SYMPOSIUM

UNION UNIVERSITY
FOUNDED 1873
UU
RELIGIO ET ERUDITIO
TENNESSEE

TWENTY-THIRD ANNUAL UNION UNIVERSITY SCHOLARSHIP SYMPOSIUM

SYMPOSIUM

TWENTY-THIRD ANNUAL UNION UNIVERSITY SCHOLARSHIP SYMPOSIUM

SYMPOSIUM

TWENTY-THIRD ANNUAL UNION UNIVERSITY SCHOLARSHIP SYMPOSIUM

TUESDAY, MARCH 31, 2026
AFTERNOON CONCURRENT SESSIONS

Poster Presentations (P)

Carl Grant Events Center	Student Presenters
12:30-2:00 p.m.	Callie Bodiford (ART)
	Annabella Wooten (ART)
	Micah Montgomery (ART)
	Abby Thomas (ART)
	Sarah Johnson (ART)
	Genevieve Michael (ART)
	Micah Lilyquist (ART)
	Kourtnee Tana Wildes (ART)
	Jacob White (BUS)
	Robert Breece (BUS)
	Lauren Lewis (BUS)
	Jonathan Zilkie (BUS)
	Wes Mhlanga (BUS)
	Gabriel Burrowes (BUS)
	Noel Pataki (BUS)
	Isaac Hoover (BUS)
	Caden Walker (BUS)
	Noah Mullis (BUS)
	Ashanie Kennedy (BUS)
	Zane Bolton (BUS)
	Reese Robison (CHE)
	Andrew Myers (CHE)
	Isabella Robertson (CHE)
	Natalie Supine (CHE)
	Rachel Allabaugh, Patrick Basie, Gage McCalester, Amy Nason, Jake Pingen, and Shane Tendo (EGR)
	Rachel Allabaugh, Jonathan Carroll, Gideon Miller, Matthew Meyn, Jordan Prunty, and Cody Tjomsland (EGR)
	Jeb Hamilton and Caleb Stone (EGR)
	Jordan Prunty (EGR)
	Philip Chase, Dalton Slater, and Easton Slater (EGR)
	Bobby Perry (EGR)
	Cody Tjomsland (EGR)
	Matthew Meyn (EGR)
	Mia Duncan (EGR)
	Isaac Beaman and Emma Bogle (EGR)
	Stacia Talbot (EGR)
	Nathan Dedman, Joshua Fugate, and Elijah Nason (EGR)
	Mia Duncan, Lawson Harvey, Cameron Kennedy, Bobby Perry, and Stacia Talbot (EGR)
	Lawson Harvey and Jack Talley (EGR)

SCHEDULE

Poster Presentations (P)

Carl Grant Events Center	Student Presenters
12:30-2:00 p.m.	Tommy Abazi and Peyton Monge (EGR)
	William Brady, Brady Shreve, and Jordan Tabor (EGR)
	Gage McCalester (EGR)
	Gideon Miller (EGR)
	Jake Lancaster (EGR)
	Alex Cunningham, Dexter Johnston, and James Williams (NUR)
	Onome Agbaza, Heidi Flowers, and April Thompson (NUR)
	Jacob Brown, Dylan Hobson, and Landon Ross (NUR)
	Brooke Cantwell, Sydney Hardin, and Katie Pritchard (NUR)
	Andrew Bassett, Timothy Hibler, and Matthew Skinner (NUR)
	Ben Afoakwa, Ritu Hasalia, and Nsikan Mbatt (NUR)
	Mercy Kuye, Vanessa Nickles, and Gorreti Onaghinor (NUR)
	Justin Fairchild, W. Levi Garrett, and Nicolas Zalewski (NUR)
	Cara Dempsey, Jordan Eads, and Gabe Keys (NUR)
	Kristen Moret, Miguel Sioson, and Tawayne Tucker (NUR)
	Carleigh Beilas, Jonathan Blea, and Haley Loper (NUR)
	Wesley Russell and Lucas Wigal (NUR)
	Shawn Lords and Stefannie Wilkes-Pounders (NUR)
	Renèe Roger (NUR)
	Kelsey Myracle and Destenee Webb (NUR)
	Jonathan Hooper and Elijan Pecheny (NUR)
	Denitra Carter (NUR)
	Octavio Rivera-Sanchez and Zach Schwabe (NUR)
	Kristopher Stone (NUR)
	Ryan Blackburn and Jake Curtis (NUR)
	Taylor Cochran and Elisabeth Tribeck (NUR)
	Corey Long and Gary Pressley (NUR)
	Lauren Johnson and Sydney Naseman (NUR)
	Christine Deere (NUR)
	Shelby Harris and Audra Romney (NUR)
	Matthew Kelly, Kenton Lee, and Yi Peng (NUR)
	Patrick Bollwerk and Grant Gay (PHRM)
	Leslie Curry and Wes Sisco (PHRM)
	Sarah Coppola, Christopher Nunez, and Keren Rosen (PHRM)
	Leslie Curry and Jisha Patel (PHRM)
	Joshua (Eli) Slaten (PHRM)
	Andrew Bragg, Madeline Bausman, Brooks Fountain, and Pola Hanna (PHRM)
	Jeaneen Scales, Trinity Stanton, Kristin Sutton, and Blake Travers (PHRM)
	Braden Middleton, James Morris, Coleson Naranjo, and Viviana Rodriguez (PHRM)
	Abigail Farmer (PSY)
	Katie Campbell (PSY)
	Eliana Butler and Tina Chen (PSY)
	T.J. Hjelte and Kate Rutherford (PSY)
	Addison Altizer and Dona Kaci (PSY)

Oral Presentations (O)

Dept.	Room	Student Presenters	Time
BIO *Session Chair:* Marc Lockett	**WH 101**	Gabriella Wiese	1:00 p.m.
		Leah Lewis	1:20 p.m.
		Tiffany Bownds	1:40 p.m.
		Andrew Pittman	2:00 p.m.
		Kyle Palmer	2:20 p.m.
		BREAK	2:40 p.m.
		Hannah Boshell	3:00 p.m.
		Georgia Jinks	3:20 p.m.
		John Fischbach	3:40 p.m.
		Logan Shreve	4:00 p.m.
BIO *Session Chair:* Faith Zamamiri-Davis	**WH 102**	Sedona Brown	1:00 p.m.
		Chance King	1:20 p.m.
		Mackenzie Cooper	1:40 p.m.
		Rose Kannankeril	2:00 p.m.
		BREAK	2:40 p.m.
		Virginia Mitchell	2:40 p.m.
		Jacob Keyl	3:00 p.m.
		Aiden N. Starry	3:20 p.m.
		Ayla Cook	3:40 p.m.
CSC/PHY *Session Chair:* Brian Glas	**EF-152**	William "Tacker" Nash and Jacob Moore (CSC)	1:00 p.m.
		Caden Miller (CSC)	1:20 p.m.
		Alex Keen (CSC)	1:40 p.m.
		Stephen Caruvana (CSC)	2:00 p.m.
		Jackson Knoell (CSC)	2:20 p.m.
		Bennett Wilson (CSC)	2:40 p.m.
		BREAK	3:00 p.m.
		Samuel McEwen (CSC)	3:20 p.m.
		Joe Garretson (CSC)	3:40 p.m.
		William Veneable (CSC)	4:00 p.m.
		Timothy White (PHY)	4:20 p.m.
		Moses Zhu (PHY)	4:40 p.m.
EGR *Session Chair* Georg Pingen	**EF-319**	Ryan Metcalf, Amy Nason, and Shane Tendo	2:00 p.m.
		Northview Middle School STEM Team	2:30 p.m.
		Landon Haywood, Jake Lancaster, and Eli Patton	3:00 p.m.
		Patrick Basie and Jacob Smith	3:30 p.m.
		Zane Bolton, Benjamin Kuhl, Judah Lampley, and Kyle Whitmark	4:00 p.m.
ART/ENG *Session Chair* Chris Bailey	**PAC D-53**	Daphne Hazard (ART)	2:00 p.m.
		Lili Pettigrew (ENG)	2:20 p.m.
NUR *Session Chair:* Allison Davis	**WH 224** (Dean's Conference Room)	Z'Erica Duncan	2:00 p.m.
		Amy Gray	2:20 p.m.
		April Robinson	2:40 p.m.
		Samantha Hall	3:00 p.m.
		Rachel Patton	3:20 p.m.
		Ashley Steinberger	3:40 p.m.

ART

The Importance of Glaze Calculation (P)
Presenter: Callie Bodiford
Faculty Project Advisor: Danielle Sierra

This research examines the minerals and oxides used to create ceramic glazes and analyzes the critical role of precise glaze calculation in achieving desired functional and aesthetic outcomes. By investigating how the materials interact during firing, one can determine how variations in the formula directly affect the surface quality, color, texture, and stability of the glaze. Emphasis is placed on understanding the relationship between the materials to create, adjust, and refine glaze recipes. This comprehensive knowledge of glaze chemistry enables ceramic artists to develop and manipulate custom glazes to achieve purposeful, consistent results.

Looking Through the Lens of a Land Artist (P)
Presenter: Annabella Wooten
Faculty Project Advisor: Danielle Sierra

A lot of modern art has taken away our creative spark, ingenuity, and intimate relationship with nature. The land art movement is helping to bring that back to us. From well-known artists such as Andy Goldsworthy and Richard Long, to stay-at-home mom Hannah Bullen-Ryner, these contemporaries have made work that connects us back to the earth and gives us a new perspective on what art can be. Art can be meditative, peaceful, and fulfilling. These artists create inspirational response pieces that reflect their interaction with nature and emphasize these attributes. This research delves into the lives and artwork of these three artists, dating from the 1960s to the present, specifically referencing the way they interact with the environment and talk about their work, incorporating both into their everyday lives. The land art movement is relatively hidden amid the bold political and socioeconomic art in galleries today, but it is worth seeing and learning from.

The Rocket Kiln: History, Construction, and Firing (P)
Presenter: Micah Montgomery
Faculty Project Advisor: Danielle Sierra

The wood-fired rocket kiln has been making waves in the ceramics community in recent years, offering a quick, accessible, and environmentally friendly way to create pottery. This research explores the history and origins of the rocket kiln. I built a rocket kiln as part of this research to describe its construction from start to finish and to expand on the firing process specific to the rocket kiln and the effects it produces.

A Judgement of Books and Covers (P)
Presenter: Abby Thomas
Faculty Project Advisor: Danielle Sierra

In this profoundly electronic era, it is becoming increasingly suspect that the publishing industry is neglecting the classic design of books in favor of the new, hyper-colorful, thumbnail-optimized versions. While this can, in part, be attributed to trends, genre conventions, and the design world reaching a creative stagnation after the flood of the digital age, the industry has traded part of its expertise for self interest. Drawing on both casual sources that showcase trend observations and industry players' analytics, this research examines what has occurred in the industry to drive this change. In looking at both past and present books, this research seeks to answer, "By what standards do we find modern covers lacking?" Several publishers are examined to determine their role in this output, and whether these new stylizations are set to become permanent conventions of the industry.

Changes in the Dance of Death in the 19th Century (P)
Presenter: Sarah Johnson
Faculty Project Advisor: Danielle Sierra

Art that is related to death goes all the way back to cave art, but it has developed over the years. Specifically in the 14th century, the theme 'Dance of Death' sprung forth in art and spread wildly throughout Europe. This theme mainly consisted of one or many skeletons, who represented Death, and people who were being taken by Death. For centuries, artists always allotted each dying person within an art piece one skeleton each, that is until the 19th century. Starting in the 19th century, artists began using a singular skeleton to represent a more overarching idea of Death for many people, as opposed to Death being for each individual. This project points out specific artists who sparked this change within the theme and dives into specific pieces that represent the change.

Logo Design: The History and Evolution of Marketing's Most Essential Element (P)
Presenter: Micah Lilyquist
Faculty Project Advisor: Danielle Sierra

Logo design has evolved tremendously from its roots, traced back to the simple form of communication in hieroglyphics, to modern mass-marketing mediums recognized and beloved worldwide. But how did we come to this from such meager beginnings? What has caused logos to become such a major part of our everyday society and an essential element when it comes to promoting a business? This research will answer those questions by examining the history of logo design, elaborating on the various steps that led it to where it is today, and how it has impacted our society as a whole.

Painting Used in Art Therapy (P)
Presenter: Kourtnee Tana Wildes
Faculty Project Advisor: Danielle Sierra

Art therapy is a growing practice that was not in use until the 20th century. It can be described as a mental health practice that produces healing and growth through the use of creativity and art making while applying psychotherapeutic theories. Art therapists who are trained in the art and psychological theories work with people who are physically or mentally unable, people who have gone through traumatic events, or those who need a way to express themselves. One of the first and most popular media used in art therapy is painting. Thought of by the first pioneer of art therapy, Adrian Hill, painting and sketching was used in hospitals to ease the mind of patients and make the experience more enjoyable. In the 21st century, painting is being used in many different ways, but this research primarily focuses on use with elementary school boys with Oppositional Defiant Disorder (ODD), adult cancer patients undergoing chemo treatment, and elderly women with high risk of dementia. The aim of this research is to inform more about the technique of painting at the beginning of the art therapy practice and the current use of the medium.

History of Figure Sculpture in Relation to Culture (P)
Presenter: Genevieve Michael
Faculty Project Advisor: Danielle Sierra

Sculpture is a discipline of art that exists in the three-dimensional world. One of the most widely recognized subsets of sculpture is that which focuses on recreating the human figure. This research project examines figure sculpture from the Classical Greek, Modernist, and Cubist periods, comparing it with the sociological events of those periods, in which the relationship between art and culture is evident. The Greeks' reliance on their pantheon of gods, as well as their engagement with philosophy, shows that idealism and progress are the foundation of their worldview of humanity. This belief is evident in their sculptures, which often create idealized versions of people while maintaining accurate proportions. In the progression toward Modernism, humanity's choices evolve. This is evident in Rodin's work through a greater emphasis on the figures' movement. Finally, in the progression to Cubism, the

consciousness of humans became much more important than their physical matter. This philosophy was expressed through figures that were much more abstract, with exaggerated features and unrealistic proportions.

The Masks We Wear (O)
Presenter: Daphne Hazard
Faculty Project Advisor: Danielle Sierra

Masks have been a part of human history for centuries. They are objects that often obscure the wearer's identity, create a barrier to the world, and can present a new identity. This study examines three main categories of masks: those created for medical purposes, those designed to conceal the wearer's identity, and those used in various religious rituals and mythology. These types of masks are explored across different cultures and time periods to provide a fuller picture of how masks are worn, why people use them, and the effects they have on both the wearers and the viewers. ⚓

BIOLOGY

In Vitro Callus Induction from Leaf Explants of African Mahogany (*Khaya senegalensis*): Effects of Hormonal Combinations and Fipexide (FPX) (O)
Presenter: Sedona Brown
Faculty Project Advisor: Mark Bolyard

African Mahogany (*Khaya senegalensis*) is a valuable tropical hardwood species experiencing population decline due to overharvesting and unsustainable practices. Conventional seed-based propagation is limited by low viability and delayed maturity, highlighting the need for alternative strategies. Plant tissue culture (PTC) offers potential, yet regeneration from leaf explants has not been previously established for this species. This study investigated conditions for callus induction by integrating prior undergraduate research and conducting a meta-analysis of African Mahogany PTC experiments at Union University. Three hormone media containing thidiazuron (TDZ), 2,4-dichlorophenoxyacetic acid (2,4-D), and zeatin were selected for evaluation. Phase 1 assessed callus induction across abiotic conditions and introduced fipexide (FPX) as a potential shoot inducer. Phase 2 refined the protocol using an optimized medium and tested FPX with adenosine monophosphate (AMP). Multiple experiments resulted in enhanced callus production; however, no shoot production was observed.

Isolation of MMP-9 Secretion from 3T3 Fibroblasts Stimulated by Thrombin (O)
Presenter: Gabriella Wiese
Faculty Project Advisor: Marc Lockett

Chronic wounds and tissue healing remain critical challenges in healthcare. The molecular basis of wound healing remains widely unknown due to the complexity of the inflammatory process. Matrix metalloproteinases (MMPs), particularly MMP-9, play a key role in extracellular matrix (ECM) remodeling, making them important targets in regenerative medicine. In this research project, 3T3 fibroblasts were stimulated with thrombin to mimic a post-injury environment. The resulting cell secretome was separated using anion-exchange fast protein liquid chromatography (FPLC), and Western Blot and gelatin zymography were used to detect MMP-9 isoforms. Although clear protein elution peaks were observed following FPLC, no detectable MMP-9 bands were observed on the gels. These findings suggest limitations in the current purification or detection strategy and highlight the need for alternative approaches. Future studies may benefit from gelatin-Sepharose affinity chromatography or examining MMP-9 expression in alternative cell types to enable further investigation of its role in wound healing.

Effects of Glucose on Biofilm Formation in Staphylococcus *epidermidis* 1457 (O)
Presenter: Logan Shreve
Faculty Project Advisor: Esther Choi

Staphylococcus epidermidis is a common bacterium found on human skin, yet it is a primary cause of hospital-acquired infections due to its ability to form biofilms. These "slimes" shield bacteria from antibiotics, making infections difficult to treat. Drawing on evidence that glucose affects resistance in the related *S. aureus*, this study tested how 1% glucose supplementation impacts *S. epidermidis* 1457. We measured antibiotic susceptibility, biofilm thickness, and the activity of biofilm-related genes. Our results showed that while glucose did not change antibiotic effectiveness after 16 hours, it significantly reduced biofilm density after 48 hours. Glucose upregulated *tcaR* and downregulated *icaA* at 16 hours, though these changes were not dramatic enough to immediately alter bacterial resistance. These findings suggest that environmental glucose levels can change how *S. epidermidis* builds its defenses. Further research is needed to understand the metabolic pathways involved and how they might be used to improve clinical treatments.

Effects of Natural Supplements on Hepatocytes to Propose a Safer and Less Expensive Treatment for Type 2 Diabetes (O)
Presenter: Leah Lewis
Faculty Project Advisor: Marc Lockett

Type 2 diabetes (T2D) is an increasing global concern that is characterized by insulin resistance and impaired glucose metabolism. The current pharmacological treatments for T2D are effective but can be expensive and cause unwanted side effects. This project investigates the use of plant-derived compounds, berberine and resveratrol, as alternative therapies. Using a hepatocyte cell culture model, their effects will be compared to a commonly prescribed T2D medication on AMP-activated protein kinase (AMPK) expression and cellular glucose uptake. AMPK expression will be measured using RT-qPCR, and glucose uptake will be assessed to evaluate metabolic changes. By understanding how these compounds influence key components of hepatic metabolism, this study aims to understand their therapeutic potential for T2D management. The results of this project are currently pending.

The Effects of Siltation on Rainbow Darters (O)
Presenter: Georgia Jinks
Faculty Project Advisor: Michael Schiebout

Sedimentation is a growing threat to freshwater ecosystems and poses risks to the conservation of native fishes such as the rainbow darter (*Etheostoma caeruleum*). Increased siltation can reduce water clarity and alter habitat structure, potentially

disrupting normal behavioral responses. It was predicted that rainbow darters exposed to silted conditions would exhibit altered antipredator and activity-related behaviors compared to fish in clear water. To test this, individuals were exposed to a predator in clear or experimentally silted treatments. During exposure freezing, hiding, normal activity, and darting behaviors were recorded. Behavioral responses were analyzed using Wilcoxon rank-sum tests. Freezing behavior differed significantly between treatments ($p = 0.0416$), whereas hiding, darting, and normal activity did not. These findings suggest that sedimentation selectively disrupts certain behavioral responses, which may have implications for survival and conservation of native freshwater fish populations.

Progesterone Interaction with Estrogen Receptor Alpha to Modulate Wheel Running Activity in Mice (O)
Presenter: Ayla Cook
Faculty Project Advisor: Robert Bowen

Progesterone decreases wheel running in mice by interaction with an estrogen-receptor-alpha(ERα)-dependent pathway. The purpose of this study was to assess if progesterone's purported inhibitory effects on wheel running are due to interactions with mechanisms leading to (i.e. upstream) or following (i.e. downstream) from the activation of ERα. Wheel running was assessed in female C57BL/6J mice under normal physiological conditions, after bilateral ovariectomy (with a 10-day recovery), and with implant replacement of an ERα agonist along with varied levels of progesterone (no, low, and high progesterone doses). Post-ovariectomy wheel running was significantly decreased ($p<0.001$), but post-implant wheel running was unrecovered during ERα stimulation and progesterone replacement, with no significant difference from post-ovariectomy wheel running. While ERα-agonist administration mimicked dosages used by other experiments, the agonist failed to recover wheel running behavior. Higher doses may be required to effectively stimulate ERα and fully assess progesterone's involvement in regulating this complex phenotype.

Impact of Amyloid-Beta Fibrils on Gene Expression of Microglial Ion Channels (O)
Presenter: Rose Kannankeril
Faculty Project Advisor: William Thierfelder

In Alzheimer's Disease, amyloid-beta fibrils (Aβ) accumulate in the brain and form plaques. These plaques activate microglia, the immune cells of the central nervous system. Stimulated microglia perform phagocytosis, chemotaxis, and cytokine release, which can cause neuroinflammation and neuron death. Key channels involved in microglial signaling are ion channels, which are expressed in Aβ stimulated microglia. These channels are a potential therapeutic target for Alzheimer's Disease. This experiment

used cultured microglial cells treated with Aβ. From these cells, mRNA was extracted, and reverse transcriptase quantitative polymerase chain reaction (RTqPCR) was performed to detect the mRNA expression levels of ion channels produced in response to Aβ. Results indicate that individual ion channels follow unique expression patterns. These changes in ion channel expression provide insight into the signaling pathways involved in Alzheimer's Disease.

Different Fish Species Affecting Crop Yields Within Micro-Scale Aquaponic Systems (O)
Presenter: Hannah Boshell
Faculty Project Advisor: Michael Schiebout

Aquaponics integrate hydroponics and fish culture within a closed-loop system that involves recycling fish waste nutrients back to plants and concurrently, the plants purify the water. Micro-scale aquaponic systems can be used to model full-scale systems and are used to gain insights into agriculture practices. This study evaluates the impact of two freshwater species—*Carassius auratus* (comet goldfish) and *Pimephales promelas* (rosy-red minnow)—on height growth and biomass production of *Lactuca sativa* (lettuce) and *Ocimum basilicum* (basil) within micro-scale aquaponic systems. Aquaponic beds were established with plant species randomly assigned across treatments. We hypothesized that the presence of fish would significantly increase plant height and biomass production in both plant species. Plant heights and nutrient levels were measured weekly for eight weeks, followed by measurements of dry biomass. Both plant height and dry biomass were significantly greater in treatments containing fish.

Wheel Running Behavior of Wild Rodents in a Temperate Deciduous Ecosystem (O)
Presenter: Chance King
Faculty Project Advisor: Robert Bowen

This study investigated whether wild rodents will voluntarily use running wheels and if local population density influences the frequency of wheel use. To address conflicting findings in previous research, 3 study sites with distinct rodent population densities were established in a temperate deciduous ecosystem based on a preliminary trapping survey. Running wheels in exclusionary cages were placed at each site for 8 weeks and monitored by an automated system using Arduino and Raspberry Pi microcontrollers to log and timestamp wheel data. No visits or running wheel usages occurred during the observation period (no visit rate = 1.000). Based on the rates of no visits in previous studies in other ecological climes (0.277 to 0.997), the lack of visits to the cages in this study was not completely unexpected and suggests that population density is not the only or primary driver of intrinsic wheel running behavior.

BIOLOGY

New Records of Cuckoo Wasps, Ensign Wasps, and American Pelecinid from Cypress Grove Nature Park, Tennessee (O)
Presenter: Jacob Keyl
Faculty Project Advisor: Jeremy Blaschke

Parasitoid wasps are help to provide a top down control of insect populations and help to regulate pests in natural and agricultural ecosystems, but many groups remain understudied due to their immense diversity, and difficulty in identifying each species. Here, we provide a preliminary species inventory of three often overlooked parasitoid wasp families cuckoo wasps ensign wasps, and American Pelecinid collected from Malaise trap samples from 2020 at Cypress Grove Nature Park, TN. Using DNA barcoding and morphological evidence, 10 species and 7 genera are newly recorded from the park, including *Ceanochrysis CF. aereolata*, *Hedychrum confusum*, 2 separate Chrysis species, *Alysson oppositus*, *Stigmatomma pallipes*, *Evaniella semaeoda*, *Evaniidae hyptia*, Hedichrydium, and *Ceratochrysis enhuycki*. This study allows for a greater understanding of the diverse species and how these parasitoids are able to control pests in our environment and forming a greater idea of what insects are being regulated.

Tree Size and Stand Structure as Predictors of Pneumatophore Abundance and Morphology in Bald Cypress (*Taxodium distichum*) (O)
Presenter: Kyle Palmer
Faculty Project Advisor: Michael Schiebout

Bald cypress (*Taxodium distichum*) produces specialized aerial roots, or pneumatophores, that facilitate gas exchange in saturated soils. This study examined whether tree size, age, and local stand density influence pneumatophore abundance and morphology. Twenty mature trees were sampled at Cypress Grove Nature Park in Jackson, Tennessee. Diameter at breast height (DBH), age from increment cores, total pneumatophore count within a 3-m radius, and individual knee height and diameter were measured. Stand density was quantified as the number of trees within a 10-m radius of each focal tree. Knee density (knees m^{-2}) and mean morphological traits were calculated and analyzed using correlation and multiple regression. Larger trees generally supported greater pneumatophore densities and larger knees, while stand density showed evidence of influencing pneumatophore production. These findings suggest that pneumatophore development scales with tree growth and may respond to competitive pressures within wetland forest stands.

Stinging Wasps (Hymenoptera: Aculeata) of Cypress Grove Nature Park (O)
Presenter: Mackenzie Cooper
Faculty Project Advisor: Jeremy Blaschke

Aculeata (stinging wasps) are a diverse and ecologically important group that includes bees, ants, and parasitoids. Despite their ecological importance, the biodiversity of aculeate wasps has not been formally studied in West Tennessee. Malaise traps were used to collect wasp specimens during the fall of 2020, 2022, and 2024 in Cypress Grove Nature Park, TN. In total, 1,933 aculeate wasps were collected, representing 24 families within Aculeata (81% of Nearctic families). Aculeate diversity was highest in 2024. Among all families, ants (Formicidae) and cricket-assassin wasps (Rhopalosomatidae) were the most abundant each year. Corresponding to their expected ecologies, Halictidae were particularly abundant in 2020, while Tiphiidae were particularly abundant in 2024. A new state record was documented for *Olixon melinsula*. An undescribed male of *Methocha impolita* was documented, along with potentially new species of *Myrmosa* and *Sierolomorpha*.

The Effect of Amino Acids on Hormone-Induced Gluconeogenesis Activity of Hepatic Cells (O)
Presenter: Tiffany Bownds
Faculty Project Advisor: Marc Lockett

Certain amino acids are associated with improved glycemic control in diabetics. Diabetes is often accompanied by dysregulation of glucagon and cortisol, which can increase the risk of complications as blood glucose becomes more difficult

to manage. Most research associating amino acids with blood sugar regulation has focused on the effect of amino acids after the ingestion of carbohydrates. This study seeks instead to measure the impact of amino acids on hormone-specific blood sugar increase. Hepatocytes were grown in cell culture and either left untreated or treated with glucagon or cortisol and/or one of three different amino acids, which included alanine, lysine, and valine. Cells in each group were measured for gluconeogenesis rate based on fructose-1,6-bisphosphatase expression. Analysis of the results will help to determine potential modulation of glucagon- or cortisol-stimulated gluconeogenesis by amino acids and their potential therapeutic value in improving glycemic control in diabetics.

Diversity of Pompilidae from Cypress Grove Nature Park (O)
Presenter: Virginia Mitchell
Faculty Project Advisor: Jeremy Blaschke

Spider wasps (Hymenoptera: Pompilidae) are solitary wasps known for their important role as ectoparasitoids of spiders. In North America, there are 300 species. We report the first inventory of Pompilidae from Cypress Grove Nature Park, TN. A combination of DNA barcoding and taxonomic keys were used to identify specimens to species. A total of 99 specimens were collected over three seasons using Malaise traps. Ninety-one of these were successfully barcoded and matched with a known species ID from the Barcode of Life Database. From these, 28 species within 14 genera were recorded. For the eight specimens that did not have a DNA barcode; morphological keys were used for species identification. These included *Poecilopompilus interruptus*, *Ceropales longipes*, *Psorthaspis mariae*, *Caliadurgus fasciatellus*, *Anoplochares similaris*, *Auplopus adjuctus*, and *Phanagenia bombycina*.

Effects of *Staphylococcus epidermidis* Supernatant on Fibroblast Activity (O)
Presenter: Andrew Pittman
Faculty Project Advisor: Marc Lockett

Fibroblasts are essential cells in the wound healing process and formation of the extracellular matrix. They are responsible for production of collagen and remodeling of the extracellular matrix during wound healing as well as signaling of other cells by secretion of cytokines and growth hormones. *Staphylococcus epidermidis* is a commensal bacterial species commonly found on human epithelia. Although usually benign, it is an opportunistic pathogen that is the most common source of nosocomial infections. Its pathogenicity is due, in part, to its biofilm forming nature which provides protection from the host immune system and many antibiotics. This research investigated the interaction between *S. epidermidis* and fibroblasts, specifically focusing on the effect the bacterial supernatant has on fibroblasts'

role in wound remodeling through a cell contraction assay, the effect on cellular death through a necrosis assay, and the effect on cellular growth. Results are pending.

New Records of Spider Wasps (Hymenoptera: Pompilidae) in Great Smoky Mountains National Park (O)
Presenter: Aiden N. Starry
Faculty Project Advisor: Jeremy Blaschke

Spider wasps (Hymenoptera: Pompilidae) are solitary ectoparasitoids that help regulate spider populations in many ecosystems, making their biodiversity an important research subject. The All Taxa Biodiversity Inventory (ATBI), an initiative to cataloging biodiversity in Great Smoky Mountains National Park (GSMNP), has been impeded by taxonomically complex insect taxa, including Pompilidae, due to the lack of identification experts, who are few and often volunteers. DNA barcoding mitigates some of these challenges by relying solely on molecular characters. To document the diversity of pompilid wasps in GSMNP, ATBI museum specimens were sent to Union University, identified by experts, and DNA barcoded. In total, 202 specimens representing 55 species were sequenced. One new genus (*Anoplochares*), seventeen new species, and five new subspecies were new records for GSMNP. Genetic evidence suggests cryptic species diversity in *Aporus niger*.

Assessment of Axillary Bud Breakage and Phytohormone Treatments in Ulmus parvifolia 'Hokkaido' Explants (O)
Presenter: John Fischbach
Faculty Project Advisor: Mark Bolyard

Hokkaido elm (*Ulmus parvifolia* 'Hokkaido') is a dwarf cultivar of *Ulmus parvifolia* (Chinese elm) characterized by markedly reduced leaf size and compact growth habit. Outside of callus regeneration, little research has examined axillary bud response of the Hokkaido elm under in vitro conditions. This study focused specifically on quantifying axillary bud break frequency and rate in response to different phytohormone treatments. Leaf explants containing axillary buds were surface-sterilized using mercuric chloride ($HgCl_2$) and cultured on basal medium or media supplemented with gibberellin, benzyl adenine, kinetin, zeatin, or thidiazuron (TDZ). Bud break occurrence and subsequent leaf emergence were recorded as measures of treatment response. This study evaluated early-stage axillary bud activation as a response to growth regulator exposure. Among the treatments tested, thidiazuron produced a significantly higher frequency and faster rate of axillary bud break compared to basal medium and the other phytohormones. These findings establish a controlled in vitro framework for analyzing axillary bud responsiveness in Hokkaido elm with a broader objective on producing leaves prepared for regeneration and trait stability research. ⚓

BUSINESS

Why Customer Discussions Challenge Business Models and Display Emotional Links (P)
Presenter: Jacob White
Faculty Project Advisor: April Rowsey

This project explores customer discovery findings related to a proposed entrepreneurial concept, which is focused on repairing sentimental items, accompanied by a video showcasing the repair and the stories behind them. The purpose of this study was to better understand customer needs, behaviors, and emotions associated with the sentiment. Data was collected through in-person discussions and interviews involving college-age participants, including men and women, with diverse backgrounds and interests ranging from premed to engineering. Analysis revealed several recurring themes such as deep emotional ties to objects of value and the stories behind them, as well as a want/inability to repair broken sentimental items. These findings informed revisions to the venture concept and clarified areas requiring further testing. The project demonstrates the value of direct customer engagement in reducing uncertainty and guiding early-stage entrepreneurial decision-making.

Wealth Management in the NIL Sphere: A Business Idea (P)
Presenter: Robert Breece
Faculty Project Advisor: April Rowsey

This project examines the development of a proposed entrepreneurial venture using the Business Model Canvas framework. The venture concept addresses the specific needs for wealth management and financial planning for collegiate athletes making money from NIL and sponsorships. The purpose of this project was to evaluate key business model assumptions related to financial literacy among college athletes and their parents and their willingness (along with universities) to pay for financial services geared towards athletes. Using iterative analysis and supporting research, the initial business model was refined based on identified risks and feasibility considerations. Findings revealed important insights regarding how the service should be marketed, what channels the business will funnel through, compliance issues around university regulations, and alterations to the pricing structure of the business, which informed revisions to the final canvas. This project highlights how structured venture design and critical reflection support evidence-based entrepreneurship and responsible opportunity development.

Financial Organization Coach Business Model (P)
Presenter: Lauren Lewis
Faculty Project Advisor: April Rowsey

This project examines the development of a proposed entrepreneurial venture using the Business Model Canvas framework. The venture concept addresses the financial stress and the need for financial organization with college students. The purpose of this project was to evaluate key business model assumptions related to whether financial stress is a serious problem for customers and whether they value financial help and are willing to pay for it. Using iterative analysis and supporting research, the initial business model was refined based on identified risks and feasibility considerations. Findings revealed important insights regarding the existence of financial stress with students and costs with workshop equipment, which informed revisions to the final canvas. This project highlights how structured venture design and critical reflection support evidence-based entrepreneurship and responsible opportunity development.

Using AI for Local Art Engagement Abstract (P)
Presenter: Jonathan Zilkie
Faculty Project Advisor: April Rowsey

This project examines the development of a proposed entrepreneurial venture using the Business Model Canvas framework. The venture concept addresses the lack of engagement with local art within the Jackson, Tennessee area. The purpose of this project was to evaluate key business model assumptions related to the value this idea can add, the customers it will target, and the way it can generate revenue. Using iterative analysis and supporting research, the initial business model was refined based on identified risks and feasibility considerations. Findings revealed important insights regarding the cost structure to manage, the revenue streams to tap into and the items needed for value delivery, which informed revisions to the final canvas. This project highlights how structured venture design and critical reflection support evidence-based entrepreneurship and responsible opportunity development.

Business Canvas Model (P)
Presenter: Wes Mhlanga
Faculty Project Advisor: April Rowsey

This project examines the development of a proposed entrepreneurial venture using the Business Model Canvas framework. The venture concept addresses the lack of structured guidance, clarity, and confidence-building support for aspiring international student-athletes within the international recruitment and scholarship market. The purpose of this project was to evaluate key business model assumptions related to the venture's value proposition and customer segment, particularly whether students require process clarity alone or deeper motivational and behavioral support. Using iterative analysis and customer discovery research, the initial business model was refined based on identified behavioral risks and feasibility considerations.

Findings revealed important insights regarding customer fit and delivery mechanisms, specifically that confusion is often normalized and emotional barriers may limit action. These insights informed revisions to the final canvas, shifting emphasis toward confidence-building, accountability, and long-term developmental support. This project highlights how structured venture design and critical reflection support evidence-based entrepreneurship and responsible opportunity development.

Business Model Canvas for Glide: A Service for Aspiring Writers (P)

Presenter: Gabriel Burrowes
Faculty Project Advisor: April Rowsey

This project examines the development of a proposed entrepreneurial venture using the Business Model Canvas framework. The venture concept addresses the desire of writers to refine and release their own works by targeting new writers from all walks of life who lack a robust routine for creating, editing, and releasing their works. The purpose of this project was to evaluate key business model assumptions related to the prospect of professional writing assistance within the amateur writing space. Using iterative analysis and supporting research, the initial business model was refined based on identified risks and feasibility considerations. Findings revealed important insights regarding interest among potential customers in comprehensive critiques and editing from positive, capable

partners, which informed revisions to the final canvas. This project highlights how structured venture design and critical reflection support evidence-based entrepreneurship and responsible opportunity development.

Costumer Discovery (P)

Presenter: Noel Pataki
Faculty Project Advisor: April Rowsey

This project explores customer discovery findings related to a proposed entrepreneurial concept focused on the emotional and confidence-related challenges experienced by international college students during their transition to life in the United States. The purpose of this study was to better understand student needs, behaviors, and perceptions associated with the opportunity. Data were collected through semi-structured customer interviews involving first- and second-year international students currently enrolled at a U.S. university. Analysis revealed several recurring themes, including emotional isolation during early transition and declines in confidence affecting social and academic participation. These findings both confirmed and refined initial assumptions about the nature of the problem. These insights informed revisions to the venture concept, shifting the focus from informational guidance to relational and emotional support. This project demonstrates the value of direct customer engagement in reducing uncertainty and guiding disciplined, evidence-based entrepreneurial decision-making.

BUSINESS

Reforge Tactical (P)
Presenter: Isaac Hoover
Faculty Project Advisor: April Rowsey

This project examines the design of minimum viable product (MVP) experiments to test high-risk assumptions for an early-stage venture addressing the issue of cost for quality Airsoft gear as a significant deterrent for people interested in Airsoft. The purpose of this study prioritizes learning by identifying critical uncertainties and proposing disciplined validation strategies. Two high-risk assumptions, selected from a refined business model canvas, are evaluated based on the risk they pose to venture viability if confirmed/disconfirmed. The project proposes two ethical, low-cost MVP experiments feasible within 1–2 weeks. For each MVP, anticipated outcomes are defined that would confirm or challenge the assumption. Findings from these tests are expected to guide revisions to the value/concept proposition and reduce uncertainty through a prioritized experimentation sequence.

Entrepreneurship (P)
Presenter: Caden Walker
Faculty Project Advisor: April Rowsey

This project examines the development of a proposed entrepreneurial venture using the Business Model Canvas framework. The venture concept addresses the challenge of building trustworthy and effective professional connections within small business owners and nonprofit organizations seeking sponsorships and partnerships. The purpose of this project was to evaluate key business model assumptions related to the value proposition, customer willingness to outsource outreach, and revenue model feasibility. Using iterative analysis and supporting research, the initial business model was refined based on identified risks and feasibility considerations. Findings revealed important insights regarding customer fit, trust-building requirements, and service delivery methods, which informed revisions to the final canvas. This project highlights how structured venture design and critical reflection support evidence-based entrepreneurship and responsible opportunity development.

Testing Personal Connection Solutions in an Impersonal World (P)
Presenter: Noah Mullis
Faculty Project Advisor: April Rowsey

This project examines the design of minimum viable product (MVP) experiments to test high-risk assumptions for an early-stage venture addressing the increased feelings of isolation among digital generations for everyday commuters. The purpose of this study prioritizes learning by identifying critical uncertainties and proposing disciplined validation strategies. Two high-risk assumptions, selected from a refined business model canvas, are evaluated based on the risk they pose to venture viability if confirmed/disconfirmed. The project proposes two ethical, low-cost MVP experiments feasible within 1–2 weeks. For each MVP, anticipated outcomes are defined that would confirm or challenge the assumption. Findings from these tests are expected to guide revisions to the value/concept proposition and reduce uncertainty through a prioritized experimentation sequence.

Customer Discovery & Market Learning (P)
Presenter: Ashanie Kennedy
Faculty Project Advisor: April Rowsey

This project explores customer discovery findings related to proposed entrepreneurial concept focused on high school boys in inner-city Kingston communities. The purpose of this study was to better understand customer needs, behaviors, and perceptions regarding mentorship and development opportunity programs. Data were collected through semi-structured interviews, informal discussions, and community observations involving high school boys and local stakeholders. Analysis revealed recurring themes, including a strong desire for opportunity rather than sympathy, the importance of trust and relatability in mentorship, and the influence of immediate financial pressure on decision-making. These findings informed revisions to the venture concept and clarified areas requiring further testing. The project demonstrates the value of direct customer engagement in reducing uncertainty and early-stage entrepreneurial decision-making.

Venture Concept Development for a Makerspace & Design Services Business (P)
Presenter: Zane Bolton
Faculty Project Advisor: April Rowsey

This project examines the learning process that occurred during the development of an early-stage entrepreneurial venture. The purpose of this study was to analyze how feedback, evidence, and reflection influenced revisions to the original concept. The proposed venture was a makerspace-style business offering engineering and design services, prototyping, and small-batch manufacturing through technologies such as 3D printing and CNC plasma cutting to help customers bring ideas to life. Throughout the semester, customer discovery, research, and testing revealed limitations in initial assumptions regarding target users and value delivery. These insights prompted meaningful pivots in the venture's business model, including a shift from exclusively producing products for clients to also equipping and educating customers through access to an open creative workspace. The findings highlight the importance of adaptability, ethical consideration, and reflective learning in early-stage entrepreneurship and demonstrate how navigating uncertainty supports responsible venture development. ⚓

CHEMISTRY

Towards the Development of a Quantitative Structure-Activity Relationship (Qsar) in the Search for a Safe and Effective Treatment for Visceral Leishmaniasis (P)
Presenter: Reese Robison
Faculty Project Advisor: E. Blake Watkins

Visceral leishmaniasis is a potentially deadly, parasitic disease caused primarily by *Leishmania infantum* and *Leishmania donovani*. Currently, there is no viable or safe treatment. The Open Synthesis Network (OSN) of the Drugs for Neglected Diseases Initiative (DNDi) uses a crowd-sourced approach to generating a large number of candidate molecules, with the goal of developing a Quantitative Structure-Activity Relationship (QSAR) to identify key structural characteristics necessary to inhibit *Leishmania sp.* effectively. The primary goal of this project was to prepare a variety of tertiary amines containing diverse aromatic ring systems to gauge the impact of ring size and specific ring characteristics on biological activity. These target compounds were prepared through a two-reaction sequence in which assorted aldehydes were subjected to reductive amination conditions, generating a secondary amine, followed by coupling with a common alkylating agent. The synthetic preparation of these molecules and their corresponding biological data will be presented.

Numerical and Computational Studies of a Multidimensional Interpolant of On-the-Fly Generated QM Data for MD Simulations of Diverse Molecular Systems (P)
Presenter: Andrew Myers
Faculty Project Advisor: Michael Salazar

A numerical study on the interpolation software of Accelerated Molecular Dynamics with Chemistry (AMolDC) was conducted. The interpolant significantly reduces computational time for quantum mechanical (QM) calculations required for molecular dynamics (MD) simulations. The interpolant has parameters that, when changed, affect the interpolated values of the calculated QM potentials and atomic forces. These parameters can cause significant changes in the absolute error of the interpolated function values. Numerical studies were conducted on diverse chemical systems that ranged from 9 to 20 atoms and contained rings, chains, and mixed degrees of saturation. The total energy, kinetic energy, and temperature were examined for each MD simulation conducted. Optimum parameters for minimizing error and computational time were determined.

Purification and Native Gel Analysis of the Prmt1 R353p Protein Variant (P)
Presenter: Isabella Robertson
Faculty Project Advisor: Betsy Cáceres

Protein Arginine Methyltransferases (PRMTs) are enzymes that regulate key cellular processes through arginine methylation and have been linked to various diseases, including cancer. They are categorized into three types—Type I, II, and III—each distinguished by the specific methylation products they generate. Among PRMTs, PRMT1 is a type I enzyme and represents the predominant isoform in mammals. It has been strongly associated with various cancers. Based on evidence from several structural studies and computer modeling, it is hypothesized that Aspartate 37, a negatively charged amino acid, forms a salt bridge with the positively charged Arginine 353. This interaction, located at the dimerization interface, is thought to contribute to the structural stability of PRMT1 and may play an important role in supporting its catalytic activity. Prior studies of PRMT1 have found this sort of interaction to be vital to the protein's ability to dimerize and perform its function. There is an interesting association between colon cancer and a mutation in the PRMT1 gene that swaps the arginine 353 for a proline. Because this mutation might change the dimerization interface to be a neutral-negative interaction rather than a positive-negative one, it is thought that this disruption may cause interference with the salt bridge formation, which would then hinder the enzymatic activity of the protein, resulting in cancerous effects. To investigate this possibility, BL21 cells were successfully transformed to express both the WT and the novel R353P mutant PRMT1 proteins.

CHEMISTRY & COMPUTER SCIENCE

Structural differences between the proteins were assessed via native gel electrophoresis and Western blotting. The western blots of this research were largely inconclusive; however, with procedural adjustments, continuation of this research will aim to clarify the molecular mechanisms underlying the PRMT1 R353P mutation's impact on dimerization and its relation to colon cancer. Additionally, a similar sort of mutation was done to the opposite side of the dimerization interface. Site-directed mutagenesis was performed to create a novel PRMT1 D37A mutant, by swapping the negatively charged aspartate in position 37 for a neutral alanine.

Exploring Synthesis Methods for Quinone-Bridged Chromium Dimers Towards Mechanistic Insight in Alcohol Oxidation (P)
Presenter: Natalie Supine
Faculty Project Advisor: Randy Johnston

Improvements in typical alcohol oxidation methods are needed due to the reaction being essential to numerous industrial processes. There is great potential in using quinone-bridged metal dimers, since there are several instances of this complex increasing the efficiency of alcohol oxidation. However, the mechanism of how oxidation occurs is still unclear. To increase understanding of this, the synthesis of a stable form of chromium-tetrahydroxyquinone (THQ) complex was pursued using two different reaction schemes. Reaction scheme one involved the synthesis of chromium-ligand intermediates which were then subjected to dimerization attempts, but none of the trials resulted in the formation of the desired complex. The second scheme

was a more direct approach where the chromium quinone dimer was made first and then ligands added to the dimer. Three ligands were tested, but only the triethylenetetramine (trien) had characterization results that were consistent with expectations for a crude product. ⚓

WatchDog: An Analytical System for the HUB (O)
Presenters: William "Tacker" Nash and Jacob Moore
Faculty Project Advisor: Brian Glas

This project is a system (named WatchDog) that provides usage analytics to department chairs and HUB directors in The Ethos Forum. Existing solutions were expensive, so we decided to build our own system that utilizes a python-based library for unique individual detection to track foot-traffic, all possible via Raspberry Pi 5s and AI-enhanced cameras that are installed around the HUB. Other metrics that the Watchdog tracks include usage of the Prusa 3D printers which is gathered via a web scraper, and usage of other machinery gathered via small vibration sensors. The goal of this project is to track beneficial metrics and provide a cost-effective solution to Union while also giving students, both now and in the future, experience in this field.

UU Student: A New Union University Student App (O)
Presenter: Caden Miller
Faculty Project Advisor: Brian Glas

Based on feedback from fellow students concerning the current student application (slow, unorganized, confusing to navigate), I decided to develop a new one using Kotlin as the primary language, with the addition of some C+ and HTML. Kotlin is one of the main languages used for making user friendly applications, allowing for an ergonomic design and ease of access, regardless of tech literacy. C+ and HTML were used to assist with the graphical user interface and some of the backend applications.

Ticket Tracker, A Ticket Management Software for Personal and Small Business Use (O)
Presenter: Samuel McEwen
Faculty Project Advisor: Brian Glas

This project aims to provide a lightweight ticket management software for personal and small business use. It stores customer service requests in the form of tickets in a database, allowing for easy management of work orders. The goal is to allow small businesses to efficiently create, access, and edit customer service and employee data. Users can easily create a new work order with the appropriate customer and service type, as well as assign any employees. Tickets can be scheduled, and progress can be tracked. Users are also able to dynamically filter what tickets they see for better organization. This project uses Python, NiceGUI, the Peewee

COMPUTER SCIENCE

ORM, and SQLite. It is designed to either be hosted on a local network or used on a single device. It can be displayed in either a web browser or natively in its own window. Ultimately, this project aims to give small businesses a tool for managing work orders in a simple and organized way.

Interactive Map of Union's Campus (O)
Presenter: Stephen Caruvana
Faculty Project Advisor: Brian Glas

The goal of this project is to create a map of Union's campus that lets people easily see where places are on Union's campus while being simple and easy to run. Currently, there isn't a good map that displays the names of each building and gives information about the buildings or activity areas around campus. It will be possible to find information on places like the disc golf course location, the Lex, and the dorms. Being able to find your way around campus is essential for students, and this app makes it easy.

Runeband (O)
Presenter: Jackson Knoell
Faculty Project Advisor: Brian Glas

This project focuses on the research and development process involved in creating a video game using the Godot game engine. Utilizing Godot's integrated tools and resources, *Runeband* will be developed as a 2D platformer that emphasizes exploration, world discovery, and dynamic boss battles to create a more engaging and competitive gameplay experience. The project will include the design and implementation of core gameplay elements such as character movement, combat mechanics, user interface (UI) design, and environment/world-building. Godot uses its own scripting language, GDScript, which closely resembles the C programming language but features simplified syntax and unique structures that make it highly accessible for game development. This project will also explore how GDScript streamlines the development process and integrates with Godot's node-based system to create interactive and visually cohesive game environments. Ultimately, *Runeband* aims to demonstrate the full game creation pipeline—from concept and coding to design and testing—within an open-source development framework.

SmartLift: A Computer Vision Approach to Powerlifting Form Analysis (O)
Presenter: Alex Keen
Faculty Project Advisor: Mason Ruby

As "science-based" gym culture has grown in popularity, more attention has been given to lifting with proper form. However, performing compound movements correctly can be difficult for beginners. This project examines whether joint angle data can be used to identify meaningful differences in lifting technique using Bayesian statistical methods. Video recordings of experienced lifters performing the bench press, squat, and deadlift were collected and analyzed using MediaPipe, a machine learning framework that provides pose detection tools for human movement tracking. From these recordings, joint angles were extracted and used to build a Bayesian model aimed at identifying common movement patterns among experienced lifters. These patterns were then evaluated to determine whether they can help distinguish between effective and ineffective form. The goal of this study is to assess whether a computer vision-based system could provide useful feedback to novice lifters.

The Incident Response Plan Builder (IRPB) (O)
Presenter: Bennett Wilson
Faculty Project Advisor: Brian Glas

This project examines best practices in effective incident response planning at the organizational level. Having an incident response plan is crucial for organizational cybersecurity best practices. Not having one can lead to regulatory fines, loss of customer trust, loss of data, and many other issues. The purpose of this project is to conduct research on modern incident response frameworks such as NIST and SANS, and bridge the research into a generalized enterprise risk management methodology, resulting in the creation of an industry-grade incident response plan. The generalized enterprise risk management methodology has been created through thorough research, while also leveraging relevant work experience in a heavily regulated environment. This research led to the creation of an incident response template, which through the ERM methodology, allows for a centralized pre-incident and post-incident report. A web-application has been developed to promote awareness of the importance of incident response and allow users to create their own IRP based on the template from the above methodology. This project has been peer reviewed by users with little knowledge of incident response, and in-depth knowledge of incident response to promote further usability and accuracy of template effectiveness. The web-application contains a downloadable blank IRP template, a filled-out IRP template with exemplary information, options for users to create an IRP template within the application, and a page containing the in-depth research that led to the creation of the IRP template.

BLR: Creating an Adventure Video Game (O)
Presenter: Joe Garretson
Faculty Project Advisor: Brian Glas

BLR is the title of a top-down action-adventure game created by Joe Garretson. The game features all original pixel art and a timing-based combat system. The goal of the project was

COMPUTER SCIENCE

to create a baseline and direction for elements that go into the creation of a video game. That being programming, art, sound design, music, story writing and more. Understanding of the Unity game engine and the C# programming language was integral to the creation of BLR. The project demonstrates experience and passion for game development as a whole, but additionally, is an attempt to showcase the design skills needed to create a full-fledged video game. BLR hopes to present an engaging experience through fun and skillful gameplay as well as a thoughtful story.

Anti-Cheating Software in Video Games (O)
Presenter: William Venable
Faculty Project Advisor: Brian Glas

This research project examines the evolution, operation, and controversies surrounding anti-cheating technology used in the video-game industry from a cybersecurity perspective. Through review of major anti-cheating systems, how they work, detection methods, security models, and developments, this project analyzes how developers attempt to preserve fair play in this increasingly complex environment. The research highlights the tension between maintaining competitive integrity and protecting user privacy, showing the mass distrust of invasive software despite the widespread epidemic of cheating in both the casual and professional environment. Findings indicate that the battle between cheat creators and anti-cheat developers is a persistent technological arms race, complicated further by emerging tools such as artificial intelligence, hardware-based exploits, and forms of memory manipulation. This project also explores future solutions through AI-driven detection and blockchain-supported verification and evaluates their potential and risks. Ultimately, this project argues that while anti-cheat technology will continue to advance, there is no single method that can fully resolve the cheating epidemic for online games, making long-term progress dependent on balancing effectiveness, ethics and user trust. ⚓

Simulating the Ethos Forum Elevator's Logic Using a PLC (P)

Presenters: Rachel Allabaugh, Patrick Basie, Gage McCalester, Amy Nason, Jake Pingen, and Shane Tendo

Faculty Project Advisor: Jeannette Russ

Elevators are staples of modern buildings, providing a convenient and less intensive alternative to stairs. Despite their prevalence, the actual control systems that govern elevator operations are often more complex than they appear. To better understand these systems, our team is simulating the elevator in the Ethos Forum using a Programmable Logic Controller (PLC). Using a combination of analog and digital inputs, the PLC models key elevator behaviors, including floor transitions, door operation, maintenance modes, and emergency procedures. These functions are demonstrated through the PLC's indicator outputs, including lights and fans, providing a clear visualization of the elevator's internal decision-making logic. This project offers hands-on experience with industrial automation and highlights the role of PLCs in simulating multi-state, safety-critical systems.

Remote Monitoring and Pressure Adjustment System for the Acetone Bubbling Stage in Plastination (P)

Presenters: Rachel Allabaugh, Jonathan Carroll, Gideon Miller, Matthew Meyn, Jordan Prunty, and Cody Tjomsland

Faculty Project Advisors: Georg Pingen and Tony Wamble

Union University has one of the eight (8) plastination labs in North America. Plastination is a process that replaces the water in biological samples with silicone, preserving them for an extensive time. The process can take months, often requiring daily, in-person monitoring. This project solves this problem through the design and implementation of a remote-controlled valve and vision system for long-term monitoring of the acetone bubbling stage of the process. The objective was to design and build a system to reduce the in-person monitoring necessary for the acetone bubbling stage in plastination that can be implemented in Union University's plastination lab. This remote system lowers the barrier of entry for new lab technicians and establishes a framework that is scalable and reproduceable for other labs.

Potentiometer Controlled Car (P)

Presenters: Jeb Hamilton and Caleb Stone
Faculty Project Advisor: Jeannette Russ

Our project involves designing and constructing a battery-powered car with a fully 3D-printed chassis and body. The vehicle's powertrain is replaced with a system incorporating potentiometers to precisely control speed and regulate the power delivered to the wheels. By integrating these variable resistors, we are able to adjust the distribution of current within the circuit, allowing controlled acceleration and smooth modulation of output power. The chassis and body components are modeled and fabricated using 3D printing technology, ensuring lightweight construction and design flexibility. Throughout testing, the potentiometer-based control system effectively manages current flow, demonstrating consistent speed adjustment and reliable performance. This approach provides a practical method for understanding electrical power distribution while showcasing the integration of additive manufacturing and circuit-based control in a compact vehicle design.

The Factors Affecting Flight Distance of a Kit Glider (P)

Presenter: Jordan Prunty
Faculty Project Advisor: Don Van

Miniature-scale hobby-grade gliders are a timeless toy and enjoyed by many. This project seeks to isolate a few key variables to determine which affects a glider's flight distance. Among these variables are wingspan, tail size, fuselage length, and the glider's material. To isolate these variables, the fractional factorial method of experimental design will be used to build 8 (eight) distinct designs. These designs will be built and tested using a controlled plane launcher, and the flight distance will be recorded over 3 (three) trials. A normal plot and a Pareto chart will be used to present experimental data for analysis.

Operation (P)

Presenters: Philip Chase, Dalton Slater, and Easton Slater
Faculty Project Advisor: Jeannette Russ

The goal of this project is to demonstrate circuit design elements learned in EGR 262 by designing an electronic game inspired by the classic board game "Operation." A light or buzzer in the circuit will be used to indicate that the player has lost the game, and a potentiometer will adjust the volume by adjusting the current to the buzzer. The project will involve creating a preliminary design for the necessary circuit in circuit lab, then implementing the circuit using basic circuit elements. The circuit will be placed in a 3D printed housing for safety and aesthetic purposes.

Design of Experiment Using a Model Airplane Launcher (P)

Presenter: Bobby Perry
Faculty Project Advisor: Don Van

This project will examine the design and experimental evaluation of a flywheel based model airplane launcher with the objective of maximizing flight distance. A dual motor

ENGINEERING

flywheel launcher will be designed and fabricated at the Union Hub to launch laser cut airplanes under controlled conditions. The effects of six factors will be studied: motor speed, launch angle, flywheel size, flywheel material, wind condition, and airplane material. Each factor will be tested at two levels. Flight distance will be measured as the primary outcome for each trial. The results identify the most influential parameters affecting launch performance and will decide the optimal combination of variables for maximizing airplane flight distance. A total of eight experiments will be implemented using an eighth fractional factorial design of experiment. Normal plot and Pareto chart will be used for the analysis and presentation of data.

Collegiate Baseball Bat Testing (P)
Presenter: Cody Tjomsland
Faculty Project Advisor: Don Van

The design of this experiment will determine which of the 6 different BBCOR certified -3 baseball bats will have the highest exit velocity off a pitching machine. Using a Rapsodo device, incoming pitch speed, outbound speed of the baseball, launch angle, spin rate, and distance can be measured. This experiment will only focus on the baseball's exit velocity on balls hit between a -5 and 30 degree launch. This will keep the data more uniform so that there are fewer outliers. Factors that can affect a baseball's exit velocity off a bat include the bat's composition, meaning what material it is made out of, the design, whether it is made as one single piece or two pieces with a connector, and the length, for this experiment 33" and 34" bats will be used. This experiment will try to answer what combination of those factors will produce the highest mile-per-hour exit velocity off the bat.

Basketball Shot Improvements (P)
Presenter: Matthew Meyn
Faculty Project Advisor: Don Van

The purpose of this experiment is to test what part of a basketball player's routine helps improve their shot the most, and which part of their routine might be hurting their shot. The experiment will be carried out by shooting 10 free throws with multiple different mixtures of variables to see which one stands out the most. The different variables are: with or without basketball shoes, men's and women's ball, properly inflated and underinflated ball, warm-up shots vs. no warm-up shots, 10 ft. rim vs 9'9 rim, fresh and physically exhausted body, and a good stretch beforehand vs. no stretching. With 7 factors, fractional factorial design of the experiment will require a table of 8 experiments to be implemented. The data gathered, normal plots, and a Pereto chart will be used to determine which of the variables on this list stand out.

How Changing Variables in Baking Affects the Diameter of a Cookie (P)
Presenter: Mia Duncan
Faculty Project Advisor: Don Van

This factorial factor design project explores the following question: "What variable has the greatest impact on the diameter of a cookie?" To do this, five different factors were examined, each of which had two options. These variables are baking time, oven rack position, dough temperature, dough age, and dough type. After implementing each factor through multiple experiments and consuming many cookies, the results of each experiment with the different variables are then analyzed to find the most impactful variable.

Sunlight Optimization Using Photoresistors (P)
Presenters: Isaac Beaman and Emma Bogle
Faculty Project Advisor: Jeannette Russ

Sunflowers use a biological mechanism called heliotropism to keep their faces pointed toward the sun to optimize sunlight exposure for photosynthesis. In this project, we want to mimic the sunflower's biological mechanism using electric devices, including photoresistors, potentiometers, and servo motors. This system will be composed of two parts, a dual-axis solar tracker (in the place of the sunflower) and a light source of variable brightness. The solar tracker will face the light source once the source reaches a certain brightness, and in the same way that sunflowers will face one another when they don't detect the sun, our device will face a set direction unless a bright enough light source is detected, optimizing the device's exposure to light.

Optimal Proportions and Materials for a Slide (P)
Presenter: Stacia Talbott
Faculty Project Advisor: Don Van

Many fondly remember spending hours at the playground as children, trying to find the best slide that they would travel down the fastest. But what makes a good slide? Many factors affect how far and how quickly an object will slide down a ramp. This project will test four different factors: height, angle, material of the ramp, and material of the ground after the ramp. What combination of factors will result in the greatest travel distance? How fast will a ramp cause an object to travel? 3D printing will be used to implement the fourth fractional factorial design to make this determination. Normal plots and Pareto charts will be used to analyze and present experimental data. There will likely be two optimal combinations: one for speed and one for distance. However, determining which combination will send an object the farthest and fastest is the goal.

Clap Switch Circuit (P)
Presenters: Nathan Dedman, Joshua Fugate, and Elijah Nason
Faculty Project Advisor: Jeannette Russ

This project investigates the design of a circuit that controls the flow of current through a noise-controlled switch. A microphone will be used to determine when a noise is heard; if a noise is picked up by the microphone, the switch will flip. A potentiometer will be used to determine the sensitivity of a microphone through variable resistance. At high resistance a loud clap will flip the switch, and at low resistance a soft clap (or even idle noise in the room) will flip the switch. An LED lamp will be used to visually indicate whether the switch is on or off.

Pressure Drop Across Heat Exchanger Guards (P)
Presenters: Mia Duncan, Lawson Harvey, Cameron Kennedy, Bobby Perry, and Stacia Talbott
Faculty Project Advisor: Georg Pingen

Belts, pulleys, fans, and anything else that spins require guards to prevent injury. However, those guards cause blockage, resulting in those items, such as fans, having to work harder. Young Touchstone was interested in finding out how much of a pressure drop the guards on their heat exchanger cause. To complete this task, guard designs from Young Touchstone were 3D printed and tested in Union University's Department of Engineering wind tunnel. A pressure sensor (ProSense Differential Pressure Transmitter) and a velocity sensor (Dwyer Air Velocity Transmitter) were used to measure the pressure and velocity data of air at different wind speeds. Those sensors were connected to an Arduino, which would send the data to Excel via Excel's Data Streamer. The data was then used to create the desired pressure drop curves.

Three-State Traffic Light Controller Using CD4026 (P)
Presenters: Lawson Harvey and Jack Talley
Faculty Project Advisor: Jeannette Russ

Traffic lights are essential for regulating vehicle flow and preventing accidents at intersections. The goal of this project is to design and implement a small-scale, adjustable traffic light controller using a combination of analog and digital electronics. The circuit employs an NE555 configured in astable mode to generate a periodic clock signal and a CD4026 to sequentially activate red, yellow, and green LEDs. The timing of the traffic light cycle is adjustable via a potentiometer, which forms part of the RC timing network on the 555 timer. Green, yellow, and red LEDs are driven from the decoded outputs of the CD4026 through 330 Ω current-limiting resistors. The project illustrates the practical application of RC timing circuits, digital counting logic, and adjustable sequential control in a real-world system, while providing a visually demonstrative learning tool for electronics principles.

Affecting Pitch with Potentiometers (P)
Presenters: Tommy Abazi and Peyton Monge
Faculty Project Advisor: Jeannette Russ

This project utilizes an astable NE555 timer, controlled by a potentiometer, to manipulate the pitch of a speaker. The NE555 timer is the main component used to run the circuit, and the potentiometer is used to increase or decrease the pitch of the speaker. Capacitors are used within the circuit to store voltage. There is a threshold and a trigger pin in the NE555 timer. The trigger pin toggles the circuit to a HIGH state when the voltage drops below one-third VCC (Voltage at the Common Collector) and the threshold pin toggles the circuit to a LOW state when the voltage rises above two-thirds VCC. This astable timer will result in producing an oscillating output between the high and low states. The oscillation produces square wave signals which results in vibration giving the speaker a "buzz."

ENGINEERING

Potentiometers for a Heat-Seeking Nerf Turret (P)
Presenters: William Brady, Brady Shreve,
  and Jordan Tabor
Faculty Project Advisor: Jeannette Russ

The objective of this project is to build a heat seeking, automated Nerf turret. The turret will swivel on motors to aim towards the heat source. Then it will automatically open fire. We intend to use potentiometers to adjust sensitivity of the turret swivel speed. Our plan is to use a Raspberry Pi or Arduino microcontroller as a heat sensor and apply an individual voltage source to adjust firing speed based on design preference. All of this will be applied to an electric Nerf gun which will be heavily modified to fit the project. We also plan to use 3D printing to adjust the setup. We anticipate printing a base at minimum, but possibly other parts to make the turret work most effectively.

Digital Battleship (P)
Presenter: Gage McCalester
Faculty Project Advisor: Jeannette Russ

A demo game of "Battleship" was developed using basic digital logic operators on protoboards. The purpose of the project was to apply concepts from the EGR 261 course curriculum in a fun, competitive manner. The design consisted mainly of a liquid crystal display (LCD) to keep track of score and a decoder on each board. While the LCDs were programmed by using 74HC4511 logic chips, the decoders were each assembled with available NOT and NAND logic gates. The decoders would output to LEDs on the protoboard to represent hits and misses. The result was a functioning demo version of Battleship. Limited resources prevented expanding beyond the demo game but offered valuable opportunity for conceptual improvement. Additionally, the project yielded valuable insight into the components of decoders, an upper-level concept beyond the scope of the class.

Bench Press Experiment (P)
Presenter: Gideon Miller
Faculty Project Advisor: Don Van

An experiment will be designed and implemented to figure out what factors can optimize exercise, with an outcome to achieve as many repetitions as possible with a given weight. The specific exercise I will focus on will be the classic bench press. Among the factors studied will be: (1) sleep at night, (2) whether I take a nap during the day, (3) whether I listen to music during the workout, (4) the number of days between tests, (5) whether or not I do a pre-workout, and (6) the time of day I workout — afternoon or night. With these factors, my experiment will be subjected to the eight fractional factorial design. The outcome will be to achieve the maximum possible repetitions with 185 pounds of weight. The factor of sleeping is thought to be the primary factor that increases performance, but that will be verified by this experiment.

Optimized Print Settings for Foaming 3D Filament (P)
Presenter: Jake Lancaster
Faculty Project Advisor: Don Van

The goal of this project is to find the best print settings to achieve reliable and high quality print results with a specific engineering filament. The filament is made by Bambu Lab, and is called ASA-Aero. It is designed for use with 3D models that are required to be very light or buoyant. ASA stands for Acrylonitrile Styrene Acrylate, which is a thermo-plastic known for being UV stable and durable. This filament would be ideal for printing parts for a remote-controlled airplane, particularly for its resistance to ultra-violet radiation. The aspect that allows this filament to be light is a foaming agent that is added to the filament during manufacturing. This foaming agent is considered to be an active foaming agent, rather than pre-foamed. This means that the foaming is done during printing and depends on the nozzle temperature. That reason alone

accounts for much of the difficulty when printing this filament. Foaming at the nozzle means filament retraction can cause major clogging. There will be two levels to the experiment, a high print speed and a low print speed. The factors I will be changing will be flow ratio, retraction amount, nozzle temperature, layer height, and chamber temperature.

Compressor Valve Plate Optimization (O)
Presenters: Ryan Metcalf, Amy Nason and Shane Tendo
Faculty Project Advisors: Georg Pingen and Randy Schwindt

This project investigates the optimization of valve plate geometries. A valve plate acts as the boundary through which gases must pass to get to and from a compression chamber. This component is key to improving the efficiency of the entire air compressor and acts as a major bottleneck to practical improvements. The team was tasked by MAT Industries with improving the valve plate design by modifying its geometry. To this end, we explored alternative materials, computational simulation, hole ratio optimization, and other experimental data acquisition.

Baja SAE Senior Design Project (O)
Presenters: Zane Bolton, Benjamin Kuhl, Judah Lampley, and Kyle Whitmark
Faculty Project Advisors: Georg Pingen and Randy Schwindt

Baja SAE is a collegiate design competition wherein engineering students are tasked with designing, building, presenting, and racing a single seat, offroad vehicle as a prototype to serve the recreational user market. During the national competition weekends, vehicles undergo a rigorous inspection process and various dynamic challenges, including an acceleration test, a suspension and traction test, a maneuverability course, a hill climb or sled pull, and a 4-hour endurance race. The Union University Baja SAE team finished their first vehicle and competed in their first national competition in October 2025. We then entered our second national competition season and designed and built a new and improved second vehicle over the course of the academic year. Overall, we achieved our primary goal of developing a higher-performing vehicle through reducing size and weight, increasing top speed, and integrating a customized suspension system with control arms we manufactured in house.

Young Touchstone Modeling Heat Exchanger Heat Transfer in the UU Wind Tunnel using Heat Pipes (O)
Presenters: Landon Haywood, Jake Lancaster, and Eli Patton
Faculty Project Advisors: Georg Pingen and Randy Schwindt

Wind tunnels are used as a tool to test how air can be used to benefit the field of engineering. In this project, our team sought to experimentally determine the effectiveness of using heat pipes within heat exchangers as an additional heat transfer system. Young Touchstone, a leading provider of heat exchanger solutions for various industries, tasked our team to use the Union University Wind Tunnel to model whether heat pipes could be used as a viable method within heat exchangers to reduce the temperature of the working fluid. Being able to reduce the temperature of the working fluid within heat exchangers would increase efficiency to improve their heat transfer capabilities. Preliminary studies, model simulation geometry, data acquisition and analysis, and wind tunnel experiments were all designed and conducted using the engineering design process to determine if Young Touchstone should include heat pipes in their heat exchangers.

An Automated Box-Folding System (O)
Presenters: Patrick Basie and Jacob Smith
Faculty Project Advisors: Georg Pingen and Randy Schwindt

A cobot is a robot designed to work alongside human operators. We are designing, validating, and integrating a box-folding system for a FANUC cobot to increase packaging efficiency, reliability, and space efficiency. TBJT ("Toyota Boshoku Jackson Tennesee") manufactures automotive interior systems. One of the products they produce is air filters, and they need a better system for folding the boxes in which they are packaged. TBJT provided the project, facilities, cobot, and much technical expertise. We are developing this system by consulting professionals in the selection and implementation of our end-of-arm-tool, conducting rapid prototyping via 3D printing, and consulting employees and industry experts for technical expertise. ⚓

The Great Turkey Rescue: A Picture Book (O)
Presenter: Lili Pettigrew
Faculty Project Advisor: Chris Bailey

Students Lili Pettigrew and Sarah Johnson are collaborating on crafting a picture book under the advisement of Union faculty and staff, namely Chris Bailey, Angela Lee, and Fran Thomas. This book will be self-published and printed, to be sold to Union friends and family. If possible, all of the proceeds of the book will be donated to Birth Choice because of the unique background of the story. The book idea originated with a situation at Snider farms in which the farm's turkeys followed a little boy, Atlas, to school. This elicited a story about these strange turkeys and their adventures and about Atlas. He and his mother both live on Snider farms after his mother decided against an abortion due to the ministry of Birth Choice. The joy of Atlas's life inspired the mission of this picture book. ⚓

NURSING [GRADUATE]

Comparison of International Health Care Systems: Dominican Republic (P)

Presenters: Alex Cunningham, Dexter Johnston, and James Williams

Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

The poster will show the healthcare system of the Dominican Republic, its structure and financing, and its regional issues and challenges. The financing of the healthcare system is a combination of public and private financing. The system is structured on a social health insurance model and is dependent on the provider of their choice. The issues and challenges facing the healthcare system include out-of-pocket expenses and workforce and regulatory issues, as well as noncommunicable diseases and an aging population. The Dominican Republic ranked 51st out of 191 countries on the WHO performance assessment of healthcare systems in 2000. The healthcare spending is low, at 4-5% of its GDP.

Comparison of International Healthcare Systems: South Korea (P)

Presenters: Onome Agbaza, Heidi Flowers, and April Thompson

Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

The Republic of Korea consistently ranks among the world's top three countries for life expectancy, reflecting the strength and efficiency of its national healthcare system. This poster

examines the structure and performance of Korea's universal National Health Insurance Service (NHIS), which provides comprehensive, high-quality, and affordable health care to nearly the entire population. Korea's health care model is renowned for its advanced medical technology, optimal health outcomes, and high preventative health coverage without sacrificing affordability and efficacy. The intricacies of Korea's health care system, including its coverage of foreign residents without additional premiums, its integrated financial model, structured government oversight, and innovative delivery model that contribute to the country's exceptional health outcomes and longevity ranking is what this presentation will explore. By examining these key health indicators and system design, Korea is identified as a leading example of how universal health care coverage can promote equity, efficiency, and long-term population health.

Comparison of International Health Care Systems: Singapore (P)

Presenters: Jacob Brown, Dylan Hobson, and Landon Ross

Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

Our presentation provides an in-depth analysis of Singapore's healthcare system, a model that is frequently cited for achieving strong health outcomes while maintaining relatively low national healthcare spending. The purpose of this presentation is to examine how economic incentives and government oversight shape system performance. Using a health economics framework, we analyze the payer system, healthcare financing and supply, reimbursement mechanisms, production and delivery of services, and provider choice. We also address challenges, such as cost-sharing, equity, and the impact of an aging population. System performance is assessed using international comparisons, including World Health Organization benchmarks, along with healthcare expenditure as a percentage of gross domestic product (GDP). The presentation also highlights the strengths and limitations of Singapore's model and identifies potential lessons applicable to other healthcare systems.

Comparison of International Health Care Systems: Netherlands (P)

Presenters: Brooke Cantwell, Sydney Hardin, and Katie Pritchard

Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

As a healthcare system, the Netherlands is recognized for providing high quality healthcare while establishing universal access for its citizens by regulating competition and maintaining affordability. A mandatory health insurance model that was put into place by the Health Insurance Act of 2006

states that all citizens must purchase basic health insurance from a private insurance company. However, the government plays a vital role in regulating the coverage and cost of insurance. By doing this, the government ensures fairness and equality in its coverage. In the Netherlands, primary care is a large and important part of the healthcare system. This helps provide better health outcomes and mitigate unnecessary spending. Overall, there is high satisfaction among the citizens in the Netherlands, however, like anywhere else, there are still challenges being faced like aging populations and rising costs for healthcare services.

Comparison of International Health Care Systems: Switzerland (P)
Presenters: Andrew Bassett, Timothy Hibler, and Matthew Skinner
Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

Switzerland's healthcare system provides universal coverage through mandatory, community-rated private insurance. Nonprofit insurers offer plans, financed primarily by individual premiums, deductibles, and co-payments (Filliettaz et al., 2021). Low-income residents receive means-tested subsidies. Service provision is decentralized across 26 cantons, with a public-private provider network. Hospitals are reimbursed mainly via the SwissDRG for basic insurance, while supplementary insurance provides add-on payments, creating differential financial incentives. Compulsory insurance covers benefits but excludes dental care; plan designs shape care delivery and cost-sharing. Patients enjoy wide insurer choice and with supplementary coverage, provider choice; however, quality transparency is limited. Key challenges include high and rising costs, geographic and equity gaps, and incentives for unnecessary procedures (Spycher et al., 2024). Despite these issues, compared to the U.S., Switzerland is characterized by superior health outcomes, increased life expectancy, and substantial healthcare spending as a share of GDP (OECD, 2025).

Comparison of International Health Care Systems: Ireland (P)
Presenters: Ben Afoakwa, Ritu Hasalia, and Nsikan Mbatt
Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

This presentation examines Ireland's healthcare economy, focusing on financing, spending, workforce, and equity, including resource allocation and cost control. It highlights the roles of the public and private sectors, noting that public hospitals are primarily funded through taxation. Primary care depends on entitlements and private insurance. Despite moderate EU spending, capacity constraints, workforce shortages, and long waits, reduced efficiency persists. Public contracts and the workforce impact the efficiency of primary and dental care. Private delivery causes variable access. Ireland's high public spending differs from Western countries. It has narrower health disparities than market systems, but barriers persist for those without full entitlements, particularly in accessing timely primary and elective care. Reforms aim to improve cost control, ensure universal access, and promote community-based prevention to enhance sustainability and equity. Funding, workforce, and entitlements influence healthcare efficiency and guide sustainable universal healthcare.

Comparison of International Health Care Systems: Norway (P)
Presenters: Mercy Kuye, Vanessa Nickles, and Gorreti Onaghinor
Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

In 2022, Norway allocated approximately 17.75% of its GDP to health care, as reported by the World Health Organization. The country's health system is predominantly publicly funded, with over 85% of expenditures covered through taxation and the National Insurance Scheme. Funding and service delivery operate in a semi-decentralized framework, where the Ministry of Health and Care Services allocates funds to municipalities and four Regional Health Authorities (RHAs). These RHAs oversee specialized services and manage 20 hospital trusts. Municipalities provide primary care, rehabilitation, nursing, and emergency services. Reimbursement methods include capitation, fee-for-service payments, patient co-payments for outpatient care, and block grants with case-based funding for hospitals. Inpatient and long-term home nursing are fully covered. Patients may choose between public hospitals and contracted private providers. Major challenges facing the system include GP shortages, geographic disparities in access, increasing demand for long-term care, and high out-of-pocket costs for dental services.

Comparison of International Health Care Systems: Denmark (P)
Presenters: Justin Fairchild, W. Levi Garrett, and Nicolas Zalewski
Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

Denmark operates a universal, tax-funded health care system focused on providing equitable access and maintaining strong population health outcomes. The purpose of this presentation is to explore the structure of Denmark's health care system, including the payer system, financing and supply, reimbursement, health care production, provider choice, and key challenges. Health care funding comes primarily from national and municipal taxes, with regional governments

overseeing hospital services and primary care coordination. Danish residents generally have broad access to health care with minimal out-of-pocket costs, though some cost-sharing exists for outpatient services and prescription medications. While Denmark consistently ranks highly in international health system comparisons, challenges remain related to workforce shortages, an aging population, and rising health care costs. This presentation highlights how Denmark balances access, efficiency, and long-term sustainability.

Comparison of International Health Care Systems: Kenya (P)

Presenters: Cara Dempsey, Jordan Eads, and Gabe Keys
Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

Health care systems vary widely in structure, financing, and access, all of which influence population health outcomes. This analysis examines the health care system of Kenya, with a focus on payer systems, financing and supply, reimbursement, production, provider choice, system challenges, global rankings, and health care expenditures. Kenya utilizes a mixed public–private health care system supported by national health insurance initiatives aimed at expanding universal health coverage, while facing limitations related to funding, workforce shortages, and infrastructure (World Bank, 2022; World Health Organization, 2023). According to the World Health Organization, the United States spends a significantly higher proportion of its gross domestic product on health care than Kenya, yet does not consistently achieve superior population health outcomes, highlighting important global differences in health system performance (World Health Organization, 2023).

Comparison of International Health Care Systems: Taiwan (P)

Presenters: Kristen Moret, Miguel Sioson, and Tawayne Tucker
Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

Taiwan faces unique challenges in its healthcare system. All permanent residents in Taiwan are covered by the National Health Insurance (NHI) program. However, this system is now facing challenges due to a rapidly aging population, leading to a greater burden of chronic diseases and long-term financial concerns for the country (Tsai et al., 2024). This presentation will explain the contrast between Taiwan's healthcare system and those of other developed nations. Additionally, the specific challenges Taiwan faces due to its geography, demographics, and culture will be discussed, as well as their influence on the organization of its healthcare systems. The unique healthcare system in Taiwan offers insights into the ongoing challenges faced across the globe.

Comparison of International Health Care Systems: New Zealand (P)

Presenters: Caleigh Bielas, Jonathan Blea, and Haley Loper
Faculty Project Advisors: Cathy E. Ammerman and Macy Arnold

Health care systems differ in structure, financing, and access, all of which influence population health outcomes. This analysis examines New Zealand's health care system, focusing on payer structure, financing, reimbursement, production, provider choice, system challenges, and national health expenditures. New Zealand operates a universal, tax-funded public health system. Most services are publicly financed, while private insurance provides additional options for elective procedures and specialist access. Hospitals are supported through government budget allocations, and primary care is funded through capitation and patient copayments. Healthcare spending represents approximately 10% of gross domestic product. Population health indicators are generally favorable, including high life expectancy and low maternal mortality. Despite these strengths, ongoing challenges include wait times, workforce shortages, and persistent concerns regarding equity and affordability.

Enhancing SRNA Regional Anesthesia Education of Interscalene and Supraclavicular Blocks through a 3D Plastinated Model of the Brachial Plexus: An Experiential Educational Project (P)

Presenters: Wesley Russell and Lucas Wigal
Faculty Project Advisors: Mary Crouse and Robert Wamble

Learning and understanding certain anatomical structures, like the brachial plexus, can be challenging for Student Registered Nurse Anesthetists (SRNAs). This can be attributed to the differences noted when comparing a two-dimensional image that is often used in SRNA education to actual three-dimensional human anatomy. While cadaveric dissection is utilized by some institutions to enhance student understanding, this method of teaching can be limited by factors such as number of donors and timing allowed by body preservation. Plastination, however, provides an anatomically accurate three-dimensional figure that is shelf-stable and can be utilized by students indefinitely and not limited to designated dissection hours. This experiential educational project will consist of developing a three-dimensional model of the brachial plexus to be utilized by SRNAs at Union University. By providing an accurate and detailed model, this educational tool is expected to significantly increase student understanding of these critical structures and improve student skill in performing upper extremity regional anesthesia.

Is Routine Video Laryngoscopy Cost-Effective for All Intubations? A Literature Review of Clinical and Economic Outcomes (P)
Presenters: Shawn Lords and Stefannie Wilkes-Pounders
Faculty Project Advisor: TaMara Carter

This doctoral project evaluates the cost-effectiveness of using video laryngoscopy (VL) for routine endotracheal intubations compared with traditional direct laryngoscopy (DL). Although VL offers better visualization and higher first-pass success, its routine use in all intubations increases costs. The aim was to determine whether VL's benefits result in overall cost savings for hospitals and patients. A comprehensive literature review covered studies from 2019 to 2025. Insights were also gathered through informal discussions with anesthesia providers. Findings indicated that although VL has higher upfront costs, its routine use might reduce

subsequent expenses related to airway injury, delayed intubation, and prolonged patient recovery. The project involved no patient contact or collection of protected health information. All data was securely stored and anonymized in accordance with ethical and institutional guidelines. This project serves as an educational experience for student registered nurse anesthetists and provides insights to guide cost-effective airway management practices.

A Look at Perioperative Anxiety Management for Geriatric Surgery Patients (P)
Presenter: Renèe Roger
Faculty Project Advisor: Molly Wright

This doctoral project addresses the significant gap in perioperative anxiety management among geriatric surgical patients, where reliance on midazolam or no intervention

remains common despite evidence of better outcomes with alternative strategies. The project is important because unmanaged anxiety in older adults can lead to negative physiological and psychological consequences, such as postoperative delirium, extended hospital stays, and delayed recovery, making effective interventions vital in clinical practice. The aim of the project was to evaluate both traditional and non-traditional approaches encompassing pharmacologic and nonpharmacologic methods in order to identify best practices that improve perioperative outcomes in this vulnerable population. Using an experiential review design, the study systematically searched databases including PubMed, MEDLINE, CINAHL, Elsevier, and Cochrane, narrowing 18 articles down to 15 for analysis, with evidence spanning systematic reviews, randomized controlled trials, qualitative studies, and integrative reviews. Findings highlighted that non-traditional pharmacological agents such as melatonin and dexmedetomidine, along with nonpharmacologic methods like music therapy and guided imagery, demonstrated effectiveness in reducing anxiety and enhancing recovery outcomes compared to limited reliance on benzodiazepines or no treatment. These results underscore the need for broader adoption of diverse anxiety management strategies tailored to geriatric patients, with implications for advancing provider education, improving surgical experiences, and shaping future research and policy on perioperative anxiety care for geriatric surgical patients.

Electronic Cigarette Use and the Anesthetic Considerations: An Experiential Educational Project (P)
Presenters: Kelsey Myracle and Destenee Webb
Faculty Project Advisor: Morgan Grones

Electronic cigarette use is increasingly prevalent, particularly among younger patients, and poses unique perioperative risks affecting pulmonary and cardiovascular function. Because e-cigarettes are a relatively new form of nicotine delivery, anesthesia providers may be unfamiliar with their anesthetic implications. This project aimed to increase provider awareness and improve perioperative management of patients who use electronic cigarettes. An educational PowerPoint was delivered to anesthesia providers in a hospital setting, accompanied by pre- and post-intervention surveys to assess knowledge and intended practice changes. Results demonstrated a significant shift in clinical approach: prior to education, 75% of participants did not differentiate electronic cigarette use from traditional smoking during preoperative assessment, whereas post-intervention, 100% reported they would make this distinction and adjust anesthetic plans accordingly. These findings suggest that targeted education can meaningfully improve provider awareness, promote individualized anesthetic planning, and enhance patient safety in this growing population.

Ketorolac: Evaluating the Clinical Impact on Postoperative Bleeding (P)
Presenters: Jonathan Hooper and Elijah Pecheny
Faculty Project Advisor: Morgan Grones

Anecdotally, many Certified Registered Nurse Anesthetists (CRNAs) express reluctance in administering intravenous ketorolac (Toradol) due to concerns about postoperative bleeding. This clinical hesitancy continues despite substantial evidence suggesting no statistically significant increase in bleeding among patients who receive ketorolac compared to those who do not. Given ketorolac's opioid-sparing analgesic efficacy and favorable safety profile, this discrepancy highlights a critical gap in clinical knowledge and practice. The purpose of this project is to: 1) evaluate the true risk of bleeding associated with ketorolac use perioperatively; 2) give advice on the best timing to administer ketorolac in the perioperative period; and 3) give confidence to CRNAs to be more liberal with their ketorolac administration. A comprehensive literature review was conducted using databases including Medline, CINAHL, and PubMed, with search terms "ketorolac or toradol," "bleeding or hemorrhage," and "perioperative." Meta-analyses, randomized controlled trials, and other high-quality studies from 2019 to 2025 have been prioritized. The findings are consistent with previous research suggesting that ketorolac does not cause clinically significant bleeding in the perioperative period. These findings may encourage increased utilization of ketorolac among CRNAs who have been hesitant to administer it due to concerns about postoperative bleeding.

The Administration of Nalbuphine to Decrease the Incidence of Opioid-Induced Pruritus in Parturients: An Experiential Educational Project (P)
Presenter: Denitra Carter
Faculty Project Advisor: TaMara Carter

Opioids remain a fundamental component in pain management within obstetric anesthesia. However, opioid-induced pruritus, an adverse effect, significantly affects maternal comfort, satisfaction, and early bonding with the newborn. The pathophysiology of opioid-induced pruritus remains unclear, complicating the determination of the most appropriate intervention. Research indicates that Nalbuphine is particularly effective in mitigating opioid-induced pruritus. Nevertheless, there remains a clear knowledge gap among anesthesia providers regarding the comparative effects of Nalbuphine relative to other pharmacologic agents. This underscores the necessity for an evidence-based approach to enhance practice guidelines aimed at alleviating maternal discomfort. This project aims to explore and evaluate the efficacy of Nalbuphine, an opioid agonist-antagonist. The primary objective is to educate anesthesia providers on the management of opioid-induced pruritus, thereby demonstrating the effectiveness of Nalbuphine in

alleviating pruritus without compromising nociception. This initiative enables healthcare providers to address pruritus effectively, consequently improving patient satisfaction and facilitating a seamless bonding experience between mother and baby. Through an educational infographic, providers will be informed about the pharmacological rationale for selecting Nalbuphine over traditional agents such as antihistamines or 5-HT3 antagonists. This experiential educational project is anticipated to foster a more informed and evidence-based approach to managing opioid-induced pruritus in obstetric anesthesia. Increasing awareness of Nalbuphine's efficacy can lead to reevaluation of current practices among anesthesia providers, standardization of care, improved maternal outcomes, and further research to substantiate its effectiveness.

From Estimation to Precision: Educating Providers on ETT Cuff Pressure Monitoring (P)
Presenters: Octavio Rivera-Sanchez and Zach Schwabe
Faculty Project Advisor: Molly Wright

This DNP educational project addresses inconsistent endotracheal tube (ETT) cuff pressure management among anesthesia providers. Many continue to use subjective techniques, such as pilot balloon palpation and minimal occlusive volume (MOV), which are frequently inaccurate and pose risks of tracheal injury or aspiration. Through a comprehensive literature review, this project synthesized current best evidence to support the use of digital manometers for safer, more accurate ETT cuff inflation. Studies show that tactile estimation methods result in incorrect pressures up to 68% of the time, while educational interventions and manometer use significantly improved provider accuracy and reduced airway complications. The final product is an evidence-based recommendation for incorporating digital manometry into routine anesthesia practice, supported by structured provider education. The project reflects Christian principles of nonmaleficence and servant leadership and will be disseminated via poster and video presentation.

Preoperative Gastric Residual Volume for an Adult Surgical Patient: A Comparison Between GLP-1 Agonist Users to Non-Users (P)
Presenter: Kristopher Stone
Faculty Project Advisor: Molly Wright

The growing utilization of semaglutide, a glucagon-like peptide-1 receptor agonist (GLP-1), as well as others for both weight management and glycemic control has introduced new challenges in the perioperative setting, primarily due to its effect on delayed gastric emptying. This review aims to consolidate current evidence regarding the anesthetic considerations associated with GLP-1

agonist use, with an emphasis on aspiration risk and perioperative gastric content assessment and the potential need to modify fasting guidelines. A literary review was conducted using PubMed, and Cochrane Library databases to identify observational studies, case reports, and expert guidelines published between 2023 and 2025. Key search terms included "GLP-1 receptor agonist," "semaglutide," "delayed gastric emptying," "perioperative," and "gastric ultrasound." Data was extracted on incidence of residual gastric contents, diagnostic modalities, and intervention outcomes. An increasing body of evidence has identified significant residual gastric content despite adherence to standard fasting guidelines, potentially heightening the risk of pulmonary aspiration. Emerging diagnostic modalities, particularly point-of-care gastric ultrasound (POCUS), have demonstrated clinical utility in preoperative gastric content evaluation. Interventional strategies such as extended cessation of semaglutide prior to surgery and the use of preoperative prokinetic agents have shown promise in mitigating these risks. Evidence-based recommendations for the perioperative management of patients on GLP-1 therapy while emphasizing individualized risk stratification and the integration of bedside gastric imaging are discussed. These developments highlight the need to revise traditional fasting protocols and enhance perioperative management strategies to optimize patient safety in the context of GLP-1 agonist use.

Is Video Laryngoscopy a Better Alternative to Direct Laryngoscopy for Endotracheal Intubation? (P)
Presenters: Ryan Blackburn and Jake Curtis
Faculty Project Advisor: Molly Wright

Background: Direct and video laryngoscopy are two common techniques used to visualize the larynx and facilitate tracheal intubation. Direct laryngoscopy requires the clinician to align the oral, pharyngeal, and laryngeal axes using a laryngoscope blade and relies on a direct line of sight to the vocal cords. In contrast, video laryngoscopy incorporates a miniature camera at the blade tip, allowing the clinician to view the airway on a screen, even when a direct line of sight is not possible. Video laryngoscopy is considered a superior method in many clinical settings because it provides improved glottic visualization, increases first-attempt success rates, and reduces airway trauma, especially in patients with difficult anatomy or limited neck mobility. Additionally, it facilitates teaching and teamwork, as the entire medical team can view the airway in real-time, enhancing safety and decision-making during intubation.
Purpose: The purpose of this project is to educate anesthesia providers about the superior method of intubation. By presenting the results from these articles, they will gain a clearer understanding of why video laryngoscopy is a better method of intubation.

Methods: A literature review of 14 articles that were graded using a level of evidence evaluation tool was our method. We then reviewed the articles to ensure they met our search criteria and, following our research, were comparable to the other articles. We carefully reviewed the findings in every study to come to a final conclusion on our problem statement.

Results: The collective evidence strongly supports video laryngoscopy as superior to direct laryngoscopy in multiple clinical dimensions—especially in terms of success rate, safety, visualization, and usability across varied populations and provider experience levels. As such, an increasing number of experts and healthcare systems are recommending a transition toward video laryngoscopy as the standard of care in both routine and complex airway management scenarios. Conclusion and Implications: The increased use of video laryngoscopy has significant implications for clinical practice, particularly in emergency and critical care settings. Its enhanced visualization capabilities improve the likelihood of successful intubation on the first attempt, reducing complications such as hypoxia, airway trauma, and prolonged intubation time. This is especially critical in patients with difficult airways, limited neck mobility, or anatomical abnormalities. The shared screen view also promotes better communication and collaboration among the healthcare team, supporting real-time supervision and teaching

opportunities for less experienced providers. As a result, institutions may consider adopting video laryngoscopy as the standard approach for airway management, investing in training and equipment to ensure consistent and safe practice across varying levels of provider experience. To conclude our research, we found that video laryngoscopy was the safer method for intubation. Direct laryngoscopy has a slightly increased risk of first-attempt failure and orotracheal injuries. While the numbers were not significantly different, choosing the proven, safer method is essential for patient care. While it is crucial to maintain the fundamental skill of direct laryngoscopy, video laryngoscopy should be the primary method for intubation. By presenting this information to healthcare providers, we can educate them on the importance of using video laryngoscopes if available.

An Evidence-Based Literature Review of Perioperative Dexmedetomidine Use for Neuroprotection in Older Surgical Patients (P)

Presenters: Taylor Cochran and Elisabeth Tribeck
Faculty Project Advisor: Morgan Grones

Background or Problem Statement: Postoperative delirium and cognitive dysfunction are common complications in elderly surgical patients that can significantly impact their

health outcomes and quality of life following surgery. Current research indicates that dexmedetomidine, an alpha-2 agonist given intraoperatively, has the potential to significantly reduce the incidence of delirium and cognitive dysfunction in elderly surgical patients. Dexmedetomidine provides neuroprotection and shows promise in mitigating multiple factors that cause postoperative cognitive dysfunction.

Purpose or Aim: The purpose of this project is to provide anesthesia providers with education on the neuroprotective benefits of intraoperative dexmedetomidine use for surgical patients over the age of 60 years. This project aims to enhance anesthesia provider knowledge and to improve patient outcomes in the vulnerable elderly population.

Methods: A literature review was conducted to analyze current research data on the neuroprotective properties of dexmedetomidine. 112 articles were reviewed, and 12 articles were kept based on inclusion and exclusion criteria. The literature review prioritized articles with high levels of evidence such as randomized control trials, meta-analysis studies, and systematic reviews.

Results or Findings: The literature review found that in elderly patients ages 60 and older, Dexmedetomidine decreased the incidence of postoperative cognitive dysfunction and delirium after surgery. Conclusions and Implications: This project can impact patient outcomes by decreasing preventable postoperative cognitive dysfunction and delirium in elderly surgical patients. Decreasing these complications can also reduce the length of hospital stays, intensive care unit admissions, and mortality secondary to delirium.

Neuraxial Neostigmine as an Opioid Sparing Analgesic in Labor & Delivery Patients (P)
Presenters: Corey Long and Gary Pressley
Faculty Project Advisor: Molly Wright

Neuraxial neostigmine has emerged as a potential opioid-sparing alternative for labor analgesia yet concerns regarding nausea and vomiting have limited its clinical adoption. Neostigmine, an anticholinesterase, enhances analgesia by increasing acetylcholine levels within the spinal cord, while glycopyrrolate is commonly co-administered to mitigate muscarinic side effects. This literature review evaluated evidence from 2004–2025, emphasizing high-level studies, to assess the safety and efficacy of neuraxial neostigmine compared with opioids. Analysis of ten selected studies demonstrated that neostigmine accelerated sensory block onset, prolonged analgesia duration, and reduced subsequent analgesic requirements, without a significantly increased risk of nausea and vomiting. Overall, neostigmine appears to be a safe and effective adjunct or alternative to opioids for labor analgesia. These findings highlight its potential role in reducing opioid exposure in parturient and support further research to refine clinical guidelines and expand provider awareness.

An Evidence-Based Practice Update to Maintain Hemodynamic Stability in Laparoscopic Cholecystectomy with Dexmedetomidine (P)
Presenters: Lauren Johnson and Sydney Naseman
Faculty Project Advisor: Molly Wright

A common gap in anesthesia practice is the limited utilization of dexmedetomidine. For this evidence-base practice update, an electronic database search was conducted in MEDLINE, NCBI, ScienceDirect & CINAHL from the beginning of January 1, 2021 to January 1, 2025, with combined terms relating to 'laparoscopic cholecystectomy' and 'Dexmedetomidine.' Studies that quantitatively assessed the effects of Dexmedetomidine to reduce hemodynamic variability in patients undergoing a laparoscopic cholecystectomy were reviewed and ten articles were used. The analysis of the reviewed articles indicates that Dexmedetomidine is more effective than alternatives such as Fentanyl and Clonidine for enhancing hemodynamic stability when used as a premedication for induction. This resulted in better attenuation of the hemodynamic variances during laparoscopic cholecystectomies.

Implementation of a Formal Mentoring Program to Improve Job Satisfaction Among Novice Nurse Faculty (P)
Presenter: Christine Deere
Faculty Project Advisor: Cynthia Reed

Novice nurse faculty often transition into academic roles with limited preparation for teaching and faculty responsibilities, which can lead to decreased job satisfaction and increased turnover. Mentoring has been identified as a key strategy to support new faculty and improve satisfaction and retention. This quality improvement project implemented a formal mentoring program at a private university school of nursing in which novice faculty were paired with experienced faculty mentors and met regularly over one academic semester. Job satisfaction was measured at multiple points during the semester using a validated survey tool. Results indicated improved perceptions of support, role clarity, and overall job satisfaction among novice faculty participants. Findings suggest that structured mentoring programs may be a feasible strategy to support novice nurse faculty and strengthen faculty retention within schools of nursing.

Volatile Anesthetics vs. TIVA? Examining Outcomes in Cardiac Surgery (P)
Presenters: Shelby Harris and Audra Romney
Faculty Project Advisor: Morgan Grones

Despite the use of state-of-the-art technology, modern equipment, and evidence-based anesthesia techniques, complications after cardiac surgery persist. A variety of

different anesthetic techniques can be used to influence positive patient outcomes, ideally tailored to specific procedures and patient characteristics. A commonly held notion is that volatile anesthetic agents may be superior in exerting cardioprotective effects in our cardiac surgical patients. Through an extensive literature review of patient outcomes after cardiac surgery, the goal of this project is to determine whether the superiority of volatile agents related to morbidity and mortality when compared to a total intravenous anesthetic technique is supported by evidence. These findings can help guide current and future anesthesia providers in best practice when caring for this specific patient population.

Enhancing Ultrasound-Guided Regional Anesthesia Education through a 3D Plastinated Model of the Infraclavicular Brachial Plexus (P)
Presenters: Matthew Kelly, Kenton Lee, and Yi Peng
Faculty Project Advisor: Mary Crouse

Background: Proficiency in brachial plexus anatomy is critical for ultrasound-guided regional anesthesia, yet its structural complexity and anatomical variability present persistent challenges in anesthesia education. Traditional 2D illustrations and cadaveric dissections, while foundational, fail to deliver the durable, high-fidelity spatial representation required for clinical translation. Digital 3D tools enable virtual exploration but lack tactile feedback and true-to-scale dimensionality, limiting their utility for kinesthetic learners.
Problem: A disconnect persists between theoretical knowledge of infraclavicular brachial plexus anatomy and the technical confidence required to perform ultrasound-guided nerve blocks. The absence of accessible, high-fidelity anatomical models restricts opportunities for deliberate, independent practice, forcing learners to rely on inconsistent clinical exposure. This gap may prolong skill acquisition and increase dependence on supervised training.
Purpose: This project developed a 3D plastinated model of the infraclavicular brachial plexus from a human cadaver specimen to bridge this educational divide. The model preserves detailed neural, muscular, vascular, and osteological relationships, optimized for ultrasound-guided procedural training. By providing an accurate, tactile, and reusable learning tool, the project aims to enhance spatial orientation, depth perception, and clinical decision-making in regional anesthesia education. Methods: We created a tactile anatomical model from a dissected cadaveric specimen through silicone plastination (Biodur S10 technique) and added latex-injected vessels to enhance visualization. The model was designed to: Accurately replicate 3D spatial relationships; Provide ultrasound-compatible landmarks; Enable hands-on needle navigation practice.
Results: The finished model will be tested in future educational workshops with SRNAs. Planned assessments include: Pre/post-tests of anatomical knowledge; OSCEs

for procedural accuracy; Likert-scale surveys on learner confidence. Conclusion: The plastinated model presents an innovative educational solution for UGRA training through its combination of cadaveric accuracy and reusable features. The model provides essential spatial learning benefits through its touchable structure which functions as both educational material and a permanent educational resource for upcoming students. The assessment of skill acquisition and clinical readiness will be conducted during future implementation.

A Quality Improvement Project Enhancing Patient Safety: Strategies to Reduce MBI's in Adult Oncology Care (O)
Presenter: Ze'Erica Duncan
Faculty Project Advisor: Cynthia Reed

Oncology patients are at high risk for mucosal barrier injuries (MBIs), which contribute to pain, infection, and increased morbidity. Evidence-based oral care protocols reduce these complications, but adherence to these protocols are often inconsistent. This quality improvement project aimed to improve nursing compliance with an established oral care protocol and to reduce MBI incidence on adult oncology units. Over 12 weeks, nurses received protocol reeducation and a revised standardized bedside checklist. Compliance was measured through daily chart audits, and monthly MBI rates. The monthly MBI rates were obtained from Infection Prevention surveillance data. A total of 1,582 audits were completed. Compliance at baseline was 4.73%, 31.61% in October, and 34.33% in November. MBIs decreased from five cases in October to two cases in November, representing a 60% reduction. These results exemplify that targeted education and structured workflow tools improve adherence to oral care practices and support reductions in MBIs.

Incorporating Animal-Assisted Therapy into Mental Health Practice: A QI Project (O)
Presenter: Samantha Hall
Faculty Project Advisor: Lindsey Cook

This quality improvement project aims to encourage the use of nonpharmacological interventions as a therapeutic approach to improve patients' mental health by educating providers on and providing a referral resource for AAT. The project was conducted at two separate clinics, where participants were educated about the evidence-based benefits of AAT in mental health treatment and how to make a referral, including a physical handout that can be provided to patients. The project tracked referrals placed by providers over 10 weeks. The results showed that 547 AAT referrals had been placed across the two clinics, indicating that educating providers and providing a resource sheet do influence referrals. This evidence can be used to improve the quality of mental health treatment provided to patients, and

the structure can be applied to many different educational topics to address patients' individual needs and implications for future research.

Increasing Education of Depression Screening on a Med-Surg Unit (O)
Presenter: Rachel Patton
Faculty Project Advisor: Lindsey Cook

Many nurses working on med-surg floors are often unfamiliar with symptoms of depression or how to use screening tools to detect a patient suffering from depression. This quality improvement project aimed to increase nurses' education of depression screening on med-surg units. An in-service educational PowerPoint was shown to all the nurses on a med-surg unit on how to screen patients using the PHQ-9 tool. Results of the study showed that implementing routine depression screening for med-surg patients prior to discharge is effective and can lead to improved mental health outcomes.

Improving Employee Wellness with Mindfulness-Based Interventions for Pediatric Hematology/Oncology Nurses (O)
Presenter: April Robinson
Faculty Project Advisor: Sharon Evans

Pediatric Hematology/Oncology nurses practice in a high-acuity, emotionally demanding environment that increases their risk of burnout and decreased work engagement. While mindfulness-based interventions (MBIs) have demonstrated effectiveness in enhancing resilience and overall well-being, limited evidence exists within outpatient pediatric Hematology/Oncology settings. This quality improvement (QI) project evaluated the impact of a daily 5-minute mindfulness intervention on nurse well-being and burnout over a 10-week period. Eligible participants included registered nurses working ≥24 hours per week in the outpatient Pediatric Hematology/Oncology department (N = 25). A pre–post survey design was utilized. Participants completed the Utrecht Work Engagement Scale (UWES-9) and the Burnout Assessment Tool (BAT) before and after the intervention. Twenty-two of 25 eligible nurses (88%) completed both surveys, and 60% engaged in the daily mindfulness intervention. UWES-9 scores increased from a mean of 3.85 pre-intervention to 4.26 post-intervention. BAT scores demonstrated minimal change over the intervention period. These findings suggest that a brief, accessible mindfulness intervention may serve as a feasible, low-cost leadership strategy to enhance engagement and support workforce sustainability in high-stress specialty nursing environments.

The Effects of Structured Orientation on Clinical Instructor Confidence in Executing Formative Feedback (O)
Presenter: Amy Gray
Faculty Project Advisor: Christina Davis

Clinical instructors with inconsistent or limited training in the use of assessment tools may lack the knowledge and confidence needed to provide effective, formative feedback. Such feedback is essential for student nurses to develop competency, confidence, and clinical judgement throughout their education. The purpose of this QI project was to evaluate the effects of a targeted Clinical Evaluation Tool orientation course on clinical instructor self-efficacy and confidence in providing constructive feedback to undergraduate nursing students. Using pre-post surveys with an adapted Clinical Nursing Teacher Self-Efficacy Scale, this project explored changes in instructor confidence, as evidenced by increased formative feedback following the orientation course. These findings highlight the need for ongoing, structured training programs to improve educators' self-efficacy and confidence, underscoring the importance of intentional faculty development to improve student outcomes.

The Importance of De-escalation Techniques in the Emergency Room Setting: A Quality Improvement Project (O)
Presenter: Ashley Steinberger
Faculty Project Advisor: Lindsey Cook

The increased use of PRN intramuscular (IM) medications for agitation in the emergency department (ED) setting has raised concerns regarding patient safety, medication-related adverse effects, and overall quality of psychiatric care. At Southern Hills Medical Center, acutely mentally ill patients— particularly those diagnosed with intellectual disabilities— frequently received IM medications without consistent implementation of verbal de-escalation techniques as a first-line intervention. Evidence suggests that lack of staff training in behavioral management strategies contributes to increased reliance on chemical restraints, staff burnout, and heightened patient agitation. This quality improvement (QI) project evaluated whether structured education and implementation of verbal de-escalation techniques among ED staff could reduce the frequency of PRN IM medication administration over a 12-week period. Guided by a Plan-Do-Study-Act (PDSA) framework, the project included staff in-service training, implementation of a standardized de-escalation tracking tool, and biweekly data analysis of medication use among patients diagnosed with intellectual disabilities (ICD-10 codes F70–F79). Baseline data demonstrated an overall reduction in PRN IM medication use. Implementing these changes saw a decrease in the need for IM medication and more successful de-escalations without the need for IM med interventions. ⚓

PHARMACY [GRADUATE]

Substituted Benzyl Carbamates: Towards the Development of a Quantitative Structure-Activity Relationship (QSAR) in the Search for a Safe and Effective Treatment for Visceral Leishmaniasis (P)
Presenter: Patrick Bollwerk and Grant Gay
Faculty Project Advisor: E. Blake Watkins

In pursuit of new therapeutic leads for visceral leishmaniasis, a series of acyclic benzyl carbamates was synthesized and evaluated as part of a global drug discovery collaboration. Incorporation of the benzyl moiety was intended to enhance lipophilicity and potentially improve interactions with biological targets. The synthesized compounds were designed to systematically vary substituent patterns to assess their impact on antiparasitic activity. We are hopeful to be able to determine the importance of aromatic substitution patterns on potency, providing key insights for future optimization. This data will contribute to an expanding shared dataset used to guide predictive modeling and compound prioritization across collaborating institutions. This work highlights the value of targeted functional group modifications in advancing early-stage drug discovery for neglected tropical diseases.

Substituted Cyclic Ureas: Towards the Development of a Quantitative Structure-Activity Relationship (QSAR) in the Search for a Safe and Effective Treatment for Visceral Leishmaniasis (P)
Presenters: Leslie Curry and Wes Sisco
Faculty Project Advisor: E. Blake Watkins

To further explore scaffold constraints in antileishmanial drug design, a series of cyclic ureas was synthesized and evaluated for biological activity. Cyclization was employed to restrict

conformational flexibility, potentially enhancing target binding affinity and metabolic stability relative to acyclic counterparts. The resulting compounds were designed with diverse substitution patterns to investigate the impact of ring size and functionalization on activity. Comparison with acyclic analogs will provide key information on the value of scaffold rigidity and what role it may play in optimizing molecular interactions with the biological target. These findings will provide important structural insights and complement ongoing efforts to develop predictive QSAR models. By contributing new data on constrained scaffolds, this work supports the rational design of more potent and selective compounds for the treatment of visceral leishmaniasis.

Substituted Methyl Carbamates: Towards the Development of a Quantitative Structure-Activity Relationship (QSAR) in the Search for a Safe and Effective Treatment for Visceral Leishmaniasis (P)
Presenters: Sarah Coppola, Chrisopher Nunez, and Keren Rosen
Faculty Project Advisor: E. Blake Watkins

As part of a collaborative effort within the Open Synthesis Network (OSN), a series of acyclic methyl carbamates was synthesized to evaluate their potential as antileishmanial agents. This compound class was selected to probe the influence of carbamate functionality and small alkyl substituents on biological activity. Structural variation focused on modifying aromatic and aliphatic regions to assess their contributions to potency. Comparative analysis with related urea analogs will allow us to detect subtle yet important differences in activity trends, providing information on key binding interactions or physicochemical properties. The results will expand the chemical space explored in this program and provide valuable input for ongoing QSAR modeling efforts. Collectively, the findings will contribute to a broader understanding of how functional group modifications impact antileishmanial activity and inform the rational design of next-generation compounds.

A Crowd-sourced Approach to Lead-Generation for the Discovery of Antileishmanial Agents (P)
Presenters: Leslie Curry and Jisha Patel
Faculty Project Advisor: E. Blake Watkins

The College of Pharmacy has joined the Drugs for Neglected Diseases Initiative (DNDi) Open Synthesis Network (OSN) to support global efforts toward identifying safe and effective treatments for visceral leishmaniasis, a life-threatening parasitic disease prevalent in tropical regions. In this study, a series of substituted acyclic ureas was synthesized and evaluated for antileishmanial activity. These compounds were designed to explore structural diversity and generate data for inclusion in a developing quantitative structure–activity

relationship (QSAR) model. Biological evaluation revealed several active compounds, with IC_{50} values ranging from 1.5 to 20.2 μM. The resulting dataset contributes to a growing, collaborative effort to refine predictive models that guide the rational design of more potent analogs. These findings establish acyclic ureas as a promising scaffold for continued optimization within this global drug discovery initiative.

Artificial Intelligence in Pharmacy Practice: A Comprehensive Continuing Education Program (P)
Presenter: Joshua (Eli) Slaten
Faculty Project Advisor: Sean King

Artificial intelligence (AI) is rapidly transforming healthcare delivery, with expanding applications across pharmacy practice. This continuing education poster explores the current and emerging roles of AI in community, hospital, and clinical pharmacy settings. Key applications include clinical decision support, medication therapy optimization, predictive analytics for disease risk, workflow automation, and pharmacovigilance. The presentation will examine how AI-driven tools enhance medication safety, improve operational efficiency, and support data-informed clinical decision-making. Additionally, ethical considerations, data integrity, regulatory oversight, and the evolving role of the pharmacist in an AI-integrated healthcare environment will be discussed. Emphasis will be placed on balancing technological innovation with professional judgment and patient-centered care. By increasing awareness of AI's capabilities and limitations, this educational activity aims to equip pharmacists and student pharmacists with foundational knowledge necessary to critically evaluate and responsibly integrate AI technologies into contemporary pharmacy practice.

Early Professional Transition and First-Year Pharmacy Student Well-Being (P)
Presenters: Andrew Bragg, Madeline Bausman, Brooks Fountain, Pola Hanna
Faculty Project Advisor: Sean King

This study assessed the well-being of first-year (P1) pharmacy students using a survey grounded in the PRECEDE-PROCEED Model to inform future health promotion strategies within the College of Pharmacy. Recognizing health as a holistic balance of interconnected dimensions, the survey evaluated physical, mental/emotional, social, spiritual, and financial well-being. The General Anxiety Disorder-7 (GAD-7) and an Academic Anxiety Scale were also administered to assess anxiety levels related to both general and academic stressors. Results provide insight into the early transitional challenges experienced during the first professional year, highlighting patterns across multiple wellness domains. Findings identify predisposing, reinforcing, and enabling factors influencing student well-being and establish a baseline for future

intervention planning. These results contribute to a data-driven understanding of first-year pharmacy student wellness and support targeted, theory-informed strategies to promote resilience and academic success.

Comparative Analysis of First- and Second-Year Pharmacy Student Well-Being (P)
Presenters: Jeaneen Scales, Trinity Stanton, Kristin Sutton, and Blake Travers
Faculty Project Advisor: Sean King

This study compared the well-being of first- and second-year pharmacy students using a survey developed within the PRECEDE-PROCEED framework. Guided by the premise that health reflects a holistic balance across interconnected domains, the survey assessed physical, mental/emotional, social, spiritual, and financial well-being. The General Anxiety Disorder-7 (GAD-7) and Academic Anxiety Scale were included to evaluate differences in anxiety levels between cohorts. Comparative analysis examined variations in overall wellness and domain-specific trends to identify potential shifts associated with progression in the professional curriculum. Findings highlight similarities and differences in stress patterns, anxiety levels, and perceived barriers to well-being between the two groups. Results provide a comprehensive understanding of how student wellness evolves across the early professional years and offer evidence to inform targeted, data-driven wellness initiatives within the College of Pharmacy.

Evolving Stressors and Second-Year Pharmacy Student Well-Being (P)
Presenters: Braden Middleton, James Morris, Coleson Naranjo, and Viviana Rodriguez
Faculty Project Advisor: Sean King

This study evaluated the well-being of second-year (P2) pharmacy students using a survey informed by the PRECEDE-PROCEED Model to guide institutional health promotion efforts. Viewing health as a multidimensional construct, the survey assessed physical, mental/emotional, social, spiritual, and financial well-being. Measures of anxiety included the General Anxiety Disorder-7 (GAD-7) and an Academic Anxiety Scale to better understand stress patterns during the second professional year. Results provide insight into the evolving stressors and wellness challenges experienced as academic rigor increases and professional expectations expand. Analysis identified key behavioral, environmental, and psychosocial factors influencing overall well-being. Findings help characterize how wellness domains interact during the second year of pharmacy education and inform potential targeted interventions to support sustained resilience, reduce anxiety, and promote academic and professional development within the College of Pharmacy. ⚓

PHYSICS

Constraining the Ionized Outflow of Mrk-266 SW with Hubble Narrow Band Imaging (O)

Presenter: Timothy White
Faculty Project Advisor: Mason Ruby

The most powerful objects in the universe are Active Galactic Nuclei (AGN), supermassive black holes that are actively accreting material. When two galaxies containing AGN begin to merge, a dual AGN is formed. One example of this is the galaxy merger Mrk-266, in which a NE and SW nucleus are present. The goal of this project is to process and use new Hubble Space Telescope imaging data of the dual AGN in Mrk-266 to obtain more accurate dimensions of the outflow cone in the SW nucleus. These new values can then be used to rework the calculations for the mass outflow rate of the cone and the kinematic power of the outflow, which are quantities used to determine whether the cone is fueled predominantly by the AGN.

Understanding Galaxy Kinematics and Supermassive Black Holes through Unsupervised Nonlinear Machine Learning of MaNGA Observations (O)

Presenter: Moses Zhu
Faculty Project Advisor: Mason Ruby

The Sloan Digital Sky Survey (SDSS) has mapped thousands of galaxies using integral field spectroscopy, providing measurements of their stellar velocity, ionized gas velocity, star formation rate, and other physical properties. Through the Mapping Nearby Galaxies at APO (MaNGA) survey, observations are obtained using "integral field units" (IFU) composed of tightly packed arrays of optical fibers. IFU observations produce high-dimensional datasets that are complex and difficult to analyze and interpret using traditional techniques. In this project, we apply dimensionality reduction methods to MaNGA emission-related features in order to uncover underlying structure and trends in galaxy properties. Principal Component Analysis (PCA) is first used to reduce noise and identify the dominant sources of variance in the data, followed by Uniform Manifold Approximation and Projection (UMAP) to construct a low-dimensional representation that preserves nonlinear relationships. With a density-based clustering algorithm, we visualize and compare emission characteristics across galaxies while retaining physically meaningful distinctions. By choosing representative galaxies from each identified group, we reveal systematic differences in emission behavior that could link to star formation activities, kinematics, and the influence of central supermassive black holes. ⚓

PSYCHOLOGY

Beyond the Physical: A Moderated Regression Analysis of Exercise Motivation and Frequency, Religiosity, and Depression (P)

Presenter: Abigail Farmer
Faculty Project Advisor: Luke Walden

It is commonly known that physical activity and exercise tend to have a positive impact on individuals' mental health (Belcher et al., 2021). However, no previous studies have examined the relationship between exercise habits, motivation to exercise, mental health, spirituality, and religiosity. This study examines the relationship between exercise and mental health in college students. With a sample of 170 Union undergraduate students, a moderated regression was utilized to determine if motivation to exercise, religiosity, spirituality, and exercise frequency predict depression, with religiosity and spirituality moderating the relationship between exercise frequency and depression scores. Results indicate that introjected regulation to exercise positively predicted depression scores, and that the interaction of religiosity and exercise frequency was statistically significant (where those who were more religious had higher depression scores with higher exercise frequency, and those who were less religious were less depressed with higher exercise frequency). It is likely that the association between higher levels of religiosity and higher depression scores with increased participation in exercise is linked to a religious scrupulosity, as concepts such as honoring one's body can evolve into an obsession as opposed to a healthy practice, leading one to fixate on the areas they fall short in and experience guilt rather than acknowledging progress toward a healthy lifestyle (Mancini et al., 2023).

Does Social Support Have an Impact on Grit in Adults? (P)

Presenter: Katie Campbell
Faculty Project Advisor: Luke Walden

Most research surrounding social support and grit has involved students. There is a gap concerning adults, which this study aimed to fill. Data was used from a survey that was a nationally representative sample, and a linear regression was done. The results showed the overall model was not statistically significant, nor did social support or gender separately predict grit scores. This goes against the literature that says social support impacts grit in students. There are certain limitations to this study that may have affected these results, but it was a close call (p=.06). Although more research should be done to confirm or deny these results, what can be taken away is gender doesn't impact grit levels. Men or women don't have inherently more perseverance.

Underneath the Surface: Latent Personalities and Their Impact on Mental Health (P)

Presenters: Eliana Butler and Tina Chen
Faculty Project Advisor: Luke Walden

The purpose of this study is to explore the relationship between the Big Five Inventory (BFI) personality traits and the mental health experiences of depression, anxiety, and stress (DAS) in college students. Previous research has found a positive correlation between trait neuroticism and increased DAS (Okutucu, 2025), and a negative correlation between openness, conscientiousness, and extraversion with DAS (Yang, 2022). Previous studies, however, have not utilized Latent Profile Analysis (LPA) to determine underlying latent groups of participants based on response patterns. The present study conducted an LPA utilizing data from a previous survey conducted at Union University. The results of this study demonstrated three latent groups among undergraduate students - one group with elevated neuroticism scores and elevated DAS scores, one group with moderate neuroticism and moderate DAS scores, and one group with low neuroticism, high extraversion, high conscientiousness, and low DAS scores. The results of this study provide a novel approach to understanding how DAS and BFI traits are related.

The Effect of Personal Epistemology on the Relationship Between Belief in Science and Religiosity (P)

Presenters: T.J. Hjelte and Kate Rutherford
Faculty Project Advisor: Luke Walden

Previous research on personal epistemology (the cognitive beliefs people have about knowledge) has not adequately explored how religiosity and spirituality impact personal

PSYCHOLOGY

epistemology and general belief in science despite elementary associations between these constructs (Hathcoat & Montgomery, 2010; Desimpelaere et al., 1999). To provide insight into this potential relationship, a path analysis was conducted to examine how personal epistemology mediates the relationship between religiosity, spirituality, and belief in science. The data for the analysis was collected from a prior survey on 324 undergraduate students at the University of Memphis. Results suggested adequate data-model fit (CFI: 0.96, TLI: 0.81; RMSEA: 0.07). Path analysis results suggest that religiosity positively predicted absolutism; spirituality positively predicts evaluativism; belief in science positively predicted by absolutism, multiplism, evaluativism; and belief in science negatively predicted by religiosity. This path analysis indicates that the relationship between religiosity, spirituality, and personal epistemology is nuanced and warrants further investigation.

No Middle Ground? Exploring the Dichotomy of Religion and Science Through Rasch Analysis (P)
Presenters: Addison Altizer and Dona Kaci
Faculty Project Advisor: Luke Walden

The Conflict and Compatibility (C-C) Scale is an 8-item survey designed to measure the degree to which one believes that there is conflict or compatibility between religion and science in certain content areas (Leicht et al., 2021). As the survey has been used to measure the conflict or compatibility between religion and science in many different groups (such as college students), it is important to know the psychometric quality of the scale. Rasch analysis is a psychometric model that analyzes how a scale functions in conjunction to respondents' patterns and has not been used to evaluate the C-C scale. In this study, University of Memphis undergraduate students (n=403) participated in an anonymous online survey for a prior study that included the C-C scale. Rasch model results indicated that the C-C scale exhibits good psychometric qualities (dimensionality, fit, and function), but reveals that the scale functions better at the extreme ends of the scale (complete conflict or complete compatibility) than for those with moderate views. Results from this suggest that response patterns for this scale follow a dichotomy of conflict or compatibility. ⚓

SYMPOSIUM

TWENTY-THIRD ANNUAL UNION UNIVERSITY SCHOLARSHIP SYMPOSIUM

RESEARCH GRANT RECIPIENTS

2025-2026

UNDERGRADUATE

Robert Bowen and Ayla Cook *"Progesterone Interaction with Estrogen Receptor Alpha to Modulate Wheel Running Activity in Mice"*

William Thierfelder and Rose Kannankeril *"Impact of Amyloid-β Fibrils on Gene Expression of Microglial Ion Channels"*

Robert Wamble, Rachel Allabaugh, Jonathan Carroll, Jordan Prunty, Matthew Meyn, Gideon Miller, and Cody Tjomsland *"A Bioinformatics Approach for the Study of Variants of Unknown Significance in Alzheimer's Disease Using Zebrafish as a Disease Model"*

Mark Bolyard and John Fischbach *"Impact of Siberan Maple (Acer ginnala) Osmoticate Exposure on Growth and Production of Secondary Metobolites in Southern Wormword (Artemesia abrotanum) and Mouse Embryonic Fibroblasts"*

Michael Schiebout and Alexis Glynn *"The Effects of Urbanization on Bat Populations in West Tennessee"*

Georg Pingen, Stacie Talbott, Mia Duncan, Bobby Perry, Lawson Harvey, and Cameron Kennedy *"Calculating Pressure Drop Across Safety Guards in a Wind Tunnel"*

Randy Schwindt, Shane Tendo, Ryan Metcalf, and Amy Nason *"Optimizing Valve Plates for MAT Industries"*

Chris Bailey, Lili Pettigrew, and Sarah Johnson *"Atlas' Story"*

Paige Moore and Micah Montgomery *"Wood Fired Rocket Kiln for the Department of Art"*

GRADUATE

Mark Bolyard and Sedona Brown *"Meta-analysis of Khaya senegalensis Leaf Culture and the Evaluation of Thidiazuron 2,4-Dichlorophenoxyacetic Acid, Zeatin, Fipexide, and Adenosine Monophosphate in the Regeneration of Khaya senegalensis"*

UNION UNIVERSITY
RELIGIO ET ERUDITIO

WHERE **FAITH** AND **KNOWLEDGE** UNITE

The Scholarship Symposium is sponsored by
the Union University Research Program

uu.edu