical decision-making skills.

Antenatal and Postpartum Depression Screening: A QI Project (O)

Presenter: Aubrey Tucker

Faculty Project Advisor: Cathy Ammerman

Antenatal and postpartum mood disorders often go undiagnosed and untreated as they are perceived as normal hormonal changes. The introduction of the Edinburgh Postpartum Depression Screen, or EPDS, opens the doors of communication between providers and their patients. The screening tool asks specific questions to get patients

talking about their mental health and help them understand that certain feelings are not necessarily related to hormones but can be treated. This tool was put into practice at a women's health clinic. The results show that this tool successfully identifies patients who struggle with depression or anxiety and can allow them to get the help they need.

Providing Structure and Fostering Communication within Mental Health Multidisciplinary Team Meetings through Application of Rules of Order (O)

Presenter: Drew Lewis

Faculty Project Advisor: Christina Davis

This quality improvement project aims to improve communication within multidisciplinary team meetings, specifically in the area of mental health. A problem was identified during the mental health multidisciplinary team meetings. This issue is effective communication among team members. These members with widely varying backgrounds and professional training can also find effective communication challenging, leading to a disordered presentation of said meetings. This is a problematic issue for multidisciplinary teams since the outcome of these meetings should serve to promote improved patient care. If the meeting, which was assembled specifically for communication, fails to communicate, then the patient will consequently suffer. The quality improvement that was applied attempted to remedy this disorder by applying a modified version of Robert's Rules of Order, also known as parliamentary procedure, to these meetings. Surveys, designed to measure the perspective of participants, were administered at planned intervals to gather this data. The results were mixed across several preselected themes. However, some positive results and implications could shape how interdisciplinary teams meet in the future.

Comparison of International Health Care Systems: Sweden (P)

Presenters: Jake Curtis, Octavio Rivera-Sanchez, and Zach Schwabe

Faculty Project Advisor: Shari Wherry

This presentation explores Sweden's healthcare system, emphasizing its structure, financing, and global standing. Sweden operates under a single-payer model, primarily financed through taxes, ensuring equitable access to healthcare services. The system prioritizes universal coverage, with minimal out-of-pocket expenses for patients. Healthcare providers are publicly employed or contracted. Key discussion points include reimbursement models, provider choice, and challenges such as managing costs and meeting increasing demands from an aging population. Comparative analysis highlights Sweden's ranking by the World Health Organization (WHO) and the allocation of



its Gross Domestic Product (GDP) to healthcare. Sweden's system shows how geography, demographics, and cultural values influence healthcare organizations. This poster aims to foster an understanding of Sweden's healthcare system, identify lessons applicable to other developed nations, and evaluate its adaptability to emerging global challenges.

Comparison of International Health Care Systems: Mexico (P)

Presenters: Matthew Kelly, Kenton Lee,
and Kristopher Stone
Faculty Project Advisor: Shari Wherry

Mexico's healthcare framework is divided into public and private sectors. The public system is administered by three primary agencies: the Mexican Institute of Social Security (IMSS), serving formal sector workers; the Institute of Safety and Social Services for Public Sector Workers (ISSSTE), catering to government employees; and the Institute of Health for Welfare (INSABI), established in 2020 to replace Seguro Popular providing care for uninsured populations, including informal laborers. Funding is government-backed, with eligibility dependent upon employment status and sector. The private sector offers premium services through privately owned hospitals and clinics for those who can afford private insurance. Finally, the Mexican Armed Forces operate its own independent healthcare network. Scholars, such as Reich (2020), highlight challenges in achieving universal health coverage and equity within this fragmented system, despite INSABI's implementation to meet marginalized populations.

Comparison of International Health Care Systems: Russia (P)

Presenters: Ze Erica Duncan, April Robinson,
Stefannie Wilkes-Pounders
Faculty Project Advisor: Shari Wherry

This poster is an informative explanation of the Russian Healthcare system as compared to other International Healthcare systems. With a population of approximately one hundred forty-five million, the life expectancy of a Russian citizen averages seventy years old (WHO, 2023). Healthcare expenditures make up 7.39% of the Russian Federation's Gross Domestic Product (GDP), (WHO, 2023). Russia's healthcare system encounters several challenges, including funding issues, staff shortages, salary disparities, and quality and accessibility of care. Russia has a universal healthcare model with a single-payer system called the Semashko Model (Shishnhkin, 2022). This model is supported by a mix model, or reimbursement that includes mandatory health insurance as well as other entities (Nikoloski et al, 2024). Medical services, pharmaceuticals, medical devices, and healthcare infrastructure are productions within the Russian healthcare system. Russian citizens can access both public and private healthcare provider choices based on their needs.

Comparison of International Health Care Systems: Japan (P)

Presenters: Ryan Blackburn, Baylee Bridges,
and Anna-Grace Terry
Faculty Project Advisor: Shari Wherry

Japan's healthcare system is a model of universal health coverage that balances cost, quality, and accessibility.

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Insurance enrollment is mandatory and is funded primarily by taxes and individual contributions. Patients are expected to pay approximately 30% of the cost of care, with exceptions for children, the elderly, and low-income families. A unique feature of Japan's system is direct access to specialists and hospitals without referral, giving residents freedom to choose their healthcare providers. Preventative care is a priority in maintaining public health through emphasis on constructing individual nutrition plans and maintaining strict guidelines for infection control. Japan is one of two countries with fewer hospital admissions than the United States. Like many systems worldwide, Japan's healthcare system faces challenges related to an aging population, regional disparities, and sustainability of cost and quality. Despite these issues, Japan's healthcare system is regarded as one of the most effective worldwide.

Comparison of International Health Care Systems: Australia (P)

Presenters: Shawn Lords, Wesley Russell,
and Lucas Wigal

Faculty Project Advisor: Shari Wherry

Australian healthcare operates predominantly through its system of Medicare, which provides universal healthcare coverage for its citizens. Funded through federal taxes, this system provides coverage for medical services as well as subsidies for prescription medications. In addition, Australians may opt to purchase private health insurance as a supplement to cover services not typically covered under Medicare, such as dental or vision coverage (Australian Institute of Health and Welfare, 2024). This poster aims to provide an analysis of the Australian healthcare system compared with other countries regarding payer system, financing, reimbursement, production, provider choice, challenges faced, World Ranking (WHO), and Gross Domestic Product spent on healthcare.

Comparison of International Health Care Systems: France (P)

Presenters: Samantha Hall, Rachel Patton,
and Ashley Steinberger

Faculty Project Advisors: Shari Wherry and
Cathy Ammerman

The French healthcare system is recognized by the World Health Organization as one of the best, serving as a model for national health insurance coverage. It provides broad, universal benefits with cost-sharing mechanisms for all essential services. France employs a mixed healthcare model, combining social health insurance with tax-based revenue financing, ensuring nearly 100% coverage of its population under statutory health insurance. Leadership within the system is decentralized among

various governmental leaders. In stark contrast, the U.S. healthcare system is a mixed public and private insurance model, resulting in notable differences in healthcare structure and accessibility. This presentation explores the advantages and disadvantages of the United States Healthcare System and France's universal healthcare system.

Comparison of International Health Care Systems: Canada (P)

Presenters: Taylor Cochran, Elisabeth Tribeck, and
Destene Webb

Faculty Project Advisor: Shari Wherry

Canadian healthcare is considered a Medicare system funded by the federal government (Government of Canada, 2023). All individuals have access to universal healthcare regardless of their financial status because the annual taxes each citizen pays cover medical care costs. Canada spends roughly 12.3% on health expenditures in their gross domestic product (GDP), indicating that citizens' health is a high priority and a financial burden (WHO, 2024). Overall, Canadians spend less on healthcare and have better medical outcomes and longer life expectancies than Americans (WHO, 2024). This poster will compare the Canadian healthcare system's finances, supply, production, reimbursement, choice of provider, and challenges within the system to other healthcare systems in countries of similar economic status.

Comparison of International Health Care Systems: United States of America (P)

Presenters: Christine Deere, Amy Gray, and Corey Long
Faculty Project Advisor: Shari Wherry

This presentation will provide a comprehensive overview of healthcare economics in the United States (U.S.). Health coverage in the U.S. comprises private and public insurance options, and with the implementation of the Affordable Care Act, we have seen a steady decline in the uninsured population. However, the U.S. has the highest health expenditures per capita, with worsening health outcomes. This analysis will include key topics discussing payer systems, financing and supply of resources, and reimbursement programs. The discussion will include information on the production of healthcare systems, patient-provider choices, and current healthcare challenges policymakers and consumers face. Finally, we will examine the United States' world ranking according to the World Health Organization and the gross domestic product spent (GDP) on healthcare in our country. This overview will offer a deeper understanding of the economic landscape of the United States healthcare system.

Comparison of International Health Care Systems: Spain (P)

Presenters: Kelsey Myracle, Sydney Naseman, and Renée Rogers

Faculty Project Advisor: Shari Wherry

In the country of Spain, the public healthcare system provides universal coverage, guaranteeing that all residents have access to quality medical care. Funded primarily through taxes, the public health system offers services such as emergency services, routine care, and inpatient treatments. These services are typically provided at minimal costs, often being free of charge. Spain's healthcare system is 70% public and 30% private (International Trade Administration, 2024). The average life expectancy in the country is 82.7 years, compared to the world life expectancy of 71.4 years (World Health Organization, 2025). The main focus of health reform in Spain is centered on the scope, extensiveness, and depth of Sistema Nacional de Salud (SNS) with a special focus on vulnerable populations (Bernal-Delgado, et al., 2024). A large majority of medical supplies are imported to Spain in order to provide a high caliber of care (International Trade Administration, 2024). Spain's public health system is applauded for its productivity, high quality of care, and affordability.

Comparison of International Health Care Systems: China (P)

Presenters: Denitra Carter, Yi Peng, and David Pierre-Louis

Faculty Project Advisors: Shari Wherry and Cathy Ammerman

This poster compares the healthcare systems of China and the United States, focusing on key domains such as payer systems, financing and supply, reimbursement, production, provider choice, challenges, World Health Organization (WHO) ranking, and gross domestic product (GDP) spent on healthcare. The poster will examine China's healthcare system, which provides near-universal coverage for its citizens through a combination of publicly funded basic medical insurance and complimentary private health insurance, which is contrasted from the more privatized structure of the United States system (Yi, 2021). In addition, this poster will explore the significant challenges China faces, including an uneven distribution of healthcare resources and low participation in insurance payments (Chen & Liu, 2023). This analysis will make comparisons to the United States healthcare system and elucidate why China ranks 16th globally in healthcare according to the U.S. News & World Report (U.S. News, 2023).

Comparison of International Health Care Systems: India

Presenters: Jonathan Hooper, Elijah Pecheny, and Rand Pressley

Faculty Project Advisor: Shari Wherry

The intention of this project is to discuss the healthcare system in India. We will present an overview of the system as well as the economics, breaking down the spending and payer systems. India has recently been spending around 3.3% of its GDP on healthcare, which is consistent to the average of the last few decades (MacroTrends, 2025). We will also delve into possible reimbursement infrastructure and production. For example, India has a decentralized approach to healthcare, where the states are primarily responsible for free health services available to Indian citizens (Gupta, 2020). Finally, we will discuss benefits and challenges of the healthcare system in India.

Comparison of International Health Care Systems: Israel (P)

Presenters: Shelby Harris, Lauren Johnson, and Audra Romney

Faculty Project Advisor: Shari Wherry

Israel's healthcare system ranks 12th globally, outperforming other countries in healthcare (Girvan, 2024). Concepts such as how Israel differs from the United States will be explored. Israel's healthcare system includes four non-profit healthcare programs (Waitzberg, 2025). Furthermore, individuals have free choice of providers (Katz & Waitzberg, 2023). Reimbursement changes are based on the type of care (Tikkanen et al., 2020). However, reimbursement is provided by the National Health Insurance Law (International Trade Administration, 2023). Challenges in the healthcare system like the aging population are being improved by electronic health (International Trade Administration, 2023). In 2017, Israel's healthcare accounted for 7.4% of the gross domestic product (GDP), over half of it being financed publicly. Despite changes in healthcare technology and the need for increased care for the aging population, the GDP has remained stable for twenty years (Tikkanen et al., 2020). Various influences play a role in the structure of Israel's health care organization.

Development of Mindfulness-Based Stress Reduction CME for Anesthesia Providers (P)

Presenters: Evan Parkinson and Samuel Vrinios

Faculty Project Advisor: Jordan Palmer

Anesthesia providers, like most healthcare professionals, are at risk of experiencing extreme stress, which can eventually lead to burnout. Long work hours, patient deaths, and general stress all contribute to this risk. Not only does this

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place providers at a higher risk for depression, substance abuse, and suicide, but it can also negatively impact patient care. Patients receiving care from providers experiencing burnout are more likely to be victims of medical errors and suffer adverse outcomes due to a lack of adherence to practice standards. Mindfulness-based stress reduction (MBSR) is a method that has been proven effective in managing stress and, therefore, in reducing burnout. To help combat this burnout, a presentation was prepared with the intention of creating a continuing medical education (CME) module that will be available for credit. This module will be sent to CRNAs affiliated with Union University. Understanding of the material will be assessed through pre-tests and post-tests. The purpose of this module is to educate CRNAs and provide them with tools to cultivate resilience and find peace amid the inherent stress associated with providing anesthetic care. Our research findings suggest that autonomic nervous system activation due to prolonged mental stress can have profound and measurable negative physiological effects. This is further evidenced by salivary cortisol measurements in individuals reporting high stress levels. Additionally, prolonged stressors such as long work hours, patient deaths, and stressful work environments have all been shown to increase the risk of burnout. This may lead healthcare providers to substance abuse, depression, and even suicide. Given the challenges associated with high work stress, our research focuses on mindfulness-based stress reduction (MBSR). These techniques have been shown to reduce burnout, anxiety, and stress. In addition, these strategies are ideal for the busy work schedules of healthcare providers, allowing them to practice these techniques whenever they experience symptoms of burnout.

Pill Count Cards and Compliance: A Quality Improvement Project (P)

Presenter: Crystal R. Hill

Faculty Project Advisor: Brad Creekmore

Patients suffering from chronic pain who are treated in pain management clinics often receive prescribed opioids as part of a regularly scheduled regimen. Unfortunately, drug overdose stands as the leading cause of accidental death, with a significant number of these overdose deaths involving opioids. However, a recognition gap exists between patients and providers regarding opioid medication noncompliance. Equipping providers to better identify instances of medication noncompliance and implementing a pill count card screening tool can facilitate timely treatment interventions and mitigate the risk of medication overutilization among patients. This tool was successfully trialed at a pain management clinic, and the results demonstrate its effectiveness in identifying patients at risk for medication overuse and enhanced compliance with prescribed treatment.



An Experiential Educational Project: Enhancing Prophylactic Ondansetron Utilization in Spinal Anesthesia for Elective Cesarean Sections (P)

Presenters: Meghan Pinson and Lindsay Votaw

Faculty Project Advisor: Jordan Palmer

The administration of neuraxial anesthesia in parturients frequently leads to hypotension, which can pose significant risks to both mother and fetus. This phenomenon is primarily driven by sympathetic blockade and the activation of the Bezold-Jarisch reflex (BJR), where serotonin-sensitive baroreceptors and mechanoreceptors play a crucial role. Ondansetron, a 5HT₃ receptor antagonist, has demonstrated potential in reducing hypotension following spinal anesthesia. Despite this, its prophylactic use in obstetrics remains inconsistent due to the lack of definitive evidence tailored to this population. Addressing this gap, the project aims to enhance anesthesia providers' understanding and usage of prophylactic ondansetron during cesarean sections through an educational intervention hosted on a Continuing Medical Education (CME) platform targeted at current Certified Registered Nurse Anesthetists.

Unmasking the Evidence: A Qualitative Inquiry into CRNA Pre-intubation Ventilation Practices (P)

Presenters: Paige Eberle and Laura Ellis

Faculty Project Advisor: Jordan Palmer

During the induction of anesthesia, providers verify their ability to mask and ventilate a patient after administering sedation medications and before giving a paralytic agent. However, with modern reversal agents, this step is occasionally bypassed by anesthetists in favor of proceeding directly to intubation. We explore the current practices among Certified Registered Nurse Anesthetists (CRNAs) who perform direct laryngoscopy in multiple practice settings across Tennessee. Through a nine-question survey conducted over 30 days with 20 CRNAs, the study

investigates whether CRNAs confirm mask ventilation before administering a paralytic agent or administer a paralytic first. The survey revealed significant variation in practices, with responses indicating that 35% of CRNAs routinely confirm mask ventilation, 35% never do, and 30% sometimes do. Additionally, 70% of respondents would not confirm mask ventilation in a healthy patient (ASA I-II) with no indication for rapid sequence induction (RSI). Factors such as BMI, known difficult airways, and clinical scenarios were commonly cited as influencing the decision to confirm ventilation. By analyzing these self-reported practices, this project aims to bridge the gap between traditional methods and current research, highlighting the need for evidence-based updates to clinical practices. The findings provide insights that should guide future recommendations and improve patient outcomes during anesthesia induction. Further long-term studies regarding the occurrence of “Can’t Intubate, Can’t Ventilate” situations in the presence of modern reversal agents need to be investigated. Both the literature and current provider habits indicate that a practice change recommendation is indicated.

Glucagon-Like Peptide-1 Agonists and the Benefits of Gastric Ultrasound as a Preoperative Assessment Tool: A Quality Improvement Project (P)

Presenters: Alexis Alexander and Tiffani Ivery
Faculty Project Advisor: TaMara Carter

This Doctor of Nursing Practice (DNP) project aimed to develop an evidence-based teaching tool to promote the use of Gastric Ultrasound as a pre-anesthetic tool used by Certified Registered Nurse Anesthetists (CRNAs) and Medical Doctors of Anesthesia (MDA). Within the past decade, there has been increased usage of glucagon-like peptide-1 agonists (GLP-1) agonists among patients diagnosed with diabetes and obesity. One of the significant side effects of GLP-1 agonists is delayed gastric emptying, which has led to increased risks of aspiration during anesthetic delivery despite adhering to “nothing by mouth” (NPO) guidelines. Recent studies have shown that ultrasound can accurately measure gastric contents and identify patients at risk of aspiration.

Have You Tried Methadone Lately? Practicing Provider Utilization Trends (P)

Presenters: Amy Haynes and Josh Sellman
Faculty Project Advisor: Jordan Palmer

This project reviews the prescribing trends of Methadone by Certified Registered Nurse Anesthetists (CRNAs) in various settings across Tennessee. We collected information from CRNAs at multiple hospitals through informal surveys and structured conversations. If a CRNA used Methadone, we inquired about the type of surgeries, dosages, pain scores and reduction in opioid use. If Methadone

wasn’t utilized, we asked about the barriers preventing its use and if the CRNA would be open to using methadone if barriers were removed. A thorough literature review indicates that peer-reviewed studies have shown significant improvements in postoperative pain management and reductions in opioid use among patients receiving perioperative Methadone compared to those treated with Morphine, Fentanyl and Dilaudid. Based on the evidence gathered from the surveys, we found Methadone to be significantly under-utilized. With support from evidence-based practice, we determined a need for a practice change to integrate Methadone more frequently perioperatively.

Alternative Approach to Teaching the Difficult Airway Algorithm (P)

Presenter: Reece Moody
Faculty Project Advisor: Ross Palmer

Anesthesia practice is an evolving art as research and clinical practice continue to provide updated tools and procedures. Arguably the most important skill a CRNA possesses is airway management. This is heightened when we are referring to a crisis situation such as the “Cannot intubate, cannot ventilate” scenario. A gap between clinical expectations and trends in human behavior are a possible point of interest for reducing poor patient care outcomes. A new method known as the Vortex Approach provides a simplistic overview of the steps necessary to manage a difficult airway, while being rooted in the science of human behavior. In this study I surveyed practicing CRNAs to determine their willingness to utilize new teaching tools in contrast to the current standard seen with the ASA Difficult Airway Algorithm. My findings suggest current providers host a high level of confidence in airway management, but also a noted understanding that teaching practices may be evolving. The physical model designed by the Vortex Approach researchers provided an evident advantage that CRNAs were interested in including in SRNA or new provider education. Implications for practice include encouraging continued research in teaching methods combined with the utilization of human behavior basics in clinical response to airway management. This tool is just one example of how the introduction of physical models and cart design may improve both teaching effectiveness and evidence-based response.

Success Rate of Arterial Line Placement with Palpation Versus Ultrasound-Guided Technique: An Experiential Project (P)

Presenters: Shannon Lantz and Andrea Montani
Faculty Project Advisor: Ross Palmer

This project aimed to determine whether success rates with arterial line placement using ultrasound-guided technique is superior to palpation technique. Some

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facilities and practitioners continue to use the traditional method of palpation for arterial line insertion. According to our research, using ultrasound was associated with decreased first-attempt failure, mean attempts to successful placement, and development of hematomas. For this project, a review of journal articles on the insertion of arterial lines with ultrasound-guided versus palpation technique was conducted. Once complete, the information and results from the articles were compiled and presented to anesthesia providers via PowerPoint presentation.

How CRNAs Translate Evidence into Practice (P)

Presenters: Krystle-Anne Crespo and Tejal Patel

Faculty Advisor: TaMara Carter

As anesthesia research advances, gaps emerge between the latest knowledge and common practice. Certified Registered Nurse Anesthetists (CRNAs) have considerable autonomy to define their own practice within their role of providing safe, patient-centered anesthesia and analgesia, and most seek to conform to the latest evidence-based practices. Understanding when, why and how CRNAs update their practice can improve the socialization and implementation of best practices by individuals and organizations. In this study we conduct a survey of practicing CRNAs to better understand their knowledge of evidence-based practice and which sources of information they use to stay up to date in their field. Informal interpersonal communications were the most frequently used source of information, however we also uncovered notable differences in evidence sources and attitudes toward translating and socializing best-practices that may have implications for how new evidence can and should be communicated. An opportunity may exist to increase the status of formal knowledge sharing through journal articles, trade publications, and professional practice manuals to ensure potential practice changes are based on the highest quality of evidence.

Administration of Calcium for Resolution of Hypotension: An Experiential Educational Project (P)

Presenters: Carmen Abarca and Ithzel Solis

Faculty Project Advisor: TaMara Carter

The standard treatment for intraoperative hypotension primarily involves vasopressors, despite their known adverse effects. This educational project explores intravenous (IV) calcium as an alternative therapy by comparing the efficacy of calcium chloride (CaCl) and calcium gluconate. Literature reviews and clinical data indicate that CaCl, with its higher calcium ion concentration, more effectively enhances cardiac output and mean arterial pressure (MAP). A survey of 14 CRNAs assessed the use of calcium chloride in managing hypotension. Initially, most preferred vasopressors, and their confidence in using CaCl was low. After an educational intervention, confidence levels

increased significantly, with 13 out of 14 CRNAs rating their confidence as 5 out of 5. These findings highlight the need for greater awareness of the benefits of IV calcium in managing hypotension, emphasizing its potential to improve patient outcomes and reduce reliance on vasopressors.

The Incorporation of Plastination for the Education of Interspace Between Popliteal Artery and Capsule of the Knee Regional Anesthesia (P)

Presenters: Brian Julian and Michael Reiser

Faculty Project Advisor: Andrew Rice

This project sought to enhance the confidence and competence of anesthesia providers in performing the ultrasound-guided regional anesthesia technique of the interspace between the popliteal artery and the capsule of the knee (iPACK) using a plastinated human cadaver's proximal knee. Mastery of ultrasound-guided regional anesthesia is crucial for anesthesia professionals, and the plastinated model was expected to provide a tangible learning resource, as the specimen highlights landmarks seen on ultrasound. Previous research by Pal et al. (2022) has shown that plastination is an excellent resource for teaching and learning anatomical landmarks. In this project, a cadaverous lower extremity was prepared by resecting cross-sectional specimens of the proximal knee. Specimens were plastinated using Union University's Plastination lab, and pertinent landmarks were highlighted. Participants completed pre- and post-surveys to evaluate their confidence and competence in performing the iPACK block before and after exposure and education using the plastinated specimen. The findings revealed that the plastinated model increased participants' confidence and competence, particularly in demonstrating the iPACK block.

Utilizing Plastination Models as Teaching Tools for Regional Anesthesia (P)

Presenters: Dustin Lane and Javaris Polk

Faculty Project Advisor: Ross Palmer

This project aimed to evaluate the use of plastinated cadaver models as a primary teaching tool in improving the confidence of clinicians performing the popliteal nerve block. Plastinated models allow the learner to view the anatomy in the transverse plane to become familiar with the depth and proximity of the nerves and other vasculature throughout the fascial planes. Complications related to regional anesthesia and improper anatomical identification include direct nerve damage, intravascular injection, local anesthetic systemic toxicity (LAST), hematoma, and poor nerve blockade (Liu et al., 2019). Therefore, proper anatomical identification under ultrasound guidance has become the gold standard in conducting a safe and effective nerve block. Data was collected using a pre- and post-survey of those who participated in the educational

in-service. The surveys evaluated if the participants' confidence in performing the popliteal block improved after using the plastinated specimen and if utilizing plastinated specimens is an effective teaching tool. The results concluded that overall confidence improved, and the plastinated specimens were viewed as effective teaching tools.

Pulsatile Cadaver's for Future Anesthesia Education (P)

Presenters: Melanie Collazos-Valencia, Emily Fulkerson, and Julia Stauffer

Faculty Project Advisor: Andrew Rice

The present curriculum for nurse anesthesia programs mandates students to achieve mastery and a comprehensive understanding of human physiology and anatomy, thereby ensuring they acquire the necessary skills and knowledge to provide superior quality of care. This project aims to enhance anesthesia education by introducing the development of a pulsatile cadaver model and demonstrating how it was created. The initiative integrates an evidence-based update on using pulsatile cadavers to help students recognize key anatomical structures relevant to ultrasound-guided anesthetic procedures. Researchers will present the process of making a still-Thiel cadaver pulsatile to implement future projects of hands-on cadaver workshops using ultrasound-guided technology. The impact of this educational approach aims to compare the effectiveness of pulsatile versus non-pulsatile Thiel cadaver experiences and provide guidelines for future DNP students on integrating this practice into their program.

Enhancing Anesthesia Providers' Knowledge of Ankle and Foot Regional Anesthesia Utilizing a Plastinated Specimen (P)

Presenters: Samuel Jones and Gaines Wilson

Faculty Project Advisor: Andrew Rice

Performing regional anesthesia of the foot and ankle is underutilized by anesthesia providers. Ankle and foot surgeries performed under general anesthesia are associated with several complications, including more extended time in the hospital, increased use of postoperative opioids, and increased mortality. Anesthesia providers must have the knowledge and skill to perform regional anesthesia of the foot and ankle to provide safe and effective anesthesia. This research project examines how the utilization of a plastinated foot specimen can enhance anesthesia providers' knowledge of foot and ankle regional anesthesia. An educational, model-focused lecture allowed anesthesia providers to learn, interact, and practice foot and ankle regional anesthesia with a plastination model. Results were collected through surveys focusing on providers' understanding and likelihood of utilizing ankle and foot nerve blocks after experience with the plastination model.

Magnesium Sulfate: A Qualitative Inquiry into Its Benefits and the Importance of Assessing Magnesium Levels Prior to Administration (P)

Presenters: Devin Daffron and Maxwell Obasuyi

Faculty Project Advisor: Jordan Palmer

The use of intraoperative magnesium sulfate as an adjuvant to pain management may provide some benefits because it has demonstrated analgesic-sparing effects with anesthesia, which allows the mitigation of opioid usage. The safe administration of anesthesia necessitates thorough management of patient pain, including reviewing the patient's labs, allergies, and medical history. Importantly, it is a cost-effective solution. An informal survey found that many certified registered nurse anesthetists who use magnesium sulfate as an adjuvant for pain management do not check patients' magnesium blood levels before or after administering magnesium sulfate. Through informal investigation and evidence-based literature review, this project examines whether obtaining magnesium blood levels is necessary and determines practice guidelines for using magnesium sulfate during the perioperative period.

Improving the Data Collection Rate of Social Determinants of Health in a Rural Federally Qualified Community Health Center: A Quality Improvement Project (P)

Presenter: Phillip Tatum

Faculty Project Advisor: Cynthia Powers

Social determinants of health (SDOH) are defined as the conditions in which people live, work, play, and age. As healthcare organizations transition to value-based care, leveraging social determinants of health data plays a crucial role in improving patient outcomes and reducing healthcare costs. Community health center staff utilize standardized tools such as the PRAPARE screening tool to collect this information, allowing them to better connect patients with essential community resources that support their overall health and well-being. This quality improvement project aimed to enhance the collection rates of social determinants of health data among patients seeking care at a rural Federally Qualified Community Health Center, ultimately fostering more comprehensive and effective patient-centered care. The project was successful in advancing a positive increase in SDOH data collection rates which allowed new health center patients the opportunity to be linked to much needed resources. ■

PHARMACY [GRADUATE]

Unraveling the Connection Between Gut Microflora and Inflammatory Bowel Disease (P)

Presenter: Noor Alnadi

Faculty Project Advisor: Lunawati Bennett

Inflammatory bowel disease (IBD), including Crohn's disease and ulcerative colitis, is a chronic gut inflammation influenced by genetic, environmental, and microbial factors. In addition to medications, dysbiosis, an imbalance in gut microbiota, can affect IBD progression and treatment response. Therapies like probiotics, prebiotics, and fecal microbiota transplantation show promise in restoring microbial balance, though their long-term effects require further study. Drugs such as azathioprine (AZA), mercaptopurine (MP), and 5-aminosalicylic acid (5-ASA) also can modulate gut bacteria, with AZA and MP cause inhibition of *Campylobacter concisus*, while 5-ASA's effects on IBD may vary by bacterial strain. As healthcare providers, understanding current research on gut flora, integrating microbiota-based strategies can provide microbiome-targeted therapies for IBD.

Application of the PRECEDE-PROCEED Model to Improve Mental Well-Being Among First-Year Pharmacy Students (P)

Presenters: Halli Friedrich, Caden Greene, Matthew Lee, Sarah Rogers, and Jonquil Simms

Faculty Project Advisor: Sean King

This project will utilize the PRECEDE-PROCEED Model to provide a structured approach for assessing and addressing mental well-being challenges among first-year pharmacy

students. The framework consists of two key phases: PRECEDE, which focuses on identifying predisposing, reinforcing, and enabling factors affecting students' mental health, and PROCEED, which involves implementing and evaluating interventions. The results of this assessment will allow factors such as academic stress, social support, and institutional resources to be analyzed in order to develop targeted strategies. Application of the PRECEDE-PROCEED Model will allow the research team to design evidence-based interventions such as stress management programs, peer support networks, and curriculum modifications to enhance student resilience and well-being. Furthermore, the evaluation component ensures continuous improvement and sustainability of these initiatives. Integrating the PRECEDE-PROCEED Model into pharmacy education fosters a proactive approach to mental health support, equipping students with the necessary resources to navigate academic and personal challenges effectively.

Shot of Confidence: Empowering Pharmacists to Overcome Vaccine Hesitancy (P)

Presenter: Darius Gale

Faculty Project Advisor: Sean King

Vaccine hesitancy and antimicrobial resistance pose significant public health challenges that pharmacists are uniquely positioned to address. This continuing education (CE) program aims to equip pharmacists with the knowledge and skills necessary to combat misinformation, increase vaccine confidence, and promote responsible antibiotic use. The curriculum will cover factors contributing to vaccine hesitancy, including historical distrust and cultural beliefs, while providing evidence-based strategies to enhance patient education and immunization practices. Additionally, pharmacists will explore the principles of antimicrobial stewardship, learning how to prevent unnecessary antibiotic prescriptions and mitigate the spread of resistant pathogens. Through interactive case studies, policy discussions, and break-out sessions, participants will gain practical tools to support public health initiatives and expand their role in immunization services. By completing this program, pharmacists will strengthen their ability to advocate for vaccines, optimize antimicrobial use, and contribute to the global effort to combat infectious diseases effectively.

Leveraging Technology for Public Health: A Continuing Education Program for Pharmacists (P)

Presenter: Andrew Nguyen

Faculty Project Advisor: Sean King

Advancements in technology are reshaping public health and pharmacy practice, necessitating continuous professional development for pharmacists. This continuing education (CE) program is designed to equip pharmacists with knowledge of cutting-edge technologies and their applications in public health. The curriculum



covers topics such as digital health tools, tele-pharmacy, artificial intelligence in medication management, and data-driven approaches to disease prevention. Interactive modules and case-based learning will provide pharmacists with hands-on experience using electronic health records, mobile health applications, and real-time patient monitoring systems. Additionally, the program emphasizes strategies for integrating these innovations into daily practice to enhance patient care, improve medication adherence, and optimize healthcare delivery. Participants will gain a comprehensive understanding of how technology can drive public health improvements. By completing this program, pharmacists will be better prepared to navigate the evolving healthcare landscape and contribute to innovative, patient-centered care.

Advancing Pharmacists' Role in Chronic Disease Management: A Comprehensive Continuing Education Program (P)

Presenter: Carson Corley

Faculty Project Advisor: Sean King

This continuing education (CE) program on chronic disease management will equip pharmacists with the knowledge and skills necessary to enhance patient care and improve health outcomes. Evidence-based strategies for managing prevalent chronic conditions such as diabetes, hypertension, cardiovascular diseases, and asthma are emphasized. The importance of medication therapy management, patient counseling, lifestyle interventions, and collaborative care models will be highlighted. The program also describes how advancements in digital health tools and tele-pharmacy are utilized to optimize patient monitoring and adherence. Assessment methods, including pre- and post-training evaluations will be used to ensure the effectiveness of the curriculum. By participating in this CE program, pharmacists will strengthen their role as essential healthcare providers, contributing to improved patient engagement, reduced hospitalizations, and better disease control. Continuous professional development in chronic disease management fosters a proactive and patient-centered approach in pharmacy practice, ultimately enhancing public health outcomes.

Assessment of Pharmacy Student Perceptions and Practices Regarding Didactic Course and Instructor Evaluations (P)

Presenters: Christian Dudley, McKenna Hunter, and Jonquil Simms

Faculty Project Advisors: Mark Stephens and Nate Daniels

Course evaluations play a vital role in assessing curricular quality and guiding instructional improvements. When completion rates are high, student ratings provide a reliable measure of teaching and course effectiveness. However,

several factors can impact participation, including timing, survey fatigue, and skepticism about whether feedback leads to change. At Union University College of Pharmacy (UUCOP), course evaluation completion rates have ranged from 17.9% to 100%, varying by course and student cohort. To better understand the barriers and perceptions surrounding evaluations, a 32-item survey was distributed to current UUCOP students. The survey aimed to identify the most common obstacles to completion, gauge student attitudes toward evaluations, and explore preferences for future improvements. Insights from this study will help enhance the evaluation process, increase participation, and ensure student feedback is effectively used to improve the curriculum.

The Role of the Gut Microbiome in Acne Vulgaris: Implications for Pharmacologic Management (P)

Presenter: Ola Boateng

Faculty Project Advisor: Lunawati Bennett

Acne vulgaris is a prevalent dermatologic condition, primarily affecting adolescents' post-puberty, though it can persist into adulthood. Its pathogenesis is multifactorial, influenced by genetic predisposition, hormonal fluctuations, environmental exposures, diet, and certain medications. Inflammation, sebaceous gland hyperactivity, *Cutibacterium acnes* proliferation, and follicular hyper keratinization have played important role in the pathogenesis of acne. Studies indicate that individuals with acne exhibit reduced microbial diversity compared to those without the condition. Dysbiosis in the gut may contribute to systemic inflammation and exacerbate acne severity. This presentation explores the role of the gut-skin axis in acne pathogenesis and evaluates the potential of probiotic therapy in addition to first-line treatments such as retinoids, benzoyl peroxide, and oral isotretinoin. Given the growing interest in microbiome-targeted therapies, understanding these interactions could inform future pharmacologic strategies in acne management.

Exploring the Relationship between Psoriasis and Gut Microbiome (P)

Presenter: Sandy Saied

Faculty Project Advisor: Lunawati Bennett

Psoriasis is a chronic inflammatory skin condition marked by erythematous, scaly plaques due to epidermal hyperplasia and excessive cell proliferation. It can affect the eyes, joints, and scalp and is linked to metabolic syndrome, diabetes, Crohn's disease, and cardiovascular disease. Triggers include trauma, infections, stress, and smoking, which stimulate keratinocytes to release pro-inflammatory cytokines. Bacterial and viral infections may contribute to flare-ups. Emerging research links psoriasis to gut microbiome dysbiosis, reducing microbial diversity and increasing intestinal permeability. Patients with moderate-to-severe disease exhibit an imbalance in Firmicutes and Bacteroidetes (F/B), affecting

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intestinal homeostasis. Treatments like corticosteroids, vitamin D analogs, and biologics may alter microbiota. Secukinumab (Cosentyx®) increases Proteobacteria and Enterobacteriaceae while reducing the F/B ratio, potentially influencing disease progression. Given the gut-skin-immune connection in psoriasis, healthcare providers must consider these factors to optimize patient care.

Role of The Breast and Intestinal Microbiome in Breast Cancer Development and Response to Therapy (P)

Presenter: Grant Gay

Faculty Project Advisor: Lunawati Bennett

Breast cancer affects nearly 13% of women in their lifetime, and accounts for 30% of female cancer diagnoses. New research has found that the breast tissue itself, while previously considered sterile, contains a unique microbiota. Furthermore, normal and cancerous tissues have been found to contain unique bacterial profiles, which may affect disease progression. The lipopolysaccharide endotoxin, most associated with gram negative bacteria, has been associated with accelerated tumor proliferation and reduced therapeutic outcomes. Additionally, the gut microbiota has the potential to alter the effectiveness of anti-cancer oral chemotherapy. Doxorubicin, a chemotherapeutic,

has been seen to result in better outcomes and reduced adverse effects when there is a higher abundance of intestinal *A. muciniphila*. The gut and breast tissue microbiomes may play a key role in carcinogenesis, and could become a useful biomarker for diagnosis, and a key factor /target of interest when considering therapy.

Role of Gut Microflora in Diabetes Mellitus Type 1 and Type 2 (P)

Presenter: Nate Hogan

Faculty Project Advisor: Lunawati Bennett

The human gut microbiota plays a crucial role in diabetes development and progression by influencing glucose metabolism, insulin sensitivity, and inflammation. Dysbiosis, characterized by an imbalance in gut microbial composition, has been linked to both type 1 and type 2 diabetes, contributing to altered immune responses and metabolic dysfunction. Key microbial metabolites, including short-chain fatty acids, bile acids, and lipopolysaccharides, mediate interactions with host metabolic pathways, affecting glycemic control and insulin resistance. Moreover, emerging research suggests that common diabetes medications, such as metformin, sodium-glucose cotransporter-2 (SGLT2) inhibitors, and glucagon-like peptide-1 (GLP-1) receptor agonists, modulate



gut microbiota composition, potentially influencing therapeutic outcomes. Understanding these microbiota-drug interactions and their metabolic consequences may lead to novel microbiota-targeted interventions, offering innovative strategies for personalized diabetes management.

Microbiomes and Heart Disease (P)

Presenter: Christopher Nunez

Faculty Project Advisor: Lunawati Bennett

Research shows that the gut microbiome significantly influences cardiovascular health, particularly through its interactions with antihypertensive medications. Angiotensin-converting enzyme inhibitors (ACEIs) not only reduce blood pressure but also favorably alter gut microbiota composition by decreasing the prevalence of pathogenic bacteria, such as *Enterobacter* and *Klebsiella*, while increasing beneficial strains like *Odoribacter*. These microbial shifts are associated with metabolic changes, including elevated levels of inositol, a metabolite inversely correlated with harmful bacteria. However, certain gut commensal bacteria, such as *Coprococcus comes*, can metabolize ester-based ACEIs, potentially reducing their efficacy in lowering blood pressure. These findings highlight the complex interplay between cardiovascular medications and the gut microbiome, suggesting that microbial composition can significantly impact therapeutic outcomes. Understanding these interactions is essential for optimizing treatment strategies and mitigating potential adverse effects related to gut microbiota alterations.

Examining the Impact of Intramural Sports on Doctor of Pharmacy Students' Stress, Anxiety, and Belonging (P)

Presenters: Amanda Gammons, Delaney Peterson,
Noah Travis, and Samarah Wallace

Faculty Project Advisor: Taylor Mathis

Students in health care programs, such as pharmacy school, have high levels of stress and anxiety compared to their peers. There is no existing literature examining the benefit of participation in team-based recreational sports. This survey-based quantitative analysis examined well-being for students enrolled in Doctor of Pharmacy Programs throughout the southeastern United States: stress (Perceived Stress Scale), anxiety (Generalized Anxiety Disorder-7), and sense of belonging (Sense of Social Fit Scale). Data were analyzed using Chi-Squared and independent t-tests, as appropriate. 116 participants completed the survey. 81% of respondents reported no participation in intramural sports. The mean GAD-7 score was significantly lower in students engaged in intramural sports compared to those not participating. All other outcomes showed no significant difference. This research demonstrates that participation in intramural sports may reduce anxiety for students enrolled in colleges of pharmacy.



The Importance of Intestinal Microbiota in Rheumatoid Arthritis (P)

Presenter: McKenzie Thomas

Faculty Project Advisor: Lunawati Bennett

Rheumatoid arthritis (RA) is a severe, chronic autoimmune disease characterized by persistent inflammation of the synovial tissue, driven by both biological and environmental factors. One crucial factor recently identified in the prevention, progression, and treatment of RA is the intestinal microbiota. Research has shown that individuals with RA exhibit a distinct intestinal microbiome composition due to microbial imbalance, or dysbiosis, compared to those without the disease. Current therapies, including methotrexate and etanercept, aim to slow disease progression while also influencing the intestinal microbiota. Methotrexate has been found to partially restore microbial balance, with treated patients displaying microbial profiles more like those of healthy individuals, suggesting its potential to reshape microbiome structure and function. Etanercept has been shown to reduce levels of Deltaproteobacteria and Clostridiaceae, microbial groups that are more abundant in individuals with RA or other autoimmune disorders. This presentation highlights the critical role of intestinal microbiota in the development and treatment of RA. ■

PHYSICS & PSYCHOLOGY

PFAS Destruction Technology and Services (O)

Presenter: Rachel Allabaugh

Faculty Project Advisor: Fonsie Guilaran

Per- and Polyfluorinated Substances (PFAS) do not degrade over time through any natural process or environmental conditions and exposure to these chemicals has been connected to negative reproductive effects, increased risk of cancers, interference with hormones, and increased cholesterol and obesity levels. Perma-Fix's solution completely destroys the fluorocarbon chain of PFAS and creates non-hazardous calcium fluoride as the primary byproduct. Clean solid samples were acquired and then contaminated using an Aqueous Film-Forming Foam (AFFF) solution with a known concentration of PFAS. A minimum threshold for the temperature and concentration of reactants necessary to destroy the fluorocarbon chain was determined using Perma-Fix's general solution that had been tested extensively on liquid PFAS prior to this testing as a starting point and adapting the method to work on solids.

Time-Series Photometry and Period Analysis of Nova V1674 Herculis (O)

Presenter: Caleb Knapp

Faculty Project Advisor: Fonsie Guilaran

This research was conducted in conjunction with the Astronomy REU program at East Texas A&M University. In this project, we utilize time-series photometry to investigate the orbital and spin period of V1674 Herculis (V1674 Her) and determine P_{spin} . We used data collected by multiple astronomers through the Center for Backyard Astrophysics (CBA), and we used data taken during the 2023 observing season. We used Python to analyze the CBA data on V1674 Her. We found, $P_{spin} = -71.2 \pm 48.3 \frac{ms}{yr}$ which is only a 1.7- σ result (not significant at 5%). We also were able to create phase-folded average waveform diagrams of V1674 Her's spin and orbital periods. ■

The Relationships Between Background Music, Musicianship, and Performance on Reading Comprehension and Verbal Recall Tasks (O)

Presenter: Natalie McVay

Faculty Project Advisor: Mollie Carter

This study examined the individual and interactive effects of background music, musicianship, and study habits on cognitive task performance. Data was analyzed from 121 students who completed verbal recall and reading comprehension tasks in both silent and background music conditions. They also completed a survey of musical

experience, expertise, and study habits. Music students demonstrated enhanced performance on both tasks, with significant positive correlations between task scores and specific variables of musicianship. Notably, there was no significant main effect of condition on performance, nor a significant interaction between musicianship and condition. More frequent usage of background music with lyrics while studying correlated with poorer performance on both tasks in silence and the verbal recall task with background music. Study habits did not interact with musicianship to influence performance. The habitual use of instrumental music was more common in music students but not significantly related to task performance in any trial.

The Relationship between Sleep, Social Commitment, and Negative Affect: A Path Analysis (O)

Presenters: Sydnie Arnolds, Ethan Hager, Alex Reeder, and Lily Grace Wamble

Faculty Project Advisor: Luke Walden

Little research has examined the connection between social involvement, sleep, and negative affect in college students. This study seeks to explore the predictive relationships between negative affect (depression, anxiety, stress, and negative emotionality), sleep, and social involvement in college students at a small private university. The study consisted of 197 college students who completed a survey measuring sleep habits, social involvement, and negative affect. Results indicated that number of social groups a student is involved in were predicted by depression ($b = -0.308$, $p = .001$), anxiety ($b = -0.192$, $p = .033$), and stress ($b = 0.325$, $p = .003$). Religious commitment predicted number of groups ($b = 0.203$, $p = .002$). Age entered as a covariate significantly predicted hours of sleep obtained each night ($b = -0.184$, $p = .008$). Implications for the field and future research will be discussed during the session.

Personality as a Predictor of Empathy and Reading Flow (O)

Presenters: Rivers Abshire, Sydney Coffman, Eliana Isom, and Makenna Tiffany

Faculty Project Advisor: Luke Walden

Previous research utilizing the Big Five personality scale shows that agreeableness and extroversion are predictive of empathy (Melchers et. al., 2016; Qunfang et. al., 2019). However, previous research has not explored the relationship between personality and reading flow alongside empathy. The purpose of the current study was to investigate the predictive relationship between these three variables. Participants ($n = 197$) were traditional undergraduate students from a private liberal arts university. Empathy was measured using the EQ-Short scale. The Big Five was measured using the BFI-2-S. Reading flow was measured using subscales of narrative presence, identification, and suspense. Data

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was collected in Qualtrics and analyzed in R. Path analysis results indicated that extroversion predicted identification and suspense. In addition, results indicated that empathy was predicted by agreeableness and extroversion. Empathy was not significantly predicted by gender. Implications of this study and future research will be discussed in session.

Gender, Empathy, & Number of Social Groups Predicting RCI (P)

Presenters: Eliana Isom, Alexandra Reeder,
and Lily Grace Wamble

Faculty Project Advisor: Luke Walden

Previous research has suggested a statistical relationship between gender and religious commitment (Stark, 2002), social involvement and religious commitment, and the impact of religion on empathy (Giordano et. al. 2014). In the current study, it is suggested that the three variables of gender, empathy, and number of social groups predict religious commitment. This study adds to previous research on religious commitment and adds a new aspect of college social involvement. Future research is needed to further explore the issues of social involvement on religious commitment and empathy as a byproduct of religious commitment.

The Association Between Cognitive Fusion and Social Media Self-Control Failure (P)

Presenter: T.J. Hjelte

Faculty Project Advisor: Mollie Carter

Cognitive Fusion is generally defined as a state in which a person fully believes the content of their own thoughts. A person who fuses their identity with their thoughts will be more emotionally impacted by those thoughts. They may use social media as a distraction from any negative thoughts or as a means to change negative thoughts into something more desirable. This survey aimed to find an association between cognitive fusion and social media self-control failure (SMSFC). A Pearson product moment correlation coefficient was conducted and evidence suggests a relationship between these two variables, $r = .33$, $p = .01$, Cohen's $d = .11$. Approximately 11% of the variance in social media self-control failure is attributable to variance in cognitive fusion.

The Influence of the Big Five on Religious Commitment (P)

Presenters: Sydnie Arnolds, Sydney Coffman,
and Ethan Hager

Faculty Project Advisor: Luke Walden

This study explores how the Big Five personality traits predict religious commitment among students at a private Christian university. The Big Five personality model is widely used to assess individual differences in personality.



Religious commitment, defined by one's involvement and consciousness in religious practices, is measured through the Religious Commitment Inventory (RCI). Previous research has suggested a connection between personality traits and religious commitment, but few studies have specifically addressed this relationship in a private Christian university setting. Using data from 197 participants, this study examines the role of the Big Five traits in predicting religious commitment. The results of this study show that religious commitment is positively predicted by openness and agreeableness and negatively predicted by neuroticism. The findings provide insight into the factors that drive religious participation in educational environments and contribute to understanding individual personality differences in regard to religious behavior.

Empathy, Gender, and Anxiety Predicting Identification and Reading (P)

Presenter: Rivers Abshire

Faculty Project Advisor: Luke Walden

Previous research has suggested that empathy correlates with reading frequency (Bolt & Tellegen, 1995) and gender predicts identification and reading frequency (Summers, 2013). Previous research has also demonstrated that empathy can predict identification (Thissen, 2018) and lower anxiety is correlated with higher rates of reading (Levine, 2020). But, past research has not examined gender, empathy, and anxiety together as predictors of identification and reading frequency. Based on the data collected in this study it can be inferred that empathy, gender, and anxiety are predictors of identification in reading and the number of books read per year by college students. This research both supports these claims and yields implications for future research.

PSYCHOLOGY & THEOLOGY AND MISSIONS

Examining the Psychometric Qualities of the Religious Commitment Inventory Using Rasch Analysis (P)

Presenter: Makenna Tiffany

Faculty Project Advisor: Luke Walden

The Religious Commitment Inventory (RCI) is a 10-item survey designed to measure religious commitment. As the survey has been used to measure religious commitment in many different groups (including college students), it is important to understand the psychometric qualities of the scale. Rasch analysis is a psychometric model that examines how scales function and has not been used to evaluate the RCI in previous research. In this study, Union University undergraduate students (n= 197) participated in an anonymous online survey that included the RCI. Rasch model results indicated that the RCI exhibits good psychometric qualities (dimensionality, fit, and function), but revealed inconsistencies with how respondents answered a few of the questions. Results from this analysis suggest that the RCI may need to be revised to reflect religious commitment as it currently manifests in society.

Associations Between Maladaptive Thought Patterns, Cognitive Social Media Outcomes, and Emotions (P)

Presenter: Caleb Cook

Faculty Project Advisor: Mollie Carter

Popular media assumes that social media leads to anxiety, depression, and stress. However, previous studies of social media use suggest no relationship between social media use and emotions. This study sought to determine if thought patterns related to social media are also associated with general maladaptive thought patterns and emotions, particularly anxiety, depression, and stress. We surveyed 61 people and found associations between maladaptive thought patterns and feelings; maladaptive thought patterns and social media outcomes of social media self-control failure, social media social comparison, and fear of missing out. Additionally, we found these social media thought patterns to be associated with anxiety, depression, and stress. ■

The Use of 'Morning Star' in the New Testament (O)

Presenter: Michael Tankersley

Faculty Project Advisor: Mark Dubis

The term "morning star" appears three times in the New Testament: 2 Pet 1:19, Rev 2:22, and Rev 22:16. Do Peter and John use this term the same way or differently? A thorough understanding of the relevant Greco-Roman and Old Testament backgrounds argues that the morning star in these texts refers to a position of rulership over the nations. Preeminently, this language refers to Jesus, the king of the world, but also secondarily to those united to Jesus by faith. ■



RESEARCH GRANT RECIPIENTS

2024-2025

UNDERGRADUATE

Robert Bowen and Hailey Sipes: "Running Wild: Quantification on Wheel Running Behaviors in Wild Organisms"

William Thierfelder and Elijah DeCuir: "Regulation of Brain Inflammation by Microglia Under Conditions of Injury and Pathology"

Faith Zamamiri-Davis and Tanner DeCuir: "A Bioinformatics Approach for the Study of Variants of Unknown Significance in Alzheimer's Disease Using Zebrafish as a Disease Model"

James Kerfoot and Melody Friesen: "Proliferation of *Aureoumbra lagunesis* in Response to Variable Nitrogen, Salinity, and Temperature"

Micah Fern and Danielle Lowe: "Field Validations of a Novel Primer for American Alligator (*Alligator mississippiensis*) Environmental DNA (eDNA) Surveys"

Michael Schiebout and Grace Orewiler: "The Effects of Urbanization on Bat Populations in West Tennessee"

Esther Choi and Emiliano Ortiz: "Unlocking Antibiotic Resistance: The Role of Biofilms in *Staphylococcus aureus* and *Staphylococcus epidermidis*"

Jeremy Blaschke and Aiden Starry: "Creating a DNA Barcode Library for the Ants (Hymenoptera: Formicidae) of Cypress Grove Nature Park, Jackson, TN"

Mark Bolyard and Emily Hall: "Using GC/MS to Analyze the Secondary Metabolite Profile of *Artemisia abrotanum* Exposed to a Seed-Derived *Acer ginnala* Osmoticate"

Georg Pinggen, Landon Haywood, Judah Lampley, Jacob Lancaster, Ryan Metcalf, Elijah Patton, Jacob Smith, and William Snelson: "Design of Experiments to Enhance Student Learning in Mechanics of Materials"

Mollie Carter and Natalie McVay: "Effect of Background Music on Cognitive Tasks"

Angela Lee and Callie Bodiford: "Letterpress at Union University-Analog Typography"

GRADUATE

Taylor Mathis, Amanda Gammons, Noah Travis, and Samarah Wallace: "Assessing the Impact of Involvement in Intramural Sporting Events on Levels of Stress, Anxiety, and Sense of Belonging in Pharmacy Students"



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