Kansas Board of Regents
Institutions present

KANSAS UNDERGRADUATE RESEARCH DAY AT THE CAPITOL

FEBRUARY 26, 2025 | 2-4 P.M.

Welcome

Thank you for attending the 2025 Kansas Undergraduate Research Day at the Capitol. Each year, this event brings together undergraduate researchers from across our state to celebrate the cumulative impacts of their work. Listed in this booklet are the names of researchers who have dedicated countless hours to the creation of knowledge, the betterment of humanity, and the improvement of quality life for Kansans and citizens of the world. We hope you'll join us in commending them for their work as you engage with them today.

Also named are numerous faculty and staff who have contributed advice, mentorship, and coordination. Thank you, faculty and staff, for believing in the future of these students and the advancement of discovery.

Additionally, we extend thanks to these people and organizations for their contributions:

- Parents and families of researchers who encourage curiosity
- Teachers and professors who spark a love of learning
- University leaders who make research opportunities available
- Legislators who continually advocate for higher education access
- Staff of the Kansas State Capitol, particularly Kathleen Williams, who aid in the logistics of this event
- Community members who attend and support

On behalf of our Kansas Board of Regents institutional peers, Kansas State University welcomes you.

Beth Powers, M.A., Director, Scholar Development and Undergraduate Research
Susan Rensing, Ph.D., Associate Director

Maggie Billman, Programs and Projects Coordinator

Content Links

Lille Nightingale
Daniel Reichart

Emporia State University

Bryan Jones, M.B.A., and Gwen Spade, B.S.

Graciela Albarran-Bautista

Junior, Elementary Education
House District 22, Senate District 21
Teachers' Perceptions of a Students' First Language to Teach and Instruct in the Second Language
Jenny Moss, Ph.D.

What purpose does a student's home language have in the classroom? English Language Learners are a growing student population in many states, including Kansas. There is also a growing push from families to incorporate students' first languages in classrooms. The use of home languages in the classroom has a long and complex history in the United States, with education policies ranging from the creation of dual language schools to ceasing bilingual education programs in public schools. In this study, I interviewed TESOL certified teachers in Kansas from three locations: Emporia, Olathe, and Kansas City. I investigated the teacher's perception of their students' first language, specifically in the classroom instruction and for second language learning. I conducted semi-structured interviews of seven teachers and analyzed the data using an inductive approach of thematic analysis. I found three themes: The effect of professional development on ESL certified teachers, participants encouraging first language use, and students having varying language skills. This research will help us gain insight as to what teachers' perceptions are of a student's first language based on their professional training and how it influences how they instruct and utilize the first language.

Taylor Breuer

Senior, History and Government
House District 38, Senate District 3
The Redefining of John Brown: an Analysis of Tragic Prelude
Steven Bellavia, Ph.D.

Artistic representation often defines how society interacts with the past. Through the observation and analysis of the iconic mural Tragic Prelude, this research seeks to answer the question of how the piece redefined the image of John Brown to Kansans who not only wished to forget him, but also challenged the portrayal of him as a man of great integrity and meekness as found in Thomas Hovaden's The Last Moments of John Brown. By focusing on the history of the mural, its relevant themes and goals, and the words of the artist, the author discusses how Tragic Prelude reclaims an accurate depiction of John Brown and transforms it to present Brown as an American Moses justified in his actions in order to create a representative figure that many Kansans are proud to claim.

Catherine Lyon

Senior, Biochemistry and Molecular Biology
House District 48, Senate District 35

Ella Ruliffson

Junior, Biochemistry and Molecular Biology
House District 1, Senate District 22
Comparison of bacterial and human phosphoglycerate dehydrogenase
Kim T. Simons, Ph.D.

In the major pathway for serine production, phosphoglycerate dehydrogenase (PHGDH) catalyzes the conversion of 3-phosphoglycerate (3PG) into 3-phosphopyruvate (PHP). PHP is then transaminated and dephosphorylated to produce serine. The PHGDH gene, when overexpressed, has been implicated in oncogenesis. E. coli PHGDH catalyzes the oxidation of other molecules and is feedback inhibited by serine. H. sapiens PHGDH is more specific for 3PG and is not feedback regulated by serine. To better understand enzyme specificity and regulation, the structure of both E. coli and H. sapiens PHGDH active sites were analyzed, and thirteen amino acid differences in the active site were identified. Site-directed mutagenesis has been successfully used to change six of these E. coli PHGDH positions into the H. sapiens version. The wild-type and mutant recombinant enzymes were purified, and enzyme activities were monitored using the cofactor NADH. To date, the substrates a-ketoglutarate and oxaloacetate were used as substitutes for 3PG. Continued mutagenesis will be used to identify the critical positions in the sequence that confer specificity with the eventual goal of understanding how the enzyme is involved in oncogenesis.

Thamirys Rego

Senior, Psychology
House District 60, Senate District 17
Mindfulness Meditation Among College Students
Samuel Hughes, Ph.D.

This study examined the effects of mindfulness meditation on stress and anxiety among undergraduate students. A total of 33 participants were recruited from Emporia State University, with ages ranging from 18-26. The participants were randomly assigned to either a mindfulness meditation group or a control group, with the experimental group engaging in a 10-minute daily mindfulness meditation session and the control group did not engage in meditation. The study utilized self-reported measures of stress and anxiety, including ["I find it difficult to relax right now"] administered after the intervention for the experimental and the only activity for the control group. Results showed a small reduction in stress and anxiety in the mindfulness meditation group compared to the control group, although these changes were not statistically significant. These findings suggest that while brief mindfulness meditation may have a slight effect on reducing stress and anxiety, further research is needed to confirm its effectiveness and explore potential influencing factors.

Isaac Tarango Fernandez

Senior, Health and Human Performance
House District 60, Senate District 17
The Effects of Proprioceptive Neuromuscular Facilitation (PNF) on Balance and Peak Force Development (PFD) in Hispanic Adults
Steven Blocker, Ph.D.

Proprioceptive Neuromuscular Facilitation (PNF) training has been thoroughly researched and proven to improve functional tasks such as muscular strength and flexibility (Takasaki et al., 2020). Diverse populations, like the elderly, those undergoing rehabilitation, and athletes have benefited from this therapeutic technique. While a wide range of populations have been studied, the Hispanic population remains unstudied. For this study, a hypothetical, quantitative research approach was used, with the participants separated into a training group through a convenience sampling technique. This approach was also experimental because of the training group receiving the PNF intervention. Participants in both groups were assessed on balance and peak force development (PFD) before and after the research study. The training group received the PNF training intervention, which lasted 5 weeks. The Berg Balance Scale (BBS) and Noraxon Force Plates from Bertec Software were used for data collection. Throughout the research study, the goal was to examine the potential benefits of an evidence-based PNF training protocol on a historically underserved population, Hispanic adults. This research will provide insight into why healthcare professionals are increasingly utilizing this technique.

Fort Hays State University

Keith Bremer, Ph.D. and Adelita Shepard, B.A

Daniel Bechle

Junior, Criminal Justice
House District 111, Senate District 40
Addressing Gender-Based Violence in Rural Ellis County: Local Challenges and Legal Responses
Ziwei Qi, Ph.D.

Victims of gender-based violence face significant challenges in rural areas due to geographic isolation, cultural stigma, and limited resources. This study examines the intersection of GBV and the legal system, highlighting systemic barriers and opportunities for intervention. This study examines the experiences of GBV survivors in Ellis County, focusing on reporting, seeking protection, and pursuing justice. It identifies systemic barriers and gaps through case analysis, court observations, and institutional review. The research utilizes content analysis of legal case records and courtroom observations to evaluate the processing of GBV cases, including accessibility, procedural fairness, and case outcomes. Through analyzing anonymized court records and direct observation of judicial proceedings, the study identifies patterns, systemic challenges, and areas for improvement within the legal system. Based on courtroom observations and content analysis of court dockets, the findings reveal significant barriers faced by GBV survivors within the legal system. Key challenges include inconsistent enforcement of protective orders, limited access to legal representation, and prolonged case processing times. More so, there are gaps in the legal system's capacity to address GBV-specific issues effectively, such as the need for enhanced education and training for legal professionals to improve their understanding of victim-centered legal advocacy. This study aims to help policymakers, legal professionals, and advocates understand the challenges GBV survivors face in rural Kansas. The findings will support the development of strategies to improve justice and support services, making a positive impact on individuals and communities in Kansas and beyond.

Nevaeh Copenhaver

Senior, Psychology
House District 64, Senate District 36

Evolving Connections: Exploring a Non-Traditional Relationship Label Through Thematic Analysis

Whitney Whitaker, Ph.D.

Every generation makes its mark on society as it comes of age—introducing novel terminology, challenging preexisting norms, and shifting cultural paradigms. Due to social media's far-reaching influence, this process has been expedited. Some neologisms such as "just talking" and "situationship" have become widely recognized; despite their prominence, concrete definitions have not yet been established. Purpose: The present study aimed to provide insights into how the current generation of emerging adults views and manages relationships with non-traditional labels. Via an online survey, participants (N=221; mean age=26.47) described newer, non-traditional relationships labeled "just talking." The researchers conducted a multi-phase qualitative analysis of the attitudes and motives held by emerging adults. Guided by the data, the researchers inductively analyzed the responses. Despite some inconsistencies, several common themes of exploration, superficiality, and dissatisfaction emerged. The phrase "just talking" offers relationship partners a sense of freedom, enabling them to explore and cultivate connections without the constraints of traditional labels. However, while this casual (non)label provides flexibility, its inherent ambiguity may also serve as a protective shield against deeper commitments. The rise of the phrase "just talking" reflects a shift in how emerging adults perceive highly committed romantic relationships. This trend may explain why more young adults are delaying marriage and choosing not to have children. These findings could inform approaches to social issues and influence policies affecting younger generations.

Delanie Patterson

Senior, Psychology

House District 111, Senate District 40

Brooklynn Raacke

Sophomore, Psychology

House District 111, Senate District 40

Ryssa Schlaefli

Junior, Health & Human Performance

House District 107, Senate District 36

The Athletes' Plate: Understanding Influences of Athletes' Eating Attitudes, Exercise Behaviors, and Body Image Satisfaction

Brooke Mann, Ph.D. and Jessica Phelan, Ph.D.

Disordered eating (DE), compulsive exercise (CE), and body image satisfaction (BIS) negatively affect male and female athletes. These variables each have a core symptomology but continue to evolve with the increased usage of social media, technology, and shifts in cultural attitudes regarding food, exercise, and body image. The aim of this review is to examine DE, CE, and BIS and how the transdiagnostic cognitive behavioral theory relates to each of them, the positive influence of intuitive eating, and gaps within previous literature. This review evaluates the challenges and barriers future researchers could face in this topic of research and future directions for studies surrounding disordered eating, compulsive exercise, and body dissatisfaction among collegiate athletes. While previous research has evaluated DE, CE, and BIS, their prevalence among college athletes, and highlighted adverse long-term health effects, little to no research has evaluated preventative resources. This research on DE, CE, and BIS specifically addresses the gaps in awareness and intervention resources for collegiate athletes. Additionally, this research might serve as a catalyst to encourage various Kansas universities to implement or modify needs assessments regarding disordered eating and other mental health concerns. The ultimate goal is to improve mental and physical health by eliminating barriers to accessing resources for college students across Kansas.

Kansas State University

Beth Powers, M.A., Susan Rensing, Ph.D., and Maggie Billman, B.S.

Lauren Apprill

Senior, Biochemistry

Out-of-state student from Iowa

House District 66, Senate District 22

Developing the next superfoods: protein interactions in vegetables leading to increased cancer prevention for Kansans

Kathrin Schrick, Ph.D.

Glucosinolates are important molecules in cruciferous vegetables including broccoli, cauliflower, cabbage, and radishes as they serve as a plant's defense mechanism against insect herbivores. However, when ingested by humans, glucosinolates offer significant nutritional and anti-cancer benefits. Thus, elevated glucosinolate levels in these vegetable crops could promote cancer prevention. Using a yeast cell system, we identified a direct interaction between two proteins found in plants: ATML1 and GIR1. ATML1 is a regulatory protein that turns on genes that are critical for proper cell division,

while GIR1 is a small protein that we hypothesized controls ATML1 activity. We observed that when GIR1 is absent in plants, there is abnormal cell division in flower buds. This finding suggests that GIR1 is involved in the suppression of ATML1 activity. We next discovered in a genomic analysis of flower buds where GIR1 is absent, that many genes involved in the production of glucosinolates were upregulated. Therefore, the presence of the GIR1 protein leads to a decreased amount of glucosinolates. The discovery of this molecular interaction affecting glucosinolate production could lead to novel strategies for development of a superfood that helps prevent cancer in Kansas and across the globe.

Will Dodderidge

Senior, History
House District 19, Senate District 7
An Overview of Kansas States Collection of 20th Century Pottery From Mexico
Lauren Ritterbush, Ph.D.

Kansas State University holds an ethnographic collection of twentieth-century Mexican tourist pottery obtained through donations from faculty, alumni, and the public. The goal of this project was to conduct research that informs the identification and organization of the vessels within the collection and review the cultural context of its production and trade. Ceramic traditions in Mexico boast a vibrant history, intricately woven with influences from Pre-Hispanic customs, Spanish colonization, and the contemporary tourism landscape. I researched the pottery traditions of Mexico and their development through time as well as the basic construction of pottery. I then used this information to categorize and attempt to locate and date pieces from the Kansas State collection. Our collection spans a wide range of time with most pieces being dated around the 1960s. This collection shows a wide range of distinct pottery traditions and techniques through Mexico from Jalisco to Oaxaca. There are also pieces from influential artisans like Dona Rosa and Ken Edwards. I have categorized Kansas State University's ethnographic collection of Mexican tourist pottery and crafted a comprehensive finding aid to the collection. This guide will serve future museum professionals and researchers seeking a deeper understanding of Mexican ceramic traditions. Preserving and promoting these traditional crafts is paramount to maintain indigenous art and recognizing the impacts that colonialism and tourism can have on these beautiful arts.

Andrew Navarro

Senior, Political Science and International Studies
House District 20, Senate District 11
A County Clerk's Story: In Pursuit of Local Elected Office
Chardie Baird, Ph.D., Ethan Bernick, Ph.D., Brianne Heidbreder, Ph.D.

While most U.S. political institutions are male-dominated, some positions in county government (clerks, specifically) are near gender parity or even female-dominated. However, we know little about how and why this happens, nor do we fully understand the experiences of these officials. Local officials' responsibilities vary, requiring the dual skill sets of politician and professional administrator. This research explores gender disparities in county positions, investigating the impact of cultural expectations on this dual role, as well as external challenges county clerks face, including legislative changes and public misconceptions. Through semi-structured interviews with Kansas elected clerks, this qualitative study examines selection processes, position responsibilities, and gender dynamics. Following the interviews, we coded responses into themes related to gender dynamics and challenges they face. These codes were analyzed and grouped to identify patterns, enabling us to draw evidence-based conclusions about the challenges and responsibilities associated with the role. Most county clerks rise within the clerk's office and rely on dual-income households due to low pre-clerk pay. Reflecting traditional workplace gender dynamics, they manage administrative duties like budgeting, HR, and election oversight, often with minimal staff. They face challenges with commissioners and the state legislature over elections and budget-making responsibilities.

Samuel Speck

Junior, Conservation Biology
Out-of-state Student from Missouri
House District 66, Senate District 22
Prairie Turnover: The Mouse Shuffle That's Changing Human Health Risks and Landscapes in Kansas
Andrew G. Hope, Ph.D.

The Great Plains are undergoing major environmental changes due to woody plant encroachment, which threatens grasslands and the small mammals that rely on them. This shift is causing changes in mammal

populations, with important consequences for ecosystems and public health. This research explores how habitat changes affect small mammal populations, focusing on two species of mice: the deer mouse (Peromyscus sonoriensis) and the white-footed mouse (Peromyscus leucopus). It aims to understand the ecological and genetic impacts of these shifts and their potential to increase disease risks. We analyzed decades of small mammal records and long-term ecological data from Kansas. To examine evolutionary changes, we used DNA analysis of mouse populations, focusing on genetic diversity and lineage differences. We also studied how fire management influences habitat and species turnover. Woody areas now support more white-footed mice, which carry more ticks and pathogens, compared to grasslands dominated by deer mice. Genetic studies revealed higher diversity in white-footed mice, increasing the risk of diseases like Lyme disease. These findings highlight the importance of monitoring habitat changes and their effects on ecosystems and human health.

Isaac Steiner

Sophomore, Chemical Engineering
House District 117, Senate District 10
New Materials for Optoelectronics: Better, Faster, Brighter *James Edgar, Ph.D.*

Our research goal is to grow large area, high quality crystals of the semiconductor hexagonal boron nitride (hBN). Crystals that are free of defects and impurities are required when it is incorporated into advanced electronic and optoelectronic devices such as integrated circuits and ultraviolet LEDs. Crystals are grown by dissolving the element boron into a molten nickel and chromium solution, at high temperatures under an atmosphere of nitrogen. The nitrogen dissolves into the solution, then as the temperature is lowered, the nitrogen and boron bond together and precipitate on the surface of the solid ingot. In order to maximize the efficiency of this growth process, the amount of nitrogen in the atmosphere varied from approximately 93% to 9% over the course of multiple experiments. These experiments found that there is a strong linear relationship between the amount of nitrogen in the atmosphere and the size of the hBN crystals. Further, a logarithmic relationship was found between the nitrogen content and the thickness of the hBN crystals. To produce the thickest, largest area hBN single crystals, operating at a high nitrogen concentration is best.

Pittsburg State University

Ram Gupta, Ph.D., Tim Dawsey Ph.D., Glenn Storey, M.A.

Megan Abdilla

Senior, Chemistry
House District 3, Senate District 13
Carminic Acid from Cochineal Insects as Color Sensor for Monitoring the Freshness of Cheese
Mazeyar Parvindzadeh Gashti, Ph.D.

The application of natural dyes in food safety has gained significant attention due to their biocompatibility and eco-friendliness. This study explores the use of carminic acid, derived from cochineal insects (Dactylopius coccus), as a color sensor for monitoring the freshness of cheese. Carminic acid's sensitivity to pH changes makes it an ideal indicator for detecting spoilage during cheese storage caused by microbial activity. For this purpose, carminic acid, starch, and lithium chloride were dissolved in an aqueous solution, followed by centrifugation, drying, and pressing into pill forms for cheese monitoring. FTIR analytical characterization confirmed the chemical structures of carminic acid and starch. The color coordinate values (L*, a*, b*, C*, and ΔE) of the pills were measured using a hand-held spectro-colorimeter after exposure to cheese for different durations at room temperature. The results showed that the color sensors successfully detected spoilage in cheese samples after 110 hours. Interestingly, sensors loaded with lithium chloride exhibited color changes at earlier stages of spoilage (40 hours), indicating greater sensitivity to cheese volatile products. This approach underscores the potential of natural dye-based sensors in advancing food safety, offering a practical solution for producers and consumers to maintain high-quality standards in dairy products.

Ayushee Dasgupta

Senior, Biology and Chemistry
House District 3, Senate District 13
Exploring the gut microbiota of gray bats in Kansas following culturable and metagenomic approaches
Anuradha Ghosh, Ph.D.

Bats are crucial to ecosystems, serving as insect population regulators and disease reservoirs, as evidenced by recent COVID-19 pandemic, Ebola outbreak, etc. This study investigates bacterial diversity in the gray bat (Myotis grisescens) from southeast Kansas. Guano samples from the bat colonies yielded 32 bacterial isolates, predominantly Gram-positive (65%). Biochemical analyses revealed 78% of isolates fermented

all tested sugars, with 21% showing urea hydrolysis and 3% producing indole. Illumina miniSequencer analysis of 16S rDNA metagenome produced 2.9 million reads, identifying Serratia, Achromobacter, Lysinibacillus, and Bacillus as dominant genera. Further analysis focused on differences between male and female bat gut microbiota. Beta diversity analysis (PCoA) explained 68% of the variance, highlighting greater intra-variability among female bats, while alpha diversity indices (Chao1 and Shannon) indicated similar species richness but slightly higher diversity in females. Statistical analysis of the Chao1 index using Welch's t-test showed no significant difference between male (mean = 2016.78) and female (mean = 1998.06) samples (p = 0.971). PERMANOVA analysis using Bray-Curtis distances indicated sex-based differences (pseudo-F = 4.123, p = 0.018, based on 999 permutations) in gut microbial community composition. These findings enhance our understanding of bat gut microbiota, supporting disease prevention and conservation efforts.

Emery Kafka

Junior, Business Management and Marketing
House District 3, Senate District 13
Quality Assurance in the Manufacturing of Sustainable Water Bottles
Sang-Heui Lee, Ph.D.

This project aims to simulate quality assurance processes using various quality tools on a pseudo manufacturing system. It involves a mock company named Pure, which manufactures water bottles. The goal of the company is to enhance customers' everyday activities and outdoor excursions by offering dependable, long-lasting, and environmentally friendly stainless-steel water bottles that support sustainable living while minimizing the waste generated by single-use plastic bottles. The project assumes that Pure started four years ago during the coronavirus outbreak when it spread across the world. With increased interest in personal wellness and self-care, many people began spending more time staying active. As local gyms closed, outdoor activities quickly became part of people's daily routines. The idea of creating an innovative, high-quality, and sustainable water bottle for outdoor activities that benefits the environment piqued the student's interest. The project focuses on quality assurance using various quality tools, including flowcharts to explain the manufacturing sequence, check sheets for data collection, histograms and Pareto charts to illustrate data characteristics, Ishikawa diagrams, gap analyses, scatter charts, house of quality, and more. Key product elements such as durability for outdoor activities, material strength, temperature retention, leak-proofing, and ease of cleaning are the main focal points.

Rylan Mason

Sophomore, Biology
House District 3, Senate District 13
An updated census of the native and non-native vascular plants in Bates County: An under-surveyed region in western Missouri
Neil Snow, Ph.D.

Current and reliable knowledge of native and non-native plant species of a given area is valuable, and county-wide floristic (=plant) surveys are a common and effective way to document plant diversity. Numerous counties in the USA have not had their plant diversity fully (or even recently) surveyed, and prior research had shown that Bates County, Missouri, was less documented than most counties in surrounding states. Our initial hypothesis was that additional fieldwork would confirm the presence of dozens of species for the first time in Bates County. The fieldwork consists of five to seven day-long plant collecting trips plants across the county in each of three growing seasons. Most collections in 2024 occurred on land managed by the Missouri Department of Conservation, with their permission. We will broaden our documentation in 2025 and 2026. Of the 342 specimens we collected through 2024, twenty-nine were the first verified reports for Bates County, including the aggressively invasive understory shrub Amur honeysuckle. Our project is providing baseline data for future ecological comparisons for things such as flowering times, the presence of invasive species, and monitoring the occurrences of rare taxa. The results also will be of considerable value for private and public land management considerations.

Alexandra Robinson

Junior, Biology and Chemistry
House District 3, Senate District 13
Activated Maple Carbon as a Bio-Based Cathodic Material in Lithium-Sulfur Batteries for Electrochemical Energy Storage Applications
Ram Gupta, Ph.D.

Electrochemical energy storage devices continually draw

attention amid the energy crisis, since they alternatively store energy sustainably. Among these devices, lithium-sulfur batteries (LSBs) are economically promising and have an impressive theoretical energy density of 500 Wh/kg. The conversion mechanism of LSBs increases efficiency stepwise for 16-step redox reactions, driven by the conversion of cathodic sulfur to sulfide using the anodic ions at discharge and the reversal process at charge. The commercialization of LSBs is inhibited by impediments such as the shuttling effect, volume expansion due to (de)lithiation process, and dendritic lithium formation. To combat these, a carbon material with a high surface area was synthesized using maple leaves to facilitate incremental conductivity in the presence of structural pores. Different ratios of potassium hydroxide were used to activate this bio-based carbon and compared to evaluate its effect on the carbon's surface properties. Further, these carbons were used in the fabrication of Li-S batteries, which were tested using cyclic voltammetry, electrochemical impedance spectroscopy, galvanostatic charge-discharge measurements, and cyclic stability at different C-ratings to reveal the effect of surface area on the Li-S batteries' electrochemical properties. The MC-KOH (1:1) sample fared the best, with a specific capacitance of 641 mAh/g at 1C.

University of Kansas

Dawn Tallchief, Ph.D. and Erin Wolfram, M.S.

Evanna Dominic

Junior, Chemical Engineering and Spanish
House District 8, Senate District 37
Extractive Distillation for Separating Refrigerants Using Ionic Liquids
Mark Shiflett, Ph.D.
The focus of this research is improving the recycling and separation of HFCs, most especially HFC refrigerants used in air conditioning and refrigeration to replace their environmental impact. HFCs do not harm the ozone layer like older chemicals, but they contribute significantly to global warming. To tackle this problem, we explored a novel separation method called extractive distillation using ionic liquids (EDIL). Our study is to separate a complex mixture of HFCs into its individual components with high purity for effective recycling. We tested mixtures of HFCs including R-410A and R-507 using a specialized distillation setup at the University of Kansas. From our simulation of the process with advanced software, we identified an ideal ionic liquid, [C2C1im][Tf2N], which significantly improves separation efficiency. We also conducted careful experimentation to determine this process's best operating conditions to get the highest quality of both the product and the waste byproducts. We also measured important properties of the HFC mixtures to ensure the accuracy of our models. This research not only offers a prospective answer to HFC recycling but also contributes to the ongoing efforts to fight climate change. These findings are presented to inform policymakers and stakeholders of the potential benefits of investing in advanced technologies for a more sustainable future.

Bhavya Gupta

Junior, Microbiology
House District 8, Senate District 29
Structural Determination of the ColeE1* and TolC Complex *Joanna Slusky, Ph.D.*
Antibiotic resistance is a critical global health challenge, with annual deaths due to infections increasing from 700,000 to 1.29 million in 2019 alone. Efflux pumps, such as the protein TolC in Escherichia coli, contribute to resistance mechanisms by exporting antibiotics out of the cell. TolC is the trimeric β-barrel outer membrane protein that interacts with the bacteriocin Colicin E1 (ColE1) and its Shigella sonnei variant ColE1*. Previous studies demonstrate a domain of ColE1 can partially plug TolC, enhancing bacterial susceptibility to antibiotics. Preliminary findings suggest a fragment of ColE1* may additionally plug TolC more effectively than colicin E1. This study aims to produce TolC, incorporate TolC into nanodiscs, and add a peptide fragment of ColE1*. Structural characterization of the TolC-ColE1* complex will be conducted using cryogenic electron microscopy (Cryo-EM). Isothermal titration calorimetry (ITC) data previously obtained indicate trivalent binding of ColE1* to TolC. These findings may contribute to strategies for addressing antibiotic resistance by targeting bacterial efflux mechanisms and efflux plugs more broadly.

Alexa Magstadt

Junior, Molecular, Cellular, and Developmental Biology
House District 10, Senate District 23
Understanding the Role of Mutant KRAS in Colorectal Cancer Metastasis
Dan Dixon, Ph.D.
In the United States, colorectal cancer (CRC) is the third-most diagnosed and second-most lethal cancer for men

and women combined. When CRC is treated early, patients have a predicted five-year survival rate of 90%. After the disease has spread throughout the body in a process known as metastasis, this predicted survival drops to 14%. One cellular process that enables CRC to metastasize is the epithelial-to-mesenchymal transition (EMT). In the EMT, the epithelial cells that line the colon are reprogrammed to resemble less differentiated, more mobile cells called mesenchymal cells. This enhanced mobility enables metastasis. This project aims to understand the role of a commonly mutated CRC protein, KRAS, in the EMT. To determine how KRAS mutations impact the EMT, we genetically modified a line of epithelial cells to express a KRAS mutation. These mutant cells lost their characteristic round appearance and gained an elongated, mesenchymal shape. They grew 273% faster than regular epithelial cells in a 72-hour period. Additionally, they demonstrated reduced expression of the distinctive epithelial protein E-cadherin, and increased expression of the characteristic mesenchymal protein vimentin. This suggests that EMT reprogramming had occurred. We then treated these mutant cells with a newly developed small molecule that inhibits mutant KRAS activity. Inhibitor treatment caused an 88% recovery in E-cadherin levels and a 51% relative vimentin reduction. The mutant cells also regained their round, epithelial shape. These results indicate that metastatic EMT reprogramming has the potential to be reversed through KRAS inhibitor treatment in KRAS-mutant cases of colorectal cancer.

Darya Moiny

Junior, Chemistry

House District 27, Senate District 11

Structure of Benzyl Isothiocyanate Self-Assembled Monolayers on Au(111)/Mica Surfaces

Rachael Farber, Ph.D.

Benzyl isothiocyanate (BITC) is an aromatic thiolate used to create biologically relevant self-assembled monolayers (SAMs). The coexistence of the stabilizing pi-pi interactions and destabilizing electron withdrawing cyanide group in BITC influences the packing structure and formation of the SAM. There is, however, little known about the molecular packing structure of BITC SAMs on Au surfaces. In this work, tapping mode atomic force microscopy (AFM) was used to investigate the relationship between solution concentration and incubation time on the molecular structure of BITC SAMs. Au(111)/Mica, was incubated in a 2 mM ethanolic solution for a total incubation time of 65 hours. Following the 65-hour incubation, a linear pattern was seen across the surface, suggesting the formation of a BITC SAM. The solution concentration was increased by a magnitude of 10. Following a 24-hour incubation, there was no noticeable structural evolution. Incubating the Au substrate for 65 hours in the 20 mM solution resulted in the characteristic linear pattern seen for the 2 mM 65-hour sample preparation, establishing that an incubation of 65 hours was needed to form a uniform BITC SAM. The solution concentration was then increased to 0.2 M. Following a 65-hour incubation, a ring-like pattern across the surface suggested the formation of a new structure at higher BITC concentrations. Future work will focus on imaging the BITC SAMs using ultra-high vacuum scanning tunneling microscopy and scanning tunneling spectroscopy to investigate the structural and electronic properties of the surface of the SAM at the atomic scale.

Kai Smith

Junior, Biochemistry

House District 101, Senate District 34

Identifying Complex Molecular Species in Clouds of the Milky Way's Center

Elisabeth Mills, Ph.D.

The center of the Milky Way galaxy hosts a remarkable gas cloud, Sgr B2, with some of the most complex organic chemistry observed in interstellar space. However, the origins of this chemistry remain unclear. Is it common to all clouds in the galactic center or unique to a rare phase of massive star evolution? To explore this, I analyzed the chemical composition of another organically rich cloud, Cloud C, and compared it to Sgr B2. This was done by measuring frequencies of light emitted by molecules within the target region as they became excited from molecular collisions. The frequencies were detected using large interferometric telescopes such as the Atacama Large Millimeter/submillimeter Array (ALMA). I was provided high-resolution images of Cloud-C covering 11.5 GHZ for the analysis. A list of possible molecules was made through synthetic modeling of the emission patterns, supported by MAdrid Data CUBe Analysis (MADCUBA) software. Preliminary results reveal that Cloud C exhibits less than half the molecular richness of Sgr B2, suggesting Sgr B2's chemistry is unique. However, this difference may stem from observational sensitivity limits, as chemical species in Cloud C generally have

concentrations two orders of magnitude lower than in Sgr B2, making rarer species harder to detect. To address this, mechanistic pathways will be developed to model plausible chemical species based on observed concentrations. This analysis will help trace the formation of prebiotic molecules necessary for the formation of life and clarify the chemical differences between Sgr B2 and Cloud C.

University of Kansas Medical Center

Ericka Sanner-Stiehr, Ph.D., R.N., C.O.I.;
Becky J. Christian, Ph.D., R.N., F.N.A.P., F.A.A.N.;
Ashley Barry, M.P.H., R.R.T.

Sabine Jean-Philippe

Junior, Respiratory Care
House District 17, Senate District 17
Improving healthcare workforce capacity in rural Kansas *Ashley Barry, M.P.H., R.R.T.*
Rural areas in Kansas face many healthcare challenges, including aging populations dealing with chronic conditions. Attracting and retaining healthcare providers in rural communities can be difficult, and many rural areas suffer healthcare professional shortages. Underserved Communities Have a Medical Provider (U-CHaMP) is a KUMC program funded through the Health Resources and Services Administration with the aim of improving the rural healthcare workforce. The program provides financial assistance to healthcare students who intend to work in rural Kansas after graduation. Recently, U-CHaMP developed virtual modules to educate students about rural healthcare and improve perceptions of rural health. A longitudinal study was designed to evaluate the efficacy of the rural healthcare modules on two areas: 1) Student knowledge of health concerns facing rural communities and 2) Rural health perceptions and student willingness to work in rural communities. Outcomes will be measured by the rural health perceptions survey and qualitative interviews conducted after module completion. We anticipate that the education modules will improve student knowledge of rural health concerns, positively impact perceptions of rural health, and increase student willingness to work in rural areas. This research will provide insight on strategies that may improve the healthcare workforce capacity in rural areas of Kansas.

Madison Johnson

Senior, Nursing
House District 38, Senate District 3
The Gift of Life Mentorship: A Secondary Data Analysis *Jennifer Williams, Ph.D., R.N., A.C.N.S.-B.C.*
The Gift of Life Program employs the experiences and skills of previous transplant recipients to orient those new to transplantation and its recovery process. Current research indicates a limited understanding of how transplant patients effectively transition to their new lifestyle. This study aims to evaluate the influence of mentors on patient outcomes during the first 60 days post-transplant. The concept of mentorship has been successfully utilized in healthcare settings for various patient populations. This study is a secondary data analysis of quantitative data. The sample consists of de-identified patients who received a kidney, liver, or pancreas transplant from the University of Kansas Health System between 2019 to 2023. In this study, mentors act as teachers and companions who follow transplant patients throughout the transplantation process. The data variables collected from mentors include the mentor's experience level and whether the mentor was previously a Gift of Life transplant patient. The mentees' variables consist of their ADL involvement, Depression Screening results, STAI (state trait anxiety inventory) scores, QOL (quality of life) assessment, readmission rates, and follow-up attendance. The data will be analyzed using descriptive statistics for the demographic variables and non-parametric analysis for the outcome variables.

Sarah Kriet

Senior, Nursing
House District 29, Senate District 8
Midwives KAN: Interviews of Midwives in Rural and Underserved Areas
Cara Busenhart, Ph.D., A.P.R.N., C.N.M., F.A.C.N.M.
There is little understanding of the unique needs of nurse-midwives and their clients in rural and underserved communities. The objective of this study is to discover the barriers to pursuing and completing midwifery training in these communities and better understand their unique needs. This study also aims to assess the specific needs of practice sites to adjust curriculum and improve outreach efforts. This study will follow a qualitative descriptive study design and is supported by the Health Services and Research Administration (HRSA grant 23-120). This study follows a qualitative descriptive methodology. We will conduct in-depth semi-structured interviews with a sample of five midwife preceptors practicing in rural and underserved

areas. Interviews will take place in February 2025. Descriptive data will be collected and de-identified through REDCap and undergo thematic qualitative analysis. Results are still pending. We expect the results to identify the needs of nurse-midwife students and preceptors and the barriers to completing nurse-midwifery education. The themes identified during the analysis will be used to adjust the midwifery educational program and outreach to preceptors to meet their needs. The themes identified in interviews will help guide changes in the midwifery education program and outreach to preceptors to meet their individual needs. We will use these results to improve midwifery education, produce a diverse and skilled maternity care workforce, and improve maternal health outcomes in rural and underserved communities.

Alejandra Wright

Senior, Nursing
House District 6, Senate District 37
Nurse Burnout and Fatigue – Impact of Extended Work Hours and Job Role in Kansas
Amy Garcia D.N.P., M.S.N., R.N., F.A.A.N.
This study investigates the relationship between job role, hours worked and burnout amongst Staff Nurses and Nurse Managers in Kansas. Existing evidence links longer work hours and involuntary overtime to increased work-related stress, burnout, and attrition but lacks information on the influence of role. Grounded in Donabedian's model, the Structure is the nurse role, overtime occurs in the Process, and the Outcome is the frequency of nurses' reported burnout and fatigue. This study utilized secondary data collected during the 2022 National Nursing Workforce Survey from a representative sample of 606 Registered Nurses in Kansas. The survey instrument was based on the National Forum of State Nursing Workforce Centers Minimum Nurse Supply Dataset (MDS). Descriptive statistics and analysis were conducted by a biostatistician using R. Nurse Managers worked more hours in a typical week than Staff Nurses. Longer working hours were significantly associated with the reported frequency of burnout for both staff nurses ($p=0.027$) and nurse managers ($p=0.006$), and fatigue for staff nurses ($p<0.001$). Nurse Managers worked more hours than Staff Nurses during Summer 2022. Burnout and fatigue were positively associated with hours worked for both. Reducing overtime may reduce burnout and fatigue.

Washburn University

Lindsey Ibañez, Ph.D.

Angel Hayes

Senior, Anthropology
House District 33, Senate District 115
Reliability of Scoring Saw Features in Sharp-Force Skeletal Trauma
Ashley Maxwell, Ph.D., Alexandra Klales, Ph.D., D.-A.B.F.A.
In sharp-force skeletal trauma, features associated with saw cuts have been used to predict class characteristics of the inflicting tool/weapon in criminal investigations involving dismemberment. Unfortunately, few studies have addressed the reliability of scoring these saw features in a large sample with diverse saw types (e.g., power vs. hand). The aim of this study was to test interobserver agreement for 25 saw features. A total of 70 saw cuts to human bone (49 complete; 21 incomplete cuts) using 42 saws (21 power; 21 hand) were macroscopically and microscopically analyzed by two experienced observers. Overall, reliability varied considerably by the trait assessed. Percent agreement was high (>85%) for floor dip (100.0%), floor dip shape (100.0%), kerf length shape (100.0%), kerf profile shape (99.3%), breakaway spurs/notches (98.0%), harmonics (97.1%), longitudinal fracturing (97.1%), kerf flare (95.7%), entrance shaving (94.3%), and presence of unintentional incomplete cuts (88.6%). Scoring agreement was lower but acceptable (<85%-70%) for exit chipping (84.3%), striation consistency (81.8%), patterned kerf relief (81.4%), initial shaving (80.0%), polish (77.1%), exit chipping size (72.9%), and tooth imprints on cut floor (71.4%). Scoring was considered unreliable (<70%) for trace evidence presence (69.3%), pull-out striae (67.1%), tooth hop (60.0%), tooth hop shape (58.6%), and tooth imprints on the wall (28.6%). Overall, many of the features presented in the literature and associated with saw class characteristics can be reliably scored in sharp-force skeletal trauma analysis. Those traits below the acceptable agreement levels of 70% should be avoided.

Brookelynn Powell

Junior, Biology
House District 26, Senate District 23
Exploring fertility trends of Ornate Box Turtles via ultrasonography in western Nebraska
Benjamin Reed, Ph.D.
Investigating and understanding reproductive ecology

for any animal is important for numerous reasons, including: identifying individual and species needs, individual fitness (relative reproductive output), population trends (growth/decline), and ultimately should better inform management decisions in conservation. In many species, especially ectotherms, the reproductive ecology is widely unknown and/or understudied. The goal of this research was to examine the reproductive ecology and fertility trends in an understudied/lesser known species, the Ornate Box Turtle (Terrapene ornata) via ultrasonography. In this study, we monitored and documented the reproductive cycle of 24 female box turtles on a four-day rotation (6 per day). Here, we characterized the reproductive development cycle (ovum to hardshell egg) in these female turtles. We also investigated whether female T. ornata individuals were capable of reproducing over consecutive years, and also if they are able to have two nesting periods in a single season. This study is important as it broadens our understanding of reproductive ecology and how reproductive success relates to fitness. Our research could spark future interest in understanding why certain females are having more reproductive success than others, which may potentially be related to variation across individuals in home range size, personality traits, and health. Finally, comparing egg-bearing trends across separate populations may be highly informative for identifying populations at risk or those that are performing well across their range.

August Wilson

Senior, Biology

House District 56, Senate District 20

Preliminary analysis of the visual acuity of terrapene ornata *Benjamin Reed, Ph.D.*

Visual acuity is a measure of the finest detail an organism can resolve. Visual acuity is relevant to ecological studies to build a more robust profile of the species and by providing insight into an animal's ability to perceive their environment. It provides context for how animals obtain resources, move within their home-range, and interact with others. For example, navigation in a dense grassland habitat should require acute vision to discern the movement of grass blades versus threats or possible food items. One standard measure of visual acuity is cycles per degree (cpd), which can be tested using high contrast, evenly spaced vertical grating, where the smallest distinguishable grating size is represented in cpd. This study assessed the achromatic visual acuity in cpd of 70 wild ornate box turtles, Terrapene ornata, using moving grating cycles. The movement stimulated the turtles' optokinetic response/reflex (OKR) as head movements following the grating. These head movements allowed their visual acuity to be tested without the need for extensive training or invasive procedures. Preliminary data analysis indicates the visual acuity of Terrapene ornata positively relates to body size and to distance from the grating. It also indicates testing responsiveness trends with sex. These finds of visual acuity are novel in the study of Terrapene ornata; they provide new context for study of the turtle's foraging, movement, and responses to threats, and add a common parameter for comparison across species.

Wichita State University

Michael Birzer, Ed.D.

Ana Brake

Junior, Honors Baccalaureate, Concentration in Biology, Concentration in Public Health Sciences, Second Major, Biology

House District 99, Senate District 16

Increasing Obstetrics Care Access in Rural and Underserved Areas: The Effect of Health Literacy Levels and Age on Fetal Monitoring Device Acceptability

Nikki Keene Woods, Ph.D.

Pregnant women in rural and underserved communities are frequently unable to access convenient obstetrics care, which is associated with a decrease in healthcare utilization levels, negatively affecting health outcomes. Younger women may have lower levels health literacy which also impacts healthcare access. Based on former wearable device acceptability research, a questionnaire was developed and assessed the acceptability (e.g., wearability, comfort) of a wearable fetal heart rate monitor during obstetrics care. This questionnaire was limited to women of reproductive age (18-49), included 47 questions and was administered online. Participants were recruited through local posters and social media using a snowball sampling recruitment strategy. One hundred sixty-three participants completed the survey. Health literacy levels increased with age. Women of age 18-20 years had the lowest health literacy level (52.9%), followed by age 21-29 (78.7%), 30-39 (91.7%), and 40-49 (95.8%) ($p < .001$). 148 participants answered health literacy questions. Older women reported higher

acceptability than younger participants (74% vs 53%, p=.026). Younger participants reported lower acceptability levels. As age increased, health literacy levels increased. Results suggest increased interactions with clinicians result in increased health literacy skills. To improve the acceptability of the device, clinicians should consider how to build trust and address these concerns. This project contributes to an interdisciplinary effort to develop a fetal monitor aimed at addressing the maternal and fetal healthcare gaps in the state.

Diego Fuentealba

Senior, Aerospace Engineering
House District 91, Senate District 27
Robust and Scalable Quantum Repeaters using Machine Learning
James Steck, Ph.D., Elizabeth Behrman, Ph.D.

Quantum computers have shown their potential to revolutionize computing due to their exponentially faster speeds over current classical (non-quantum) digital computers. To evaluate if quantum repeaters can be trained to perform their task and remain resistant to noise and decoherence using machine learning. Using a simulation of a quantum machine in MATLAB, a system of 2-qubits is trained to sufficiently low error using machine learning. The system is then scaled up to 4-,6-, and 8-qubits using transfer learning of the previous system's parameters, with no additional training. Once complete, noise and decoherence are added to the systems and tested to evaluate their resilience. Research is still in progress. Preliminary results show that the initial system of two qubits can be trained to very low errors, on the order of 10-7. Increasing system size to 4+ qubits led to only a very slight increase in error to a magnitude of 10-4, still less than 0.1%. Testing on a trained system demonstrated that the system could handle noise and decoherence up to a magnitude of 10-5 with no issue. Because of its flat geography and position, Kansas could become home to quantum networking and quantum satellite communications, making it a leader in groundbreaking quantum repeaters in quantum communication technology in the US and the world.

Sejun Moon

Junior, Computer Science
House District 87, Senate District 25
Multi-Agent Reinforcement Learning Approach for Robot Teaming in Mars Exploration
Fujian Yan, Ph.D.

Mars exploration is crucial for understanding the planet's potential to support life, its climate and geological history, and for preparing future human missions. However, Mars exploration poses challenges due to constrained communication capabilities. This research proposed a MARL-based method for autonomous path planning for robot-robot teaming. Group-oriented Multi-Agent Reinforcement Learning (GoMARL) is commonly employed for robot-robot teaming. However, this method faces limitations regarding computational complexity as the number of agents increases. The proposed approach designs a hierarchical structure to mitigate this complexity and enhance scalability. The proposed MARL structure organizes agents into multiple layers, where higher-level agents manage strategic decisions like group formation while lower-level agents focus on tactical execution like navigation, thereby reducing computational complexity and improving scalability for large teams of robots. Research ongoing. The experimental environment is set up in ROS2 to simulate Martian conditions. The preliminary reinforcement learning model showed promising results. The proposed method allows multiple robots to navigate autonomously with limited human interaction under extreme circumstances, like Mars. Kansas is highly prone to disasters like Tornados, and the proposed method can contribute to post-disaster rescue.

Lille Nightingale

Senior, Dance
House District 92, Senate District 30
Embodied Research on the Physical and Emotional Challenges Wildebeests Face While Migrating
Denise Celestin, M.F.A., Cheyla Clawson Chandler, M.F.A., Mina Estrada, M.F.A., Sabrina Vasquez, M.F.A.
Wildebeests are known for their annual migration across the African savanna, called the "Great Migration." Wildebeests are the primary driving force behind this movement of millions of animals across the Serengeti plains, making them a keystone species. This research investigates the behavior and emotions of wildebeests and translates their movements into a choreographed dance. The goal is to capture the essence of wildebeest migrations and create an engaging and educational dance performance. The study involved a combination of video analysis and literature review to gather comprehensive data on wildebeest behavior, emotions, and patterns during their migration. This information was then used to create the choreography for the dance.

Research indicates that wildebeests exhibit a variety of unique movements, such as leaping and trotting, and they form complex group formations, shapes, and lines during migration. Wildebeests also experience emotions such as fear, anxiety, and calmness. The dance performance born from the research captured these behaviors and emotions, creating an engaging and educational performance. This research and subsequent dance is relevant to Kansas in that it exemplifies the importance of the arts and dance to Kansans.

Daniel Reichart

Senior, Aerospace Engineering and Physics
House District 101, Senate District 27
Simulation of Solar Wind Charged Particle Energy Deposited and Particle Identification by ΔE-E Discrimination in the SNAPPY Cubesat Detector
Nickolas Solomey, Ph.D.

The Solar Neutrino and Astro-Particle Physics (SNAPPY) Cubesat will carry into polar orbit a prototype detector for solar neutrino background studies while over the Earth's poles for the neutrino Solar Orbiting Laboratory future project (*ν*SOL). During this flight it is possible to do other science measurements, such as an improved study of the solar wind particles through better particle identification measurements. This study aims to understand how well the solar wind particles can be identified using the planned detector. Instead of using the veto array for anti-coincidence, it will be used as a ΔE energy sampling of a phoswich particle identification system. The particles used in the simulation are the most abundant particles found in Solar Energetic Particle events, with energies corresponding to the most probable ranges. Simulations indicate that electrons, protons, and alpha particles separate into distinct regions of the ΔE-E plot, suggesting that these particles can be identified via this process. Solar wind particles from the Sun can be hazardous to both energy generation and transmission systems on the ground as well as to aviation flight. Identifying particles in solar wind can help our understanding of these hazards.